IRISH FORESTRY

Published by
THE SOCIETY OF IRISH FORESTERS
MAY, 1945.

Vol. II. No. 1.

Price to Non-Members 3/-

IRISH FORESTRY

CONTENTS

SOCIETY OF IRISH FORESTERS

PRESIDENT.

H. M. Fitzpatrick, Kendalstown, Delgany, Co. Wicklow.

VICE-PRESIDENT.

J. A. K. Meldrum, Ben Wyvis, Lakelands Park, Terenure, Dublin.

SECRETARY.

T. Clear, Albert Agricultural College, Glasnevin, Dublin.

TREASURER.

S. M. O'Sullivan, Aberfoyle, Orwell Road, Rathgar, Dublin.

EDITOR, "IRISH FORESTRY."

M. L. Anderson, 16 St. Stephen's Green, Dublin.

BUSINESS EDITOR.

T. McEvoy, Rathdrum, Co. Wicklow.

COUNCILLORS.

1944-45.

P. Barry, 94 Malahide Road, Dublin.
S. M. Petrie, 58 St. Lawrence Road, Clontarf.
F. McMahon, Annagh Bay, Hazelwood, Co. Sligo.

1945-46.

M. O'Beirne, Casino House, Avondale, Rathdrum, Co. Wicklow.
N. Diver, Rathdrum, Co. Wicklow.
T. Madden, Donadea Castle, Donadea, Co. Kildare.

AUDITOR.

Duncan Craig, 102-103 Grafton Street, Dublin.

TRUSTEES.

M. L. Anderson, T. Donovan, J. A. K. Meldrum.

HONORARY MEMBERS.

A. C. Forbes, Glenageary, Co. Dublin.
J. Crozier, 62 St. Laurence Road, Clontarf, Co. Dublin.

The object of the Society is to advance and spread in Eire the knowledge of forestry in all its aspects. The Society is primarily a professional one, but any person desirous of furthering the object, who is not qualified to become a professional or technical member, is open to join as an associate member, and will be welcome.

Particulars may be had from the Secretary.

IRISH FORESTRY

VOLUME II. NUMBER I.

MAY, 1945.

"Irish Forestry"

With this issue of *Irish Forestry*, the third so far, the Society can only be said to be feeling its way forward. What the future form and nature of the Society's journal will be cannot as yet be determined, but it may not be out of place with the issue of this third number to review the whole position and to discuss possible lines of development. Varying views are held regarding the policy which should be adopted in respect of what is to be published in the Journal. There is no doubt, however, that any attempt to fix rigid standards, and to establish restrictions would at this stage be wrong. Apart from the all-important fact that the material available is much too limited for that, considerable latitude should be allowed to contributors so that the Journal may become, as its main function intends it to be, a satisfactory medium for the expression of views by the members of the Society and a source of information for their use.

The first point, which should perhaps be stressed, is that the main object of publishing a Journal is to benefit the individual members of the Society and through them the Society as a whole. Our Society is a professional Society and there should therefore be a considerable number of purely technical articles and discussions. There is an enormous scope in forestry for material of this kind, concerned both with pure silviculture or other forestry subjects and also with those other branches of science or of human activity which are closely related to forestry. Glancing through the material already published it would seem that, so far, this field has been inadequately represented. It would be a mistake to set too high a standard in respect of technical articles. There will always be room in the Journal for articles of the highest standard which will have an appeal outside this country, and, indeed, it is extremely desirable that that should be so. We must face up to the fact, however, that we shall never have, in this small country, more than a few specialists in the various branches of forestry, and that, therefore, we cannot expect to have more than occasional contributions of that advanced, intensive character. There is, however, unlimited scope for shorter articles and in particular, for brief notes on matters of general interest to foresters.

Many members are, unfortunately, reluctant to put pen to paper because of a feeling that their writing may not be up to the desired literary standard, or they may be under the impression that what they have found to be of interest may already be generally known. They do not wish to make themselves appear to be ignorant by writing about something that is not new. That is a mistaken attitude. Every item that is of personal interest to one member is likely to be of general interest to all and every carefully and fully recorded report of any occurrence or experience in relation to forestry is worth recording. It may not be of immediate value but in a long-term business like forestry it may ultimately prove of the greatest value, especially when combined with numerous other records. There must surely be a number of keen and accurate observers amongst our members and an increase in contributions and in the number of contributors of short forestry notes seems to be a possible line of development.

Several members have expressed the view that the Journal should contain matter of a more popular nature in propaganda form, and in connection therewith they express the view that the Journal is too highly priced. They feel that the Society should use its Journal more for the purpose of putting forestry over to the public. In this country the people, as a whole and in the mass, are strongly in favour of forestry and forestry development. This feeling finds its expression in the policy of the Government. Apart, therefore, from the fact that any popular

journal, to remain popular, must appear frequently and must be certain of a constant flow over a long period of suitable material that will appeal to a wide public, if it is not to be a financial failure, there does not seem to be any urgent call for our purely professional Society to undertake work which is more of a political character or of a sort best left to the public press. The Society, by its provision for recruitment of associate members, whose numbers should continue to increase, is catering for all persons who desire to take more than a general interest in forestry matters or to further the development of forestry in this country.

All this does not mean that there is no room in the Journal for papers and articles of a less technical and more popular nature. The proportion of such articles which have already appeared is, in fact, quite high, if we are to regard those papers of historical character as coming under that category. This issue contains the third of that type which definitely has an appeal outside forestry circles. Here again there is considerable scope for quite short articles or notes of interest which can be culled from a perusal of the literature and records of the past. One of the Society's tasks is to build up a forestry tradition in this country and these historical articles have a value in that connection. We should know more of the work of those who planted so extensively in the last three hundred years. We should draw our information from whatever old records are available, while at the same time we should be providing records for the interest and use of those who are to follow us.

Another feature of the Journal which should be developed has been the provision to members, in the form of reviews, of information of what is happening in forestry matters abroad, in so far as the present restrictive emergency conditions allow. To keep members in close touch with forestry developments abroad, especially in those countries where the climatic and edaphic conditions are analagous to those which prevail here, is of the utmost importance and the provision of well-informed professional comment on publications coming from abroad, is a proper function of the Society.

A new feature in this issue is an abstract in some detail of an important continental paper on a subject of great silvicultural interest and importance. There can be no doubt of the utility of abstracts of this nature which provide detailed practical information and stimulate interest along new lines, and more of the same character would be welcome to supplement information from home sources such as is contained in the original articles which appear in this issue.

The names of a number of new contributors appear in this issue to swell the list of active helpers and now that they have broken the ice, it is to be hoped that they will see their way to continue their support. If the Society, however, is to realise its ultimate highly-desirable objective of producing *Irish Forestry* quarterly, more contributors and more contributions will be required—a steady stream of material will be necessary so that new features can be introduced. The lack of any academic distinction or of a fine literary style need deter none from submitting his views and experience on any information, however brief, concerning any matter of forestry interest. It is the Editor's hope that a state of affairs will eventually occur where he will be in the happy position of being able to pick and choose—where he will have to exercise restraint lest the proceedings of the Society, the abstract of accounts, reports of meetings and occasional lists of members, for whose publication the Journal plays an essential role, be ousted altogether from its pages. In the meantime, however, he is anxiously wondering whence the material for the fourth issue is to be derived, for it is hoped to publish a second number to this volume if the necessary paper ration is duly granted.

SOME ASPECTS OF SOIL CLASSIFICATION

BY P. H. GALLAGHER, D.Sc.

The classification of soils must necessarily be of very considerable interest to the forester if only for the reason that he is so often expected to make some practical use, not only of an assortment of crumbs, but also of the more or less indigestible bones that may, so to speak, fall from the agriculturist's table

Numerous as are the soil problems of ordinary farming, it is in cases where the farmer is fully convinced that these problems are economically insurmountable that you are apt most frequently to find land on offer to the forester. The latter, we will admit, has at his disposal a crop capable of giving an economic return on many classes of soil which may reasonably be considered unsuited for normal farming use. It is the character of the soil which ultimately decides whether a particular district be economically plantable, just as it is the character of the soil which chiefly decides the tree species which will likely give the most profitable return.

Vegetation as an Indicator of Soil Conditions.

Many foresters rely to a considerable extent on evidence derived from existing vegetation when assessing the value of a plantation site. There is unquestionably a relationship between the vegetation established on a given site and the local soil conditions. Experience and caution are, of course, necessary if the inferences to be derived from one type of vegetation are to serve as a universal guide in forecasting the growth of another. Consideration of the whole plant community or association serves as a more reliable guide to soil conditions than does the presence or absence of any single plant. Some plants require fairly specific soil conditions in order to establish themselves. but the absence of a plant is no proof that the soil is unsuited to it. The general plant association, on the other hand, will sometimes be found to vary with change of environment, even where soil conditions may not be materially different. Elevations and wind exposure have a notable influence in this respect. We have examples of plant associations in the Survey of the Vegetation of South Co. Dublin carried out by Petherbridge and Praeger some years ago. Fraser, of the Macaulay Soil Research Institute, has in recent years given considerable attention to the plant associations as a means of assistance in forestry development in Scotland.

Relationship of Soils and Geology.

In the course of the many attempts which have been made to formulate a comprehensive system of soil classification in the past, geology has figured very prominently. So much was this the case that at one time the scientific study of the soil was frequently regarded as being exclusively within the province of the geologist and the mineralogist. When the Irish Geological Survey was established over a century ago, it was set the task of accomplishing a soil survey in conjunction with the solid or rock geology. The project of soil classification was abandoned, however, at quite an early stage, the reason stated being that it was considered preferable to devote the full resources of the organisation to the more fundamental solid geology.

Looking back at the position which existed a century ago, one may question whether a useful survey of Irish soils was at that time really feasible, and whether a realisation of the true position after some little experience may not in fact have determined its abandonment. For some reasons which I shall refer to at a later stage, no direct relationship can be said to exist generally in this country between the soil and the solid geology. The theory of glaciation, which goes far in explaining the displacements of our soils from their parent rocks, was not formulated until considerably later than the period at which the Irish Geological Survey commenced its work. Moreover, there did not exist, a century ago, any proper realisation of the climatic or weathering processes which have a fundamental influence on the character of a soil.

The Climatic Soil-forming Process.

The study of the weathering processes which impart to the soil most of its individuality was first developed in Russia towards the close of the nineteenth century. Making due allowance for the ability and initia-

tive of the Russian investigators concerned, it will be seen that a country so vast, and possessing such diversity of climate, offered a unique opportunity for the study of a problem of this kind. Throughout most of Central and Western Europe the climatic soil-forming process is substantially so uniform that it was perhaps, pardonable that persons studying the soils in these regions tended to forget the existence of any specific weathering process at all. In Central and Western Europe, attention was in great measure confined to factors connected with local geology. The Russian investigations to which I have referred, showed that where you had sufficient differences in climate, the effects of climate superimposed themselves on local geology in different ways. A particular rock situated in one climatic region would, for instance, give rise to the relatively infertile soil-type known as the "podsol," in another climatic region the same rock would yield the very fertile "black earth" or chernozem. The same geological formation in the tropics would give rise to a lateritic soil, which is totally different from the other two. These interesting and important facts have given rise to a somewhat deplorable consequence. They have led nowadays to a rather common belief that the geological parentage of a soil is of little or no practical significance. From your own practical experience of Irish soils, I doubt very much if you will be disposed to agree with this view. At the same time it is true that each species of climatic soil-type occurring in this country is to be found on quite a variety of geological materials. The essential point is that the climatic factor can be superimposed on a geological material without entirely obliterating the individual qualities of that material. There are, moreover, qualities inherent in our several geological formations which have determined the extent to which each has reacted in the past to climatic influence.

Climatic Factors Influencing Soil Formation.

To gain an understanding of the essential characters of Irish soil-types it is necessary first to consider the climatic factors which have affected their formation. Soils, of course, originate from the crumbling down of the rocks which form the solid core of the country. Mere disintegrated rock, however, does not in the true sense constitute a soil. It is merely the raw material from which, through the combined operations of climate and vegetation the soil is fashioned. The features of climate which are of importance from the point of view of soil development are temperature and humidity. These are interdependent, since for a given rainfall, the higher the temperature, the greater will be the surface evaporation, and consequently the lesser will be the effects of rainfall as a leaching agent in the soil. The higher the temperature, the more rapidly and completely also will the residues of vegetation tend to decompose. Where you have excess of rainfall over evaporation, and where also the temperature is such that growth is good, but the decomposition of vegetation residues is comparatively slow—in such climatic circumstances soil formation becomes dominated by a leaching process of acid character, resulting ultimately in the soil-type known as the podsol. The climatic circumstances necessary for podsolisation are found in what the geographers term the moist temperate zones, which is precisely the type of climate that we occupy.

Sources of Soil Acidity.

I have referred to the process which gives rise to the podsol as a leaching process of acid character. Although the geologists speak of certain rocks, such as granite, as being acidic, very rarely does one find a freshly disintegrated rock to be actually acid. Even quartz, though chemically acidic, is not an active acidifier. The primary source of acidification in the soil lies in the residues of vegetation. This is not necessarily the so-called "humic acid" that one frequently hears about. Plant tissues themselves are acidic. They contain various comparatively simple, soluble, well-defined organic acids, such as oxalic and tartaric. Plant residues reaching the soil not only contain such acids, but they further produce them on decomposition. Simple organic acids of this kind, however, are somewhat readily decomposed by bacterial action. They consequently exert their influence in the portion of the soil not far removed from the region of plant residue decay.

Soil Impoverishment Resulting from Leaching.

Acid leaching inevitably results in soil impoverishment. Loss of lime, is, perhaps, the most prominent starting point, a notable result of which is that the deterioration process becomes accelerated through the

establishment of a calcifuge vegetation which tends progressively to produce a more acidifying vegetable residue. The soil thus becomes generally depleted of its base reserves, while at the same time phosphate deficiency tends to become pronounced, not because this latter fertiliser is easily lost in drainage, but because the acidified soil acquires the power of rigidly precipitating phosphate and withholding it from the plant. The persistent drainage to which soils are subjected in our climate is a primary source of loss of fertility and it is, perhaps, the principal reason why manuring is so very important in our agriculture. In South-Eastern Europe, where the climate is not podsolising, crops such as wheat and maize, which we are apt to regard as exhausting, are normally grown successfully year after year without intervening fallows or green crops and with little or no attention to livestock production or to manuring as we know it.

The Mature Podsol.

One of the most noticeable features of advanced podsolisation is the manner in which the soil becomes zonated, as it were. Beneath a variable depth of peat or raw humus, which frequently forms a cover, there lies first of all the original surface soil. In the fully developed podsol, this is normally blackish in colour, due in the main to organic matter. This is succeeded in depth by a comparatively bright coloured layer resembling grey ash in the most typical instances. The comparatively bright colour of this layer is due to severity of leaching of the mineral particles and to comparative freedom from organic matter. Leaching of mineral constituents is well-nigh equally severe in the overlying darker layer which I have referred to, except that in this case organic matter somewhat obscures the mineral particles. The bleached layer is succeeded in depth by a reddish-brown layer which is usually referred to as the B horizon. This in turn overlies the more or less unaltered or unweathered parent material. The B horizon is, in fact, the receptacle of some of the soil constituents which have been removed from the layers which overlie it. It is enriched in iron and aluminium, often also in organic matter, and even in phosphate, although the latter is not necessarily present in an available form. The B horizon is also frequently the seat of iron-pan.

The Alkaline Podsol.

It should be noted that there are numerous instances on comparatively fertile soils on limestone drift in this country in which one meets with some of the salient features of the podsols which I have described. There is ample evidence to show that a downward migration of iron and aluminium occurs in practically all our soils, but the deposition of these elements in a definite B horizon in the subsoil is only apparent either where leaching has gone to an extreme, or alternately, where the parent material is exceptionally rich in lime. These two manifestations of podsolisation are readily distinguishable with a little experience, and they should on no account be confused. It would be a very serious error to plant the one with tree species suited only to the other. The normal acid podsol is definitely infertile, and one must be content to plant it with Scots Pine and similar conifers. Where the formation of a B horizon is due to lime, fertility will rarely, if ever, be found to be seriously impaired.

Comparative Immaturity of Irish Soils.

The condition of infertility which characterises the normal acid podsol represents what might be expected to be the ultimate condition which all our soils would attain in our prevailing climate. The mature podsol occurs here, however, to but a limited extent, and it is to be found for the most part in mountainous districts. Its frequency in the latter is to be attributed to geological factors rather than to elevation. The materials arising from different geological formations vary very considerably in power of resisting what one may describe as the degradation to which the podsolising process subjects them. The highlands in this country, especially where they are covered by coarse materials, are generally speaking of poor resistance to weathering as compared with the lowlands. At the same time the comparative immaturity of so many of our soils from the point of view of podsolisation is doubtless attributable to the glaciation of the country which would have had the effect of setting back the process of superficial weathering to a new beginning in relatively recent geological times.

Brown Earths.

I wish now to refer to the features of two very important groups of immature soils which occur in the podsol climatic zone on virtually all geological formations. The first of these is termed the "brown earth" and the other the "gley." The brown earth is a soil which shows in its profile none of the zonation of constituents which is characteristic of the podsol. The colour is a nearly uniform brown to a very considerable depth, the upper portion being usually somewhat darker than the remainder owing to accumulation of organic matter. While the podsols which occur in this country are nearly always light in texture, being either sandy or gravelly, the brown earths are usually loams. From the point of view of fertility the brown earth is definitely superior to the podsol, and it is suited to the growth of the more exacting tree species, including the hardwoods.

The "Humus Podsol."

The brown earth owes the characteristic colour of its profile to an even distribution of iron in a comparatively full state of oxidation. There occurs on many geological formations in this country a soil type which, though materially different from the brown earth in many important respects, is very liable to be confused with it. This is the more or less immature humus podsol, which is normally distinctly inferior to the true brown earth in fertility. The humus podsol owes most of its characteristic brown subsoil colour to a peculiar variety of organic matter. The presence of this organic matter to a considerable depth in the subsoil is quite evidently the result of podsolic leaching, as a result of which it has migrated in a soluble form from the upper layers of the soil, to be finally fixed in position through absorption by the oxides of aluminium and iron which already have accumulated in a podsol B horizon. The resulting coffee-brown subsoils are distinctly soft and crumbly, possessing none of the plastic or cohesive properties which are displayed by both peat and clay.

Gley Soils.

While all of the foregoing soils owe their origin to free drainage, we have a climatic soil-type known as the "gley," which owes its essential characters to defective drainage, associated with either permanent or periodic water-logging. Where the water-level in the soil is high and substantially permanent in position, the subsoil displays substantial uniformity. Crumb or aggregate formation is noticeably absent below the organic surface layer. When the subsoil is allowed to dry, it merely cracks as a result of shrinkage. Gley soils are very frequently regarded as being heavy clays, although the percentage of clay material in them, as distinct from sand or silt, is frequently not high in comparison with well-drained soils possessing good structure. The colour of permanently water-logged subsoils is most frequently a somewhat uniform yellowish-grey. There are cases, however, where bluish or even black colours may be met with.

The most common class of gley soil, however, is that in which the water-level fluctuates periodically with seasonal changes. The soil in this case acquires a characteristic variegated appearance in the portion in which the rise and fall of water occurs. The body of the subsoil is usually yellow-grey, but in the channels resulting from the decay of roots, and in the site of old shrinkage cracks, the colour is a rustry brown. This distribution of colour gives the soil a mottled or semi-marbled appearance which serves for the diagnosis of drainage conditions even during a period of drought. The distribution of colour in these soils is due to the fact that when air is excluded owing to the presence of stagnant water, iron present in the soil becomes reduced to a relatively soluble and colourless form. As the water-table falls, air gains easiest access through cracks and old root channels, on the walls of which the dissolved iron is precipitated through oxidation.

While gley soils have not been subjected to the severity of leaching which has been the fate of the podsol and even of the brown earth, and while they thus may be expected to contain a relatively greater reserve of plant nutrients, they none the less possess many undesirable features from the point of view of fertility, owing to the asphyxiating influence of ground-water. They frequently contain notable amounts of sulphide. When artificially drained, they are exceedingly slow in acquiring a desirable structure, while in the absence of drainage, they are suited only to the growth of species which are tolerant of a high ground

water level. One must also bear in mind that a high ground-water level restricts the effective depth of soil from which the plant can acquire its nutrient supply. Although gley soils are at present seldom classed as arable, some of them are subject to extremely high Poor Law Valuations in this country, a fact which is probably to be ascribed to their apparent heaviness and to their productive capacity as meadows.

It is important to note that gley soils very frequently occur in other than low-lying positions. Where soil structure is so imperfectly developed as to interfere with proper drainage, gley conditions will arise irrespective of local topography.

Hybrid Types.

While refraining from chemical and physical details, I have sought to indicate the principal features of podsols, brown earths and gleys because these types represent definite landmarks in this country from the point of view of climatic development. While there are many soils which belong specifically, to one or other category, there are others which share the properties of two or more categories. Chemical analyses of the clay fractions from different positions in brown earth profiles frequently yield evidence that the migration and deposition of iron and aluminium, which is characteristic of the podsol, has already taken place to some degree. In profiles which are substantially of brown earth character, one sometimes finds visual evidence of such migration. These are the so-called "podsolised brown earths," the fertility of which tends to be somewhat depressed, as compared with the brown earth proper. Most of the brown earth soils of this country are in agricultural use, and it is possible that evidence of slight podsolisation in many of them may have been obliterated by tillage operations. Gleyed brown earths are also not uncommon, as well as the soil-type known as the gleyed podsol.

The existence of soils conforming to these hybrid types may at first sight seem surprising and a contradiction in terms, since both podsolisation and brown earth formation depend on freedom of drainage, while gley formation is due to defective drainage. But there are soils capable of maintaining a water-table at such a distance from the surface that while drainage may be sufficiently free through the upper levels to produce the essential features of the podsol or brown earth, the lower levels, being under ground-water influence, will display the properties of a gley. I would mention that the well-known indurated deposit known as iron-pan may conceivably be the result of gley conditions in podsols of coarse texture. The deposition of iron from ground-water in coarse soils would tend to take place at a comparatively uniform level, and not in the diffuse manner which is usual where loams and heavier soils are concerned.

Significance of Climatic Soil-type in Land Classification.

The question which now naturally arises is, whether in a country as limited in area as Ireland, the climatic soil-type in all its ramifications is capable of furnishing an adequate basis for a practical system of land classification. A classification of Irish soils on a purely climatic basis would unquestionably coincide with very important relationships between the potential fertility of various districts, but there will be found to exist a certain lack of uniformity within each climatic group of soils. This lack of uniformity is ascribable to variations in the soil parent material, which, of course, is traceable to its geological source. As an example, I would point out that the brown earths of our Silurian districts, while bearing many points of resemblance to those derived from Old Red Sandstone, are at the same time very noticeably different from them. Soils of brown earth character on limestone drift are in many important respects different from both the corresponding Silurian and Old Red Sandstone types. As I indicated at an earlier stage, climatic features are superimposed on the geological ones without by any means totally obliterating all of their individual qualities.

The climate of this country may be regarded as reasonably uniform in respect of temperature, rainfall and evaporation, but the effects of humidity on and within the soil will be determined, not only by the inherent drainage capacity of the soil material, but also to a very important degree by the character of the local site in which the soil has formed. Making allowances for a somewhat greater rainfall in the west than in the east, with a resultant tendency to greater podsolisation in western districts, it can be stated that from a given geological material,

wherever it may occur, soils of practically identical characteristics have been formed where drainage facilities within the soil have been substantially similar. Where drainage facilities have differed, however, one or other of the climatic soil-types—podsol, brown earth, gley and intermediate phases—will result, depending usually on the circumstances of local topography.

If the geologist has in the past failed to evolve a satisfactory system of soil classification, this, I believe, is in the main due to lack of adequate reference to the facts of climatic weathering which determine the soil-type which a given geological product will evolve in any given location. It would be equally futile, in my view, to seek a comprehensive practical classification on the basis of climatic factors only, without reference to the parent material on which they operate. It will, I think ,be clear that it is in the interrelationships of both the geological and the climatic factors that the true solution may be said to lie.

Complexity of Irish Soil Geology.

The direct application of existing geological data to the classification of Irish soils is, however, by no means so simple as one might at first sight suppose. We possess in this country quite a variety of geological formations, the sites of which have been very fully explored as far as the solid geology is concerned. As a consequence of glaciation and erosion, the soils derived from these formations have, throughout most of the country, been transported over considerable distances; but the information available as regards the nature and extent of Irish soil displacements is meagre in the extreme. The position is further complicated by the fact that the soil material is very frequently a decided mixture from a geological point of view. A further complication is that a single geological formation is not necessarily comprised of a uniform rock or soil producer.

It would quite obviously be an error, therefore, to approach the subject of soil examination from simple considerations of solid geology, although in certain areas, where the geological formation is sufficiently uniform and extensive, it is possible to do so. Contrary to what one might be apt to suppose, however, the glaciation of our soils has not resulted in rendering their geology totally chaotic. It has subjected them for the most part to relatively limited lateral displacements. Within some miles of the geological boundaries, it is a frequent occurrence to find the soil composed of material totally different from that which the underlying rock would give rise to. The intermixture of materials in the neighbourhood of geological boundaries is a further complication, should one seek to classify soils from a purely geological standpoint.

Importance of Profile Examination.

Now if soil geology had been free from these various complexities; if, in other words, each geological formation were substantially uniform, and if the soil boundaries strictly agreed with it, the problem of soil classification would resolve itself into ascertaining the climatic variations in the soils within each formation. The existing geological complexities are such, however, that the only general practical approach to our soil problems is a direct one, depending on their individuality as soils.

If we therefore accept the soil as an object of independent individual study, in what manner are its individual qualities best expressed? To seek to judge a soil by the texture and other properties of its upper few inches constitutes a limitation in approach which has been materially responsible for the somewhat tardy advances in soil study which have characterised the work of the agriculturist and of the agricultural chemist for many years. To ascertain the general character of a soil, one must consider its whole profile which comprises a vertical section to the depth to which roots and weathering influences have penetrated. Where you have substantial identity between whole profiles, there also do you find substantial similarity from the point of view of natural adaptability to one or other kind of vegetation.

In respect of adaptability to vegetation, one should bear in mind that soil type is properly decided by what may be regarded as permanent features of the soil, and it has no direct reference to artificial expedients for temporarily altering its productivity, such as in the case of ordinary manuring. But response to manure is undoubtedly influenced by the absorptive properties of the soil material which is largely determined by its type.

If we accept the soil profile as a standard of type—and a more comprehensive criterion is difficult to conceive of—what general features ought one to look for in characterising it? You will discern a series of features which are systematically interrelated, including its climatic derivation, the nature of its parent material, its texture and structure, its drainage properties, its natural acidity and its depth. Two soils showing substantial agreement in these particulars are unlikely, except in very exceptional instances, to show lack of conformity in chemical properties, or in adaptability to vegetation. And when you meet with instances which are apparently exceptional, you ought to remember that it is by studying the exceptions to its rules that science accomplishes most of its advances.

Necessity for Reconnaissance.

There are many interesting aspects of classification which it would be impossible to touch upon in a brief review such, for instance, as those connected with the peats which the forester is frequently liable to encounter. I would like to refer to some general aspects of the subject in conclusion. In dealing with a product in the formation of which so many factors have had interplay, one might be led to suppose that soils are unduly complicated, and that the task of classification would be well-nigh insuperable. That they are in many respects exceedingly complex is, of course, to be admitted. It is none the less true that even when one specifies for classification purposes as comprehensive a degree of conformity in profile as I have indicated, the soils of this country are divisible into a not unduly large number of distinctive types, each of which possesses its individual adaptability for economic use.

The preliminary exploratory work on soils which has already been carried out in a number of agricultural areas is, I believe, capable of convincing anyone who is willing to go into the fields in order to examine it that in profile examination on the lines which I have outlined we have the clue to the solution of soil classification problems which in the past have baffled the ordinary practical man and the ordinary scientist, alike. Assuming that we, in this country, desire to acquire systematic comprehensive information on the properties and interrelationships of our soils, what then would be the logical method of approach? One must first explore by general reconnaissance the broader features of the country as a whole, so as to gain a general knowledge of all our soils, the nature and extent of their actual types. On such a general knowledge alone can a framework for an ultimate detailed classification or survey be based. Our geological surveys would have been impossible without the systematic investigations on the nature and properties of rock formations which preceded survey work, but which subsequently enabled the geological surveyor to decide what each fundamental rock formation consisted of, where one ended and another began. A similar systematic and rational approach to the problem of soil classification is an obvious need.

I confess I have referred but little in this talk to the trees which are your primary concern. None of us is likely to forget that the most important feature of a soil is its natural purpose as a producer and supporter of vegetation. The assessment of the relationships between soil properties and productivity in the plantation is an important aspect of your work. I hope I have in some small measure succeeded in indicating to you the lines on which at least one phase of that work may some day be more fully systematised.

NISBET'S OBSERVATIONS ON IRISH FORESTRY IN YEAR 1904

S. M. PETRIE.

Introductory.

Some interesting information on the condition of the woods existing in this country at the beginning of the present century, on forestry practice then in force, and on recommendations for future schemes of work—are to be found in Dr. Nisbet's " Report on the Woods, Plantations and Wastelands in the South Eastern Counties of Ireland," which was addressed to the Department of Agriculture in 1904. Dr. John Nisbet was, at this time, regarded as one of the ablest exponents of scientific forestry in Britain and in the space of his career had held various important forestry appointments. Born in 1853, he was educated in Edinburgh and studied forestry for some time at Munich where he was a pupil of Gayer. He passed into the Indian Forest Service in 1875, retiring in 1900 after reaching the rank of Conservator. Little is known of his work in India which is merged in the merit of the Service; it was by his continual endeavour on his return to the United Kingdom, to awaken the Government to its responsibilities regarding the growing timber consumption and the need for ensuring an adequate supply of home-grown timber that he was mainly recognised, and it is realised now that much of what has already been done is due in great measure to his efforts. He is probably best known to foresters by reason of his publications, which include among others " British Forest Trees," " The Forester; a Practical Treatise on British Forestry and Arboriculture " and " The Elements of British Forestry."

In 1903, Nisbet made an advisory tour of the woods and waste grounds in Counties Wicklow, Wexford, Carlow, Kilkenny and Waterford at the request of the Department of Agriculture, and his general report and proposals for large-scale afforestation in Ireland by the State have been largely followed in actual practice. His inspection notes on many of the stands visited throw some light on condition and quality of much of the woodland being cleared or thinned at the present time, but it is apparent that he had very little time to spend in each wood and his methods of stating dimensions of trees and rates of growth often do not give a very clear picture of the wood, while insufficient attention appears to have been paid to the aspect and altitude of stands upon which rate of growth and quality of trees depend very much in a small island country. At this time, there had been little division of the old estates and forestry work on these properties was of a somewhat haphazard nature, depending principally on the protection of game and on ornament and to a lesser extent on the supply of pit-wood for the English and Welsh collieries and for estate and local requirements.

General Statistics.

In 1902, the Agricultural Statistics, Ireland, showed the extent of woodland in the five counties visited to be 17,644 acres in Wicklow, 9,785 acres in Wexford, 3,046 acres in Carlow, 9,995 acres in Kilkenny and 19,749 acres in Waterford, making a total of 60,219 acres. The proportion per cent. of woodland to other land under the above was respectively 3.5, 1.6, 1.4, 2.0 and 4.4, Waterford and Wicklow containing by far the largest percentages of woods and plantations to be found in any county in Ireland. The percentage for the whole country was 1.5, the smallest for all Eureopean countries, so that Ireland could be regarded as the worst wooded country in the world. Nisbet stresses that one very great disadvantage of this want of woodlands was the absence of shelter from cold and strong winds in a country where stock raising in the open field was the main branch of agriculture.

That the south-eastern part of the country was at one time much more heavily wooded, there is no doubt, but in the fifty years previous to Nisbet's tour there was very little change in the total area, statistics showing a figure of 304,906 acres for the whole country in 1851 as compared with 303,023 acres in 1902. Woodland reached its maximum area in 1880, after the great famine, with 339,858 acres, but with the passing of the Land Act of 1881 very little additional planting was done and large

clearances took place from then onwards. According to the returns for the whole country, the figure of 303,023 acres in 1902 was estimated to consist of 45,033 acres under larch, 32,998 acres under fir, 14,976 acres under spruce, 2,494 acres under pine, 26,611 acres under oak, 6,987 acres under ash, 10,095 acres under beech, 2,519 acres under sycamore, 2,709 acres under elm, 4,702 acres under other trees and 153,899 acres under mixed crops. Oak was the principal tree in demesne woods and woods of an ornamental character and larch was the chief tree in woods intended to be worked for profit. It will be interesting to compare these figures with those arrived at in the recent census of woods carried out by the Forestry Department.

Classification of the Woods.

From his inspection of the various woods, Nisbet put them into the following five classes:—

A. Remains of the original woods and old plantations.

1. Demesne woods and ornamental plantations usually in the form of belts near residences.

2. Old oak copse woods or coppice under standards, formerly worked for timber.

3. Old oak coppices formerly worked for bark and now either interplanted with conifers, or forming scrub with a mixture of self-sown birch, willow, rowan, etc.

B. Plantations formed since the great famine of 1846-47.

4. Plantations chiefly coniferous, intended for game protection or shelter.

5. Coniferous plantations formed on poor land mainly with a view to profit.

Of the first class little need be said. They were mainly of an ornamental character, but the majority of them contained extremely fine specimens of both broad-leaved and coniferous trees which give the lie to the assertion that timber trees will not grow as well in the climate of Ireland as in that of the Continent of Europe.

The second class formed at one time a large proportion of the woodland, but by the beginning of the present century they were of very limited extent. They were confined to the larger estates and were worked principally for ship-building timber. The management of coppice with regular age classes of standard is now a lost art in this country, and with the fall in the value of the underwood, it is never likely to be recovered. Roddenagh Wood, near Aughrim, is mentioned as having been one of the finest of these woods.

Classes two and three form the chief remnants of the old oak woods with which Ireland must at one time have been greatly covered, class two being confined to the better land and class three to the more exposed and shallow soil areas. These coppice woods were often the most valuable part of landed estates, but with the decline of the bark industry they were no longer subject to any regular system of management. Landowners either cleared them and allowed them to develop from coppice shoots to high forest or in many cases inter-planted them with larch, possibly to act as a nurse for the oak shoots, but more probably because of the commercial value of this conifer. Conditions for larch were generally ideal on these sites, and many fine crops of this timber were cut during the twenty years previous to Nisbet's visit. By this time, the oak woods thus treated were already mature, but not of great size, and numerous borings showed a very slow rate of growth. The treatment advised for these woods is very much the practice which is being followed to-day—a gradual replacement with conifers—as it was foreseen that there would be very little demand for oak of this size and that such woods would be very unremunerative in their present form. The advent of two world wars has considerably disproved this forecast.

Class four calls for no comment, but it is of interest to note that as regards shelter belts, coniferous trees were not favoured by Nisbet for this purpose, but if these are preferred, he recommended Mountain Pine, Spruce, Silver Fir or Douglas Fir. Present-day observations do not confirm the suitability of these species, with the possible exception

of Silver Fir and any species of Spruce makes a most unsatisfactory shelter belt in any type of ground.

Of the last class, which is the most important from the forester's point of view, it was estimated that such woods formed only one-fifth to one-quarter of the total woodland area, and on very few estates was any regular system of management adopted in their treatment. Owners, agents and foresters had no knowledge of areas, costs of working or revenues from the woods and planting and felilng were generally of a sporadic and haphazard nature.

Over-thinning.

Nisbet's chief complaint concerning the woods in Class five was that they were all subjected to "premature and unnecessarily heavy thinning," and this led him to discuss the matter of thinning comprehensively. Modern foresters would not agree with much of what he says, particularly as regards larch, the principal tree in these woods; his main object was to keep the crop dense for a long period, removing only dead, dying, diseased and blown trees, and it is common experience now that in the majority of privately owned mature and semi-mature larch woods proper development of the trees had been hindered by too long a delay in making the early thinnings. No doubt many of these woods were cut into too heavily in places to improve their usefulness as cover for game and for ornamental effect, but Nisbet's German training had apparently influenced his ideas too far in the other direction.

Management at Gurteen.

Early saleable thinnings and short rotations were obviously best suited to the private owner who was anxious to have as quick a return as possible from his investment, and an example of this type of working is given for the De la Poer property at Gurteen. The data per acre are as follows for larch grown for the pitwood market:—

1st. thinning	at about 15 years of age,	yields about	580 trees	=20 tons
2nd thinning	at about 20 years of age,	yields about	500 trees	=25 tons
3rd thinning	at about 27 years of age,	yields about	380 trees	=20 tons
4th thinning	at about 30 years of age,	yields about	360 trees	=30 tons
5th final clearance	35 years of age,	yields about	240 trees	=20 tons
Total per acre			2,060 „	=115 tons

The prices obtainable for the timber sold standing and measured down to 3" top diameter, over bark, were 10/- to 12/- per ton for larch and 5/- to 5/6 for Scots Pine. The cost of replanting at 4' x 4' averaged from £2 10/- to £4 15/- per acre—use of wire netting on the fence being unnecessary.

Instead of the heavy thinning adopted under this system Nisbet recommended clear felling an area of wood each time to give an equivalent number of poles, followed by immediate replanting, but there is no reason why, on suitable sites, pitwood timber and large commercial timber should not be obtained from the same stand when managed on a proper system. It was suggested, however, that the burden of growing timber of large size on long rotations was not one to place on the private landowner, but was obviously the obligation of the State, and Nisbet considered that satisfactory timber could well be grown here if Continental forestry practice were applied. A certain amount of broad-leaved trees would always be grown in the vicinity of country houses for their beauty, but softwoods being in greatest demand, would form the bulk of the forests.

Condition of Coniferous Woods.

For the unsatisfactory conditions of the existing coniferous woods, Nisbet attributed the following reasons:

1. Owners and their foresters had no opportunity of acquiring any knowledge of forestry, except of a rough rule-of-thumb kind.

2. Even such knowledge of practical forestry as obtained among these men was not acted upon, first considerations being given to game preservation and ornament

3. Lack of adjacent wood-consuming industries, poor prices for tim-

ber and the need for plantations to be convenient to a sea port to be at all remunerative.

4. The above three reasons had induced premature and heavy thinning, leaving the older stands very thin and generally devoid of larch which was the most readily saleable species.

5. In consequence of 4, yield per acre was smaller and the timber of poorer quality. Damage from windfall also became much more frequent.

6. Again as a result of 4, the woods were forced into prematurity, larch completing its main growth in the south-east of Ireland from 35 to 40 years of age. It was found in the majority of woods visited that, although this was the case, there was no reason why larch, if given close canopy and grown on suitable sites, should not be treated on a rotation of 60 to 70 years. Some of the finest larch timber seen in the United Kingdom was from a 70-years-old stand at Castlebernard, portion of which was blown in the great gale of 1903.

7 Larch, being the tree most easily sold and commanding the best price, was planted on all sites, inducing frequent attacks of the canker disease. This disease was found to be principally confined to plantations formed between 1870 and 1881, the worst cases noted being at Cuckoo Island, Birr, and at Castle Boro, Co. Wexford. There was comparatively little damage in Co. Wicklow where larch was chiefly planted through Oak and Scots Pine. Pine plantations frequently showed attacks of *Peridermium pini*, the worst cases noted being at Shillelagh, Co. Wicklow, and Cappagh, Co. Waterford, and squirrel damage was prevalent in nearly all plantations. Rabbits appear to have been as plentiful as they are to-day.

Douglas Fir.

This tree was regarded as the most important timber tree introduced into Europe in the nineteenth century, and the Pacific or dark-green variety was considered as being a very suitable forest tree for Ireland in the event of the Government undertaking large-scale afforestation. Its rate of growth was calculated to be greater than larch and its timber to be superior to that of Scots Pine, commanding a price half-way between those of larch and Scots pine. Reference was made to the small Douglas fir plantation planted in 1885 at Whalley Abbey. It was originally a mixture of Douglas fir and Thuya, planted at 6' by 6,' the Thuya being completely suppressed at an early age and in 1904 the fir was about 50 to 60 feet in height with an average girth of 27 inches at breast height. The fact that the lower branches still persisted, although dead, caused Nisbet to recommend planting at 4' by 4' or 4½' by 4½', but it is apparent now, when extensive plantations of Douglas fir have been established, possibly on the recommendation already made in this paragraph, that artificial pruning is necessary no matter what the planting distance. Pure plantations of this species were recommended.

Plantable Wastelands.

In 1885 Dr. Schlich estimated that 2,000,000 acres of the waste lands of the whole of Ireland, north and south, could be made available for planting, but this figure is judged to be very much in excess of what could be planted with any reasonable hope of profit. Exposure is so severe that vast stretches of land, otherwise suitable, could not produce marketable timber at a profit even allowing for a considerable rise in the market value of timber in out of the way places. In the counties visited by Nisbet, he came to the conclusion that approximately one-fifth only of the lands classified as waste land could profitably be planted, so great were the deductions to be made for turf bog of too great a depth, for very exposed ground above the 1,000 foot contour and for land occupied by water, roads and fences. Applying the ratio of one-fifth to the whole of Ireland would give a figure of 755,928 acres. The cost of planting such an area, including draining and fencing, over a period of 50 to 60 years was estimated to cost four and half to five million pounds disregarding interest and exclusive of the cost of acquiring the land and maintaining the woods and plantations. In addition there was endless scope for shelter belts all over the country and strong recommendations were made to replace those cut over and to increase the existing number for the benefit of farmers.

Samples of Costs and Revenues.

Various calculations were made to show the probable profits likely to be obtained from plantations of different types, but space does not allow quoting these in a short article, nor did Nisbet place much faith in these statistical calculations. More useful is his account of several stands for which some figures of costs and income were available.

Ballyreagh Wood, near Enniskerry, is one such stand, particulars of which are as follows:—Area, 1,100 statute acres, ground steep, aspect north-east, elevation 500 to 800 feet, loose soil over a granite rock. Planting was done about 1870, species principally pine and larch, with a small amount of Spruce, Silver fir and Douglas fir. Planting was by T. notching, costing 12/6 per acre; plants used 9 to 15 inches high, put in at 4-foot spacing. Cost of planting including drainage and erection of the boundary wall was about £4 per acre. Beating up was done for the following three or four years. In 1904 this wood showed 372 trees per acre, 250 larch and 122 Scots pine, but over-thinning was evident. Average height 58 feet. Squirrel damage was serious on the pine. Considerable sums had been taken from the sale of thinnings and it was estimated that the standing crop remaining was worth £40 to £50 per acre.

Garryduff Wood, Rathdrum, another example, was a wood of 473 acres with all aspects represented and reaching a height of 925 feet above sea level. Planting was done from 1845 to 1849, chiefly with Larch and Scots Pine and a little Spruce on the moist ground. There was no record of the cost of planting which was by the pitting method at a distance of 3½' by 3½' and 4' by 4'. From the age of 20 years tangible returns in the way of thinnings and windfalls produced about £620, expenditure on cleaning, thinning and maintenance amounting to £599. In 1903 a clear felling over 60 acres, 291 trees per acre, realised £3,050 and the quality of the Larch was stated to be excellent. At this time, the Larch girthed 28 to 40 inches and the Pine 30 to 38 inches at breast height and the crop was very thin, with large bracken-covered gaps, but was estimated to be worth £60 per acre standing. Damage from squirrels and bark beetles was evident, but there was very little trace of canker.

General National Economic Point of View.

The effects of large-scale planting were stated generally: —

1. To equalise atmospheric and soil temperature and to diminish extreme differences.

2. To increase the relative humidity of the air and probably to a slight extent, the rainfall.

3. To store up moisture in the soil, reducing flooding and providing for the perennial flow of rivers, streams and springs.

4. To prevent erosion.

5. To provide employment.

and with special reference to Ireland

i. To increase trade and industry generally.

ii. To provide home-grown supplies of timber.

iii. To provide shelter from wind, desirable in a stock-raising country.

iv. To increase facilities for sport and the amenities of the countryside.

The type of land which it was recommended should receive first attention was the furze and bracken-covered ground which prior to the famine had been either under cultivation or satisfactory grazing, and large tracts of this type were available. They are very suitable for mixed conifers, the land generally being loamy and naturally well drained. The cut-away parts of peat bogs, too, are very often plantable but there is seldom any very extensive area of such and very expensive drainage is generally necessary. Deep peat bogs and high barren ground are not worth attention. No mention is made of cut-away woods or extensive areas of uneconomic scrub, and it would appear that these should obviously have first preference and would be naturally most suitable in a scheme of re-afforestation.

Considerable space is devoted to the system which should be adopted in planting large tracts of land, and this generally applies to-day, but the principle of raising artificial shelter-belts before the main blocks are planted is a point to which a good deal of attention is given and one generally completely neglected at the present time, chiefly on account of the administrative and supervisory difficulties which would arise. Mention is made of the difficulties likely to be encountered in acquiring large blocks of land, of the reasons why it is not in the power of landowners to plant extensively and of the Government's obligation to undertake large afforestation schemes.

Proposed Organisation of a Forestry Department.

In the event of the Government undertaking to afforest land on a large scale, Nisbet proposed that a Forestry Branch should be formed in the Department of Agriculture and that the head of such Forestry Branch should be responsible for the entire work of that Branch. Such technical officer would be *ex-officio*, one of the new trustees to be appointed under Section 20 (1) of the Irish Land Act, 1903. In addition to this Departmental officer, two trustees should be appointed in an honorary capacity in each county where land was acquired, and it was suggested that one of these should be a leading landowner nominated by the Department of Agriculture and the other some person resident within the county, nominated by the Rural or District Council, and approved by the Department of Agriculture. These men, having special and intimate local knowledge, would be able to give valuable advice and would cooperate with the Departmental officer who would be responsible for all technical matters and for the best utilisation of the funds at disposal under the budget. Some idea would thus be obtained of the type of land which could be acquired in each county, and upon the data collected for the first year or two schemes of work and extent and sites of nurseries could be arranged. With the expansion of the work, one assistant forest officer would be required for each province, a forest ranger for each county where sufficient land had been acquired, and a trained forester to take charge of each forest unit. It was observed that 2,000 acres of woods should be the maximum area under the charge of a forester, under the most favourable conditions. Much greater areas are single charges at the present time and also much smaller areas, and it is not considered desirable to allocate a charge according to area. Its extent will depend upon the age and condition of the plantations, upon the intensity of working and upon the type of ground and location of the forest with regard to neighbouring industries and density of population.

Technical Instruction in Forestry.

The need for a course of instruction in forestry, to be given for the benefit of agents and foresters as well as to the forest apprentices who would be recruited for the Government service, is dealt with at considerable length, and can be briefly summarised. As regards the apprentices, their training should be of a thoroughly practical nature, and they would be required to carry out all types of forest and nursery work under an experienced forester, while indoor theoretical work, although equally essential, should be made subsidiary and supplementary to that and should be done at times of the year when outdoor work makes the least demand on their time A good grounding in the four main branches of forestry—silviculture, protection, management and utilisation—should be given and a necessary elementary knowledge of plant physiology and agricultural chemistry, "the two sciences upon which the art of forestry must establish itself." Such a course for the training of practical foresters was estimated to take from eighteen months to two years, and during that time it was recommended that apprentices should get a small weekly wage in addition to board and lodging and instruction.

It was advised that the school should be under the charge of a Director (non-resident), and a Forester (resident), and that it should be at no great distance from Dublin in order that lecturers in cognate sciences at the Royal College of Science might occasionally give a lecture in the school, and that the Director might also lecture in the Royal College of Science in a suggested more advanced course for agents, stewards and estate foresters. For these reasons, Avondale House and

Whalley Abbey, both in Co. Wicklow, were recommended as being eminently suitable, and for the same reasons Carrick-on-Suir was ruled out although it was otherwise ideal, because of the extensive woods in the neighbourhood, the ozier beds on the Suir and the various wood-consuming industries in the town. A nursery with the school was, of course, essential.

The more advanced course for agents, stewards and foresters would not involve the day after day manual work necessary in the case of apprentices, but a short course of practical work might be undertaken at the forest school. In the curricula of Continental schools for forest officers, and at British Universities much of the student's time is taken up with cognate sciences such as botany, zoology, geology, surveying, etc., but nothing so elaborate as this was suggested, nor is a deep academic knowledge of these subjects necessary for the administration of forestry work. If attention is paid only to the four main branches of forestry such a course could be covered in 100 to 120 lectures given during the summer months with weekly or fortnightly excursions to woodland centres of practical interest. It was suggested that the Director of the forestry school might give these lectures at the Royal College of Science; at a rate of two lectures a day, the course would be of 50 to 60 days' duration, and in addition to the excursions it would be further improved by a suggested two weeks' visit to the Continent where "forestry on a more extensive scale, and in a more intensive manner could be seen." A fortnight in a Continental country is much too short a period to learn a great deal concerning the forests and forestry practice there, and a visit to a well-managed Scottish or English estate would probably be of more value. However useful such a course may have been fifty years ago, it would be of little value to-day when the majority of the large estates have been parcelled into self-contained farms and the employment of stewards and foresters by private landowners has become almost a thing of the past.

Summary.

1. Only one-fifth to one quarter of the existing woods in the south-east counties of Ireland were originally formed with the intention of working for profit.

2. Growing stock was much less in volume and quality than it should have been owing to heavy thinning and it was much more liable to damage from wind.

3. The market for home-grown timber was very poor, the chief market being for larch for export to England and Wales.

4. Crops of coniferous trees were those most likely to prove profitable and best suited to soil and climate.

5. About 755,928 acres of waste land in the whole of Ireland seemed plantable with a chance of direct monetary profit.

6. Mixed plantations of conifers, made at an average cost of £7 per acre, should prove profitable in the future.

7. Formation of woods and shelter belts would be of great benefit to grasslands and stock-raising.

8. Plantations should be in large blocks, preferably not less than 1,000 acres and shelter-belts should be raised five years before the main planting.

9. There was little likelihood of an increase in the woodland area unless the State accepted the duty of planting and a Forestry Branch of the Department of Agriculture should be set up.

10. Before any great national scheme of planting could be undertaken it would be necessary to provide technical education for practical foresters and, to improve the management of private woods, a course of instruction should be arranged for estate agents, stewards and foresters.

MOUNTAIN FIRES

O. V. MOONEY.

The object of this contribution is not a discussion on the technical aspects of mountain fires and the fighting of those endangering plantations, matters of which experienced foresters have little to learn; it rather aims at presenting for consideration some broader aspects of the subject which seldom receive serious attention. The sum of public interest is reflected in occasional short and highly picturesque contributions to provincial newspapers which interest themselves chiefly in developing the aesthetic qualities of night fires but attend little to the wake of devastation or their underlying meaning. Certainly no blame can be directed to the majority of our community for being unaware of the serious implications behind the question of mountain fires for it is painfully obvious that most people are so far personally detached from them as to obscure any reflection except that of the spectacular. Where drainage work is required in a countryside the necessity is made sufficiently obvious by flooded fields or roads and a remedy is demanded by all, but in the case of mountain burnings there are no such apparent effects to stimulate public indignation. Furthermore, there are no doubt sections who would argue that mountain burnings are beneficial, as serving their own immediate interests. Therefore, it may be propounded that no important public attention is directed to this perennial process of destruction.

In recent years, say for fifteen or twenty years back, mountain fires have been on the increase, and within the last five years the increase has been further accelerated by new sources of fire provided by large-scale turf-cutting operations throughout mountain districts. The high incidence of plantation fires within the last six or seven years is due more to these increases in possible sources of mountain burnings than to the influence of the great extension in the number of plantations and the frequency of dry spring seasons. With regard to this subject, a remark was made some time ago in hyperbole, but, notwithstanding, with some aptitude. It was to the effect that forestry had so far progressed in this country as to be capable of staging forest fires which compare very favourably with the giant conflagrations of the great forest States of North America. The comparison was inspired by the occurrence of a fire in a Tipperary State forest centre which consumed 596 acres of prospering fourteen-years-old plantation in the short space of thirteen hours. It is worth noting that this fire took place in May and was attributed to mountain burnings getting out of hand. The originator of such a fire, and indeed of the majority of recorded fires, is as securely enshrouded in mystery, as if enveloped in the smoke of his own handiwork.

Figures recorded in the Department's forestry reports show that in a period of five years from 1939-1943, 2,482 acres of young plantations were destroyed by fire; in this same period 29,180 acres of plantations were laid down, which shows that it is possible for fire to destroy over a short period an acreage equivalent to about 8½% of the area of newly-formed plantations, a seemingly high proportion. Under prevailing conditions and provided with an unlucky run of years there is no real reason to deny the possibility of even more alarming figures. The report also shows that during this five-year period 263 fires, damaging or otherwise, were recorded in the vicinity of forestry plantations and attributed to mountain burnings, picnic parties, smokers, dinner fires on bogs, and so on. Of these causes mountain burning is by far the most important in contributing to the destruction of plantations, and indeed, all else in their way. Such Departmental reports are necessarily concise and do not elaborate, but underlying such figures is the unheralded and arduous work, by night and by day, of foresters and their helpers in defending State forests against destruction.

It is well recognised in mountain districts that these fires are initiated by graziers in order to burn off large furze and wiry heather and other shrubby growth, and to remove the older and coarser molinia grass, all of which tend to suppress the growth of mountain grasses upon which their sheep and other stock feed. In ideal conditions this does happen and various sweet grasses may come up in the spring and early summer along with a softer growth of young molinia grass. Also, young

heather shoots are stimulated and this is often important in districts where snow lies for any length of time in the winter as the sheep can feed on these young shoots when ready access to ground grasses is denied them. However, if these burnings are to be carried out rightly, if they can be carried out rightly, they should be done in the early spring or late summer, or even in winter, when dry vegetational conditions prevail and circumstances are such as to facilitate the control of the fire and its confinement to a definite area. It is not much of an exaggeration to state that controlled burning at such seasons and under such conditions is never practised in this country.

It may be argued that the increase in mountain fires already mentioned is due to a succession of very dry springs over the last decade which often develop into drought periods with continual east winds, but it seems more probable that the number of fires were on the increase long before and that their effects have only been accentuated by these dry periods. It may here be mentioned that during the times of the estates, close control was maintained over large tracts of mountain, principally for the purpose of preserving game amenities; with the passing of the estates this protection has ceased. Such burning as was carried out on preserved hills was usually done in rotation on small patches or strips, at long intervals, and with the principal object of producing young heather shoots for grouse. In other countries, especially in Scotland where hill farming was practised on a large scale, a tenant was always subject to definite regulations governing heather burning and the matter was carefully controlled on a rotational basis in accordance with the size and age of the heather.

When we turn to our own country we find that there is little measure of control nowadays and that fire is put to the mountain without regard for weather or season, and at all hours of the day and night. Fires which have travelled anything up to five miles from their source have often been the cause of serious forest destruction. In this regard it is interesting to note that according to the Game Preservation Act, 1930, all burnings on uncultivated mountains are prohibited between April 1st and July 14th, unless permission be had in writing from the authorities, and that offences are subject to penalties. Yet it is as impossible to believe that the instigators of the weekly hundreds of mountain fires are fortified with written permission as it is to credit spontaneous combustion as their cause. Furthermore, it is well nigh certain that, provided weather conditions remain unaltered, a traveller through mountainous country could not distinguish between the frequency of fires before or after the 1st April.

The advantages of mountain burning to the grazier, particularly when it is uninfluenced by any system or method of control, are of a temporary nature and the practice is short-sighted. In the past when controlled burning was practised extensively on hill grazing farms in Scotland, it was even regarded as "a valuable agricultural operation," and burnings were carried out on a six to eight-year rotation and entailed the strictest control over the season and existing ground conditions of the chosen portion of mountain before it was set alight. Even under these ideal circumstances it is very difficult to believe that the burning followed by grazing did not constitute explotiation of natural resources.

In proceeding to deal with the practice of mountain burning and its effects, it is as well to point out that the type of hillside envisaged here is that more or less usual to most of our mountain ranges, which is, a sandy, shallow soil overlain by a light peat layer, seldom exceeding one foot and more often in the region of three to nine inches if not already rendered shallower by previous burnings. The burning of deep peat bogs or deep soiled drifts or valleys will not be treated here, as they have only an individual rather than a general bearing on the subject and space will not allow.

A grazier may burn his mountain from time to time according to the speed with which the heather, furze, and rank molinia re-occupies the ground after previous burning off, or maybe as often as there is enough vegetation to burn. In this way he may be rewarded for a period of years by a sufficient growth of young grasses and heather palatable to his grazing stock. In the process, however, he is surely removing, in proportion with the frequency and severity of fires, the fertility from which his grazing vegetation arises. In the first place the friable surface humus, often the source of sweeter grasses, is burnt away, and the

growth which contributes vegetable matter to this humus is weakened. This is brought about by burning in drought conditions where vegetation and soil alike are tinder dry and it is possible for the fire to scorch or burn the top layer of peat, thereby rendering it to ash and damaging the roots of the surface plants. There are admittedly certain conditions when this burning could be done with less damaging effect to the surface peat or soil, that is when the vegetation is dry and the ground moist, and such periods would more likely prevail in winter or early spring. Where such moist conditions exist the fire can less easily penetrate to the roots of the shallow rooting vegetation, and this is an important point. Repetition of indiscriminate burning in all cases reduces the energy of the plant growth and a general change and deterioration in the vegetational community occurs, the peat layer becoming gradually hard, shallow and impervious. Usually a mixture of erica, dwarf furze, molinia, and later, on flatter ground, scirpus and sedges, asphodel and lichen replace calluna to some extent, and hylocomium mosses, sweeter grasses and herbs altogether. Furthermore, the vegetation becomes sparse and fails to cover the ground adequately, resulting in surface extremes of wet and dry according to weather conditions. A sort of sub-climax may be reached where the ground cannot be burnt over further, because of the scarcity of vegetation on the sterile peat. Here, unfortunately, there is no reversion to the original type and large tracts of this impoverished ground are painfully evident over big areas of our mountains. Alternatively the remaining peat layer may be burnt away and the soil or rock laid bare. The soil, particularly if it lies on slopes and is of a light or sandy nature, is exposed to the agencies of erosion and is gradually washed downwards and removed. Very often there is little or no soil under the peat and the bare rock is exposed comparatively soon. Again, in the early stages, fire is capable of penetrating into and under the good fresh turf sod, and by burning away for weeks renders all the surface peat to ash. With the aid of wind and water the same climax is again reached, but more rapidly, and the rock laid bare. All these processes described lead but to one end, the total or partial impoverishment of the grazing value of the ground.

In other countries, particularly in the U.S.A., extensive and costly schemes are put into operation in an attempt to arrest the conditions of denudation brought about by indicriminate bush fires. It would profit us well to examine conditions on our own mountain slopes and see whether similar problems lie in the future for us if restriction is not now applied.

The impoverishment of soil fertility is the principal but not the only loss attributable to mountain fires. Subject to wind and dry conditions such fires may sweep for miles across country, destroying fences and sod ditches as well as turbary and footed and stacked turf.

The game bird population of the mountains is a part, however inaccessible, of our national wealth, yet every nest and egg of game or other birds that comes in the path of these fires is most surely destroyed. Anyone who has attended a mountain fire in spring, more particularly at night, will not readily forget the pathetic agitation of the unfortunate nesting birds. The matter has a dual inimical effect on the increase of the grouse, one of our most valued game birds. Firstly their nests and eggs are so frequently destroyed that it must have an effect on their numbers and their instinct to return to the locality. Secondly, the supply of healthy calluna, an important food for grouse, is greatly diminished by repeated burnings, and its sparseness has a limiting influence on the numbers of these birds.

The effect of burnings is becoming increasingly evident everywhere in our mountains by the appearance of grey arid patches of bare rocks or screes of stones of greater or lesser extent. Where these patches are small and adjacent to one another, one can easily imagine their joining up and merging into one; very frequently no imagination is needed. No person acquainted with our hill ranges can fail to have noticed within a short span of memory the change in certain parts from mercurial purples and browns to the static and unbeautiful grey of rock. The process is evident in the Galtees and the Knockmealdowns, in the Wicklow Mountains, and indeed in nearly every mountain range in the country. Dubliners need travel no further than the Sugar Loaf Mountains to find good evidence of what fire can do. If they look to the western slopes of the Little Sugar Loaf they will see a grey hillside of stones and boulders, where not much more than ten years ago there grew a thicket of vegetation. Turning west to the Big Sugar Loaf they will

see a patchwork of grey stoney ground with the normal dark brown heather ground interwoven, the preliminary stage before the ultimate bareness of its sister mountain. It is true that in this so perfect example the mountain grazier has played little enough part and the destroying fires were mostly the work of careless picnickers and holiday makers, but it is none the less striking and convincing evidence of what fire can do. Perhaps, it is not too much to ask the imagination to foresee a time when most of our mountains will be like this.

Taking the long view, the subject is indeed one to which, without frivolity, the attention of our Irish Tourist Board might be drawn for, though we know the grey escarpment of Burren to be both unique and interesting, a whole country of such hills would be extremely dull.

An enumeration of the destructive effects of fire would be incomplete without due reference to its influence on watersheds and its ramified effects on flooding. In what should be the normal course of events, where a strong and even vegetation occupies the ground, the rain falling on mountains is first of all broken up by the overground umbrella of plants and it is then absorbed, to a great extent, by the loose humus covering the peat or soil. This is particularly obvious with good heather growth which holds great quantities of water in its leaves and branches after a shower of rain. Again, with strong vegetation in natural conditions the surface peat or soil is kept open and in receptive condition, and the water which ultimately finds its way there can percolate slowly downwards. The process is the same in miniature as that which occurs in forest covered areas where it has been well proven that the fall and off-flow of rain water is importantly influenced by the tree cover. And so, the whole off-flow of water after rain is regulated and contained at source, the influence of which extends from the smallest of mountain streams to the mouth of the biggest river.

It has already been shown that, as a result of fire, conditions are reached on mountain sides where vegetation becomes sparse and dwarfed and the surface peat hard and impervious. In such conditions rain falls more or less direct on the ground surface and, with the peat hard, flows away at once and follows gravity downhill in volume, probably to the nearest stream or river. On such hard peat slopes this is very obvious after heavy rain when the water can be seen to flow about as if on oilcloth. Eventually this volume of water, which is abnormal, has to be received by the streams and rivers. Very often they are inadequate to the task, and their sides and banks are torn away and flooding takes place laterally on to the hill slopes.

More often perhaps the deeply cut mountain streams are able to take these sudden onrushes without serious flooding high up but where the stream gradient eases out to flow into the flattening foothills, flooding of a more serious nature takes place. The shallower and wider rivers of the lowlands cannot contain such sudden spates, silting occurs, the water is no longer restrained and bridges are broken up, roads scored out, houses and yards inundated and fields flooded. In a panorama of hill country, with its lowlands and hundreds of watershed rivers the effects of such onrushes of water must combine to swell and render uncontrollable the ultimate lowland big river, and so to the sea, with effects which are ultimately as widespread as they are harmful. So, perhaps, the effects of mountain fires might after all be less obscure to those living many miles distant from them than was at first suggested in this contribution.

Returning to the forestry aspect of the matter, it should be clear to anyone who admits the extensive destructive effects of these mountain fires that during the passing of the years thousands of acres of mountain slopes, potential forest ground, are gradually being rendered sterile and useless for any purpose. Changes in social and economic conditions may in the future render these mountain sides available on a large scale for planting, by which time they may be so impoverished by fire and erosion as to be useless for forestry or, at best, requiring one or more rotations of forest cover to bring them into profitable tree growing condition.

A great deal of good work has been done in safeguarding our existing forest plantations by fire belts and other means. Economic considerations may have deterred even more efficacious work being done, but it is generally recognised that fires will come from time to time whose rapid progress no available human agency can check or divert. Consequently one must turn to prevention at source as the only real way of combating this danger to our plantations and to the productivity of our

mountains. In what quarter, or by what means can one, therefore, seek a remedy? Like all ills, it is far easier to stress the destructive qualities than to find the constructive cure. Perhaps, the remedy lies in the hands of those authorities responsible for the administration and enforcement of our laws, perhaps more fundamentally with the teachers and instructors throughout the country. Certainly, in respect to the existing laws which govern mountain burnings, it would seem that the authorities are inadequately equipped with powers of limitation. Except for the Forestry Act, which prohibits burning within one mile of a plantation or wood, all other burnings are legal when carried out outside the period 1st April to 14th July. In view of the severe spells of drought which we have experienced in March in recent years, this state of affairs seems extremely weak. Furthermore in the writer's opinion, the existing laws are seldom strictly enforced and are consequently ineffective. If our agricultural authorities were to interest themselves seriously in the matter, much could be done by instruction and possibly by adjustment of the existing laws. Foresters themselves can contribute much by co-operation and otherwise in limiting these destructive practices, but their sphere is limited, and it must rightly lie with other powers to act more effectively whether the brand be raised on a plantation mountain or any other mountain.

During these times we talk a lot, and read more about reconstruction, yet here we have a contemporary and insidious process of national destruction which is allowed yearly to go on its way completely unopposed, and no voice has yet been heard in protest.

The case which has been put is, in brief that mountain burning as practised in this country is destructive in its effects no matter from what aspect it may be regarded, that it is gradually reducing the value of mountain vegetation as a subject for grazing, that it is steadily diminishing the sporting potentialities of grouse moors, that it is annually contributing a volume of water to the flooding of our more fertile lowlands, that is surely detracting from the natural beauty of our mountains, and lastly, that it provides a perennial and avoidable menace to the young forests being built up in the country.

Mountain burnings carried out with co-ordination and co-operation can, to an extent, serve all these interests and not destroy them.

In the nature of things, however, the danger is that the damaging effects of fires may only become evident as a serious problem when they have reached a stage when human efforts towards recovery are of little avail—when, indeed, it will be too late to mend.

NOTES ON EUCALYPTUS SPECIES AT AVONDALE, CO. WICKLOW

M. O'BEIRNE.

There is hardly any family of trees so beneficial to man as the genus *Eucalyptus* (or Eucalypts) which comprises over three hundred different species, growing in the most diverse conditions of soil and climate. They are all natives of Australia and its adjacent islands—Tasmania New Guinea, etc.—but are extensively grown in many other countries nowadays. They are all evergreen and mostly big trees, some in the valleys growing to the astonishing height of 400 feet, others high up in the mountains, reduced to mere shrubs. Those species which come from the parts where frost and snow are common in the winter and where the rainfall is somewhat like our own, do best here. Those that come from the warmer climate are unable to stand our winter frost.

The genus *Eucalyptus* belongs to the natural order of Myrtaceae which includes myrtles. The name is derived from the Latinized Greek words meaning "well concealed." This refers to the flower bud which is in the form of a little woody cup in which the flower is hidden and protected by a cap until the suitable season arrives when the cap falls off and the flower, comprising only stamens and pistil, unfolds. It is

in these cups that the seeds develop and are shed through valves or slits in the top. The size and shape of these seed receptacles are important identification marks for the different species.

For the first few years all species have juvenile leaves which are tender and are of a different shape from the adult leaves which develop afterwards and are much more hardy. Consequently all species require protection from severe frost during the first winter or two, and many species tender during this period prove hardy afterwards. The presence of a belt of old wood to shelter the young plants from the cold winds is very beneficial, and a mixture of evergreen conifers with dense crowns is also helpful.

In the spring of 1908 Mr. Forbes, the Director of Forestry then, procured from the Government Department of Tasmania four small packets of Eucalyptus seed labelled *E. Muelleri, E. urnigera, E. coccifera* and *E. Gunnii.* The latter, judging by the development of the plants, should have been labelled *E. ovata* (*E. Gunnii* is a small but very hardy tree). Seed beds were prepared in the garden nursery at Avondale by inserting inverted grassy sods (turves) 6" wide by 4" deep into the garden soil and covering the sods with leaf-mould and fine soil. The seeds were then sown thinly in lines over the inverted sods and covered very lightly. The seedlings were kept watered during dry weather throughout the summer and during winter were covered by laurel branches kept in position by light poles nailed on stakes 1½ feet high. In the spring of 1909 groups of holes were prepared on Avondale lawn amongst the old beeches and oaks. The plants were lifted from the nursery by inserting the spade straight down behind each plant, lifting it with portion of the decayed sod attached to the roots. The plants were then inserted and tightened in the prepared holes, keeping every species separate, and the plants being set out 5 feet apart each way.

During the first two years the plants were kept free of weeds and there were few failures. After that little was done to them for twenty-five years, after which some lanky and suppressed poles were removed. All the species made rapid growth and proved hardy until the severe winter frost of 1939 when *E. ovata* suffered badly from "frost crack," and though not killed got a severe set back

The following are particulars of the trees that remain from measurements taken in January, 1945. The heights were determined with a Brandis hypsometer and the volumes are rough estimates based on the heights and basal areas:—

Species	No. of trees	Av. Height	Q.G. B.H.	Av. Vol per tree	
E. Muelleri	.. 11	105 ft.	12½"	43 c.ft.	Q.G.o.b.
E. urnigera	.. 7	108 ft.	13¼"	50 c.ft.	,,
E. coccifera	.. 5	73 ft.	11¼"	29 c.ft.	,,
E. ovata	.. 11	107 ft.	12½"	45 c.ft.	,,

One nice plant of *E. ovata* planted out by itself made rapid growth and formed a beautiful tree which is now (in 1945) 112 ft. high with a quarter girth at breast height of 23¾ inches. It, too, suffered from frost crack in the winter of 1939, but its wounds are gradually healing over. All the trees in the group of *E. ovata* grew tall, straight and clean but the heavy frost killed about half their crowns and split the bark down to the base. Had they been closely surrounded by dense crowned trees like spruce the damage would not have been so great. The bark of *E. ovata* peels off the upper part of the tree leaving the new bark of a light grey colour. The seed cups are about ¼" wide, and of the same depth with dome-shaped top and narrow base, 3 to 7 cups forming an umbel. The juvenile leaves are stalked and oval opposite at first but gradually becoming alternate. The adult leaves are lanceolate and alternate and of the same dark green colour on both sides. The foliage of this species got damaged again by the severe frost of January, 1945.

E. Muelleri, a native of Tasmania, proved perfectly hardy, formed tall straight, clean trees with light crowns. It is easily recognised by its bowl-shaped fruit about ⅜" wide at top and about the same depth, sloping to a narrow base, three sessile fruits forming an umbel. Each fruit is green and ridged on the outside, generally three-celled and opening by three valves on a whitish plate on top. Its old bark peels off in strips, leaving the new bark of a greenish-grey colour. Its juvenile leaves are round to oval, sessile or short-stalked, gradually becoming stalked. Adult leaves are alternate four to five inches long and ½" to 1" wide, tapered

at both ends, both sides of the same glossy dark-green colour. Leaf-stalk 1" long. It is sometimes called *E. Johnstoni.*

E. urnigera, a native of the mountains of Tasmania, also proved perfectly hardy, forming tall, straight trees but inclined to be a bit more branch and rougher than *E. Muelleri.* The old bark peels off every year leaving the new bark of a greyish-white colour, more or less blotchy. Its fruit ⅜" wide and ½" long, is urn-shaped and stalked, normally three fruits (cups) forming an umbel with a stalk about an inch long and each fruit three or four celled opening by the same number of valves situated well down in the cup. Its juvenile leaves are sessile, round or cordate and opposite. The adult leaves are alternate 4-4½" long, ½-1" wide, on stalks about 1" long, lanceolate, glossy green on both surfaces. The name *urnigera* was suggested by its urn-shaped fruit.

E. coccifera, a native of the high mountains of Tasmania, is extremely hardy, but hardly suitable for timber, as it is inclined to grow rough and branchy. It sheds its bark, leaving the stem whitish. The shoots and fruit are often covered by a white encrustation. The fruit, about ½" wide at top, is like an inverted cone, four-celled, flat-topped. The leaves are about 3" long and ½" wide, tapered at both ends on stalks about ½" long.

Other species subsequently planted at Avondale were *E. globulus*, *E. gigantea* and *E. regnans.* The former was soon killed out by frost *E. regnans* also disappeared but *E. gigantea* withstood the frosts and is growing vigorously In the spring of 1942 a ¼-acre plot was planted on the lawn with *E. Muelleri* and *E. urnigera* mixed with a few *E. viminalis* and *E. ovata* These were mixed with beech (25%) and all are doing well.

At Ballymanus, near Gleanealy, in Co. Wicklow, and within about four miles of the sea, the following species, planted in the years 1934 and 1935, withstood the frost and are growing vigorously:—*E. Muelleri, E. viminalis, E. urnigera, E. amygdalina, E. gigantea, E. Dalrympleana, E. radiata.* These trees are now up to 35 ft. high with average quarter girth at breast height of 4". At Kilmacurragh, Co. Wicklow, there is a large tree of *E. cordata.*

The name "gum trees" is loosely applied to trees of the genus *Eucalyptus* but in modern books the name is reserved for those species that shed their bark annually. Many species do not shed their dead bark yearly but retain it for a time as a covering over the new bark. In some of these the old bark becomes fibrous, and these are known as "stringy barks." In others the old bark becomes hard and deeply fissured and these are called "iron barks."

The seeds of the *Eucalyptus* ripen in the second harvest after flowering. Slight heat is sufficient to open the valves for the escape of the seeds, which can be stored in a linen bag suspended from a rafter in a cool dry place until spring.

The seeds should be sown in finely prepared beds in March or April and protected from frost by laths or branches overhead. Watering during dry weather is also essential. Most species are bad transplanters, and need special treatment when young. Transplanting into pots when a few inches high is a good plan. The pot might be sunk in the ground and kept watered. The plants can be planted out of the pots without disturbing the roots. Transplanting with balls of earth around the roots is also effective. Sphagnum moss is often used to keep leaf mould and fine soil around the roots. After "mossing" the plants can be lined out in the nursery for a year and protected from winter frost.

Eucalyptus in general have the following advantages:—

1. They are eminently suited to the three types of forest management—high forest, coppice, and coppice with standards—but it is as high forest that they are mostly used. They produce clean, strong and durable timber which is used for a great variety of purposes—house construction, furniture, transmission poles, fencing and firewood, etc.

2. Their leaves yield valuable oils and resins much used in medicine and in the manufacture of soap, disinfectants, etc.

3. Their flowers are rich in honey and are much patronised by bees for honey and pollen.

4. They produce a large quantity of seed and commence bearing at an early age (5-10 years). The seeds are very small and can be sent long distances by post.

5. They reproduce themselves freely from stool shoots, so once a crop is established further planting will not be necessary.

6. They are evergreen and very desirable from an aesthetic point of view, especially in the winter when other broad-leaved trees are bare.

7. They are supposed to have a salubrious effect on the climate in which growing, giving out fragrance and balm into the atmosphere.

8. A species can be chosen for almost any soil or situation, so varied are the conditions under which they grow in their own natural habitat.

9. They grow much faster than any other broadleaved trees and the planter can see the trees mature in his own lifetime.

It will, therefore, be interesting to keep under observation the older trees of the various species of *Eucalyptus* which have been planted for some time, as well as those more recently planted and to secure others for trial purposes.

ABSTRACT

THE GROWING OF POPLARS

A paper with the above title (*) has recently come to hand and gives most interesting and useful data on the poplar and aspen species. It is written by K. F. Miron, a Russian sylviculturalist, and deals with extensive experiments in certain regions of the U.S.S.R. Allowing for climatic, soil and other differences which exist between this country and Russia, the material in this article should be considered most useful, particularly from the sylvicultural point of view, the aspect to which I have chiefly confined myself in my summary below. Little need be said concerning the usefulness of poplars economically, aesthetically and from a protective viewpoint. They produce probably a greater quantity of timber in a shorter space of time than any other hardwood except the eucalypts, and though this is so, the timber of many of the species is useful and strong. Packing-case material, waggon and cart bottoms, matchwood and paper manufacture are a few of the uses to which the timber can be put and to my mind their use in the manufacture of paper is most important, since thinnings can be made use of at the age of from 12 to 20 years for this purpose. The Black, White and Italian poplars are the least inflammable of all the woods and their use as shelter belts can easily be seen. Poplars on the whole are fairly accommodating as to soil, frost-hardy and wind firm, so there should be no reason for not growing them more extensively. The author of the above article mentions the following poplars—The White Poplar (*P. alba*), Bachofens Poplar, (*P. Bachofenii*), the Turkestan Pyramidal Poplar (*P. Bolleana*), the Naryn Poplar (*E. hybrida*), *the Aspen* (*P. tremula*), the Black Poplar (*P. nigra*), the Lombardy Pyramidal Poplar (*P. nigra var pyramidalis*), the Canadian Poplar (*P. canadensis Moench P. deltoides, Marsch*), the Balsam Poplar (*P. balsamifera*), the Chinese or Eastern Poplar (*Simonii*), the Berlin Poplar (*P. berolinensis*). In describing these species the author quotes extracts from a book entitled "Poplars and their Cultivation." by P. L. Bogdanov. A brief description is given below of a few of the above species which are less well known in this country.

Bachofen's Poplar—P. Bachofenii Wierbzb.

Distinguished from *P. alba* by having large ovate buds up to ½" long, flattened leaf petioles and extremely leathery leaf surfaces. On the stool shoots the leaves are naked, with a white silvery felt below. It reaches large dimensions with a large spreading crown.

This poplar roots well from cuttings. The regions over which it is distributed are characterised by little forest cover and waste sands, indicating that this species might be good for the planting of sandy areas.

(*) The Growing of Poplars, by K. F. Miron. Published by "VNILKh," Moscow, 1939.

The Tufkestan Pyramidal Poplar—P. Bolleana Lauch.

A tall tree with a narrow pyramidal crown and light grey bark and differs from the previously-mentioned poplar only by its pyramidal crown. It grows rapidly and develops a well-shaped stem. Can be grown in regions subject to drought but gets frosted towards the north. It is useful for shelter belts.

This species may be grown from root cuttings and root suckers; stem cuttings have a low percentage survival.

The Naryn Poplar—P. Hybrida M.B.

The leaves of this species are like *P. alba*. The matured shoots are pubescent and root shoots quite glabrous. Aspen-like flattened leaf petioles, buds small, bark yellowish and somewhat scaly. Twigs have at first grey down covering but are later glabrous.

The Laurel-Leaved Poplar—P. Laurifolia, Ledeb.

A tree which reaches a height of 82 ft. with a thick, fairly smooth, tapering stem and a branchy, broad crown. Bark, grey and fissured deeply. The young greyish-yellow or straw-yellow shoots are strongly ribbed, due to longitudinal corky growths. The buds are brownish green, up to ¾", acuminate and viscid. The leaves are ovate or lanceolate, tapering gradually, rounded at the base, glabrous, with glandular teeth along the margin, green on top, shining, dull whitish below. The flowering and leaf flushing take place simultaneously. The male catkins are purple, the style has a two-lobed stigma with revolute lobes.

This poplar usually grows along river valleys and sometimes on lake shore sandhills. It is tolerant regarding climatic conditions and grows well from cuttings. Its tolerance and capacity for growing large well-shaped stems, indicates that this tree might be used for growing timber.

The Chinese or Eastern Poplar—P. Simonii, Carr.

Not a particularly large-growing tree. The young reddish-brown shoots turn yellowish-brown when more mature; they are strongly ribbed at their attachment to the leaves and have large lenticels. Traces of the ribs, in the form of a peculiar design, remain for a long time on the smooth, steel-grey colour of the bark. The brownish-tinged buds are large, adpressed and viscid. The leaves on the lateral shoots are usually thin and somewhat pendant; on the twigs they are large and oval, tapering to both ends; on leading shoots and stool shoots they are larger and broadly oval. The prominent red nerves on the upper light-green surfaces of the leaves are typical for this species; the lower surface is lighter in colour. The petioles are very short.

Due to a long vegetation period, it suffers from early autumn frost. Stem cuttings root well. It grows well on a clay loam and is characterised by a deep root system which makes it useful in preventing erosion.

The Berlin Poplar—P. Berloninensis, Dipp.

This is a hybrid between *P. laurifolia* and *P. nigra* var. *pyramidalis* and it is remarkable for its growth rapidity, resistance against cold and the ready rooting capacity of its stem cuttings. The crown is broadly pyramidal and the mature shoots are greenish yellow, first ribbed, later cylindrical and densely leaf-covered. The leaves are elongate ovate, tapering to a long point, shining and light green on the upper surface (it is the lightest green of all the poplars), dull below. Buds almost lacking in stickiness, acuminate, dark brown towards the tip. Leaf petioles flattened.

Growth continues late but this species is frost-hardy and reproduces well from stem cuttings which root to an extent of 80%.

* * *

THE TECHNIQUE OF VEGETATIVE PROPAGATION OF POPLARS FROM THE PARENT STOCK IN THE FORM OF PLANTATIONS.

The Object in View.

Poplar parent stock plantations are established specially for the growing of stool shoots for cuttings and rooted cuttings. The stool shoots may be cut on stumps that are cut low down, but the best shoots obtain-

able are those which are cut from the crowns of trees. It has been proved experimentally that cuttings taken from stocks which have originally been grown from seedlings and not from cuttings, are the best and it therefore follows that parent stock plantations should be formed by planting out seedlings. This method is however still in its infancy and the parent stock plantation will have to be formed by planting out cuttings.

The Soil and its Preparation.

The soil must be very fertile and the moisture conditions satisfactory. The soil under the plantation is worked in the same way as that under nursery stock.

It is recommended that the cuttings be planted at the following spacings:—

(a) For growing rooted cuttings in the course of a single year—2' between the rows and 10 ' in the rows (26,000 per acre).

(b) For growing rooted cuttings over a period of two years—30" between the rows and 10" in the rows (19,600 per acre).

(c) For growing one year stool shoots for cuttings by stumping them back annually—30" to 40 ' between and in the rows. (4,350 to 3,670 per acre).

The above dimensions completely meet the needs of mechanical working in tending the plantation and lifting the material.

Stem cuttings should be taken from selected parent poplars distinguished by the most rapid growth, well-shaped stems, slight branchiness, frost-hardiness, immunity from diseases and capacity to resist drought.

The cuttings should be 8" to 10" long in sufficiently moist regions and 12" to 14" in dry regions.

The Technique of Lining Out.

The cuttings are inserted vertically with the morphologically lower or thicker end beneath. Above the surface the end of the cutting protrudes ¾" to 1½" with one normally developed undamaged bud. The cuttings should be well firmed. The opening of the line to receive the cuttings should be done with an iron dibble.

Lining out should take place when the buds begin to swell, i.e., about the second or third week in April, and it should cease when the buds commence to flush.

Weeding and loosening of the soil should be done three or four times during the growing season—care should be taken not to damage the surface roots of certain species. In prolonged drought the plantations should be watered copiously.

The treatment of the stool shoots consists in thinning them out annually, commencing from the second stumping. There should be five or six well-developed shoots left on the stumps.

PREPARATION OF POPLAR STEM CUTTINGS.

Place and Method of Collection.

The shoots of poplars for cuttings, as we have seen, can be supplied in the parent stock poplar plantations either by stumping the stool shoots which have grown up in the form of bushes from rooted cuttings or seedlings, or by pollarding the crowns of special parent trees.

The stumping of the stool shoots or the pollarding of the crowns must be done annually because one-year stool shoots are required for cuttings, as that ensures a large out-turn of cuttings and their highest survival capacity.

Stool shoots which have been grown in the form of bushes from rooted cuttings, in the first year are severed from the stump no higher than 2¾" to 4" from the parent cutting, and each succeeding year no higher than 2" to 3¾" from the stubs of the previous cut.

In the plantations, those rooted cuttings are not cut from the stumps which are to be the future parent poplars for the provision of cuttings by the method of crown pollarding. The future trees are left at an equal spacing between the rows and in rows of from 19 to 23 feet. In the first year in the case of rooted cuttings which are to make the future

trees, one of the best developed straight shoots is left. On it, from below upwards to half-way, the lateral branches are pruned off. Pollarding of the trees should be begun from two years of age and continued annually thereafter.

Shoots for cuttings may be taken throughout the whole winter from autumn, provided that the leaves have begun to fall. Early spring however, is the best time for taking shoots for cuttings, before the visible swelling of the buds. Shoots taken in early spring also shorten the period of storage.

Cuttings must be taken from one year shoots and as far as possible from the longer, straighter, clean, fully-ripened ones with the best-developed buds, free from mechanical damage. Thin twigs are no use.

Collected shoots must be stored before time for lining out, the object being to prevent the buds from swelling and loss of moisture. If this is not done, the subsequent cuttings will lose much of their vitality.

Shoots taken in early spring can be stored in cold buildings, cellars, ice houses (humidity not to be lower than 80% cent and temperature not higher than plus 3 degrees C.)

Shoots should be graded into 20, 30 and 40 inch long bundles of 50 to 100 each; avoid any mechanical damage doing this. The bundles of shoots should have their butt ends on an earthen floor and are also covered with moss.

Cuttings which of necessity have had to be taken in November and December, can be stored during the winter time in trenches 2 ft. deep, in open elevated places. Lay the bundles of cuttings in a single row along the bottom of the trench and cover over with soil to a depth of 8" to 10"; cover the tops with straw.

Severing the Cuttings from Shoots.

Severance of the cutings from the shoots should be done on the day that the cuttings are lined out or not earlier than two days before lining out, when they should be stored in wet moss during that period.

In moist conditions, the length of the cuttings should be from 8" to 10", and in dry conditions 12" to 14". The shoots must be cut into cuttings in such a way that the top end of the cutting lies not more than a half or threequarters of an inch above the last normally-developed sound bud, which, when the cutting is lined out, will remain above the surface; this ensures that the new shoot will rise vertically and not at the side. The cut should be smooth and slightly oblique.

Grading of Cuttings.

This is done at the same time as the shoots are being divided into cuttings and it is desirable owing to the fact that the quality of the cuttings falls off in the direction of their distribution from the butt to the tip of the shoot.

Grade I—Cuttings with an upper cross section diameter of 5/16" and over, taken from the butts to the middle portion of one-year-old shoots, collected in the spring before the swelling of the buds. These have the highest survival percentage and the most energetic growth.

Grade II—Cuttings with an upper cross section diameter of 3/16" to 9/32," taken from the top part of the shoot. To this grade also belong cuttings taken from shoots which have to be taken in the autumn and winter. These have average survival percentage but less energetic growth.

Culls — Cuttings with a cross section diameter of 5/32" and less, taken from the top part of the shoot, and also include leading shoots. These have the lowest survival percentage.

TECHNIQUE OF TAKING GREEN CUTTINGS OF POPLARS

The essential point in this consists in the growing of rooted cuttings from green summer cuttings, taken in summer from the growing young shoots.

This practice should be resorted to when it is necessary rapidly to multiply some species of poplar from which a large number of cuttings cannot be taken. Its main advantage lies in the fact that a great number

of green cuttings can be taken even from young trees and rooted cuttings can be grown from them during the course of a single incomplete vegetative period.

According to investigations, green cuttings of Canadian, Balsam and Chinese poplar root to an extent of 90%; Berlin and Laurel-leaved poplars 60%; Black poplar to an extent of only from 10 to 15%.

Higher temperatures for external conditions are necessary than in the case of the normal growth of the plant dealt with, satisfactory moisture supplies and good soil aeration. To prevent the cuttings from withering before root formation, shading from the sun's rays is necessary, or even to reduce evaporation by moistening the air heavily.

The best time for taking green cuttings is during the first ten days in June, though they can be taken during the summer all through the growing period. Cuttings taken in June develop more stoutly, do not suffer from early autumn frost, successfully survive the winter and if well developed, can be planted out in the planting areas.

Preparation of Forcing-beds to take Cuttings.

This is carried out in cold forcing beds i.e. without manure. The usual size beds are used i.e. 4½' by 6½' and 8" to 10" high, on three frames. Compost to a depth of 4" to 6" is put in the bottom of the bed, and a 4" to 6" layer of coarse sand to top this. Prepare the forcing beds one to two days before cuttings are put in and keep under glass frames.

Growing leafy young shoots are severed from the tree with a sharp knife, and cut up under water into cuttings of not more than 4" to 4⅝" long, in such a way that the cutting comprises 2 or 3 internodes; it is essential the upper cut is made not more than 2/5" above the last axiliary bud with a leaf and the lower cut immediately below the leaf cushion of the lowest leaf, as this is the point of really active cambial concentration.

The leaves on the cuttings are all removed except the top one and this is halved if it is a big one.

The sand in the beds is plentifully watered and an hour before setting the cutting. The surface is then marked off with a special board fitted with some rows of pegs (short), at distances between the rows of 4" and in the rows of 2". The places marked with the pegs are deepened with wooden pins to a depth shallower by ½" or ¾" than the length of the cutting.

The thick ends of the cuttings are then inserted, so that the top end of the cutting projects ½" or ¾" along with the axillary bud and leaf blade. The cuttings are well firmed and the surface is again sprinkled with water through a fine rose.

Timely watering is essential, and for the first 20 to 25 days after the setting out, the forcing beds must be watered on dull or showery days once in the morning, and on dry sunny days—morning and evening. It should be possible to keep the lower compost layer up to 50% of its full moisture capacity.

To prevent scorching on hot sunny days, the forcing beds must be shaded with solid unbroken screens and in cloudy weather with screens in the proportion of light to shade of 1 to 1.

On hot sunny days the temperature in the beds should not be allowed above what it is in the shade in the open air. If the contrary occurs the frames must be opened for about five minutes in order to reduce the temperature.

With the formation of rootlets and shoot development, watering should be reduced so that the compost now contains not less than 30 to 35% of its full moisture capacity. The forcing beds should now be left open, 2 to 3 hours every morning At the end of about 35 days the edge of the frame should be left open at night to a height of about 12" to 16"; when the tips of the plants reach the glass of the frames, the latter are gradually removed and when the plants are exposed to the open on hot sunny days, they are shaded with screens. At the end of two months, the cuttings are grown without any shading on the beds.

COLLECTING SEEDS OF POPLARS AND ASPEN AND PREPARING THEM FOR SOWING.

Place and Time for Seed Collection.

The seeds of these species are enclosed in seed capsules on long catkins and are equipped with down (winglets). The catkins must be gathered from the very best trees from 15 to 25 years of age and *when the first seed with down in the catkin capsules have begun to show themselves and escape.* The catkins must be collected before their wholesale opening out. The falling of the seed continues in the case of poplars for 5 to 10 days and in the case of aspen for 3 to 5 days.

The seed of poplar usually ripens in the first ten days of June and that of aspen about the second ten days of May, with a variation of ten days in some years, of delay or acceleration.

Method of Collecting Catkins and Cleaning Seed.

The catkins must be severed from the ends of the twigs on the trees, carried into a well-ventilated dry room and laid on a tarpaulin in a layer of not more than 1½" thick.

At a temperature of 18 to 20 degrees C., the majority of capsules open up in 24 to 48 hours, the remainder opening in 2 or 3 days. The largest of the capsules open in the first day and as the seed from these are the best they should be collected and not be allowed to mix with the later opening and smaller capsules, which have not as good a quality. The seeds are separated from the air-dry down by gently rubbing them through a sieve.

The catkins can also be sown, but best results are obtained by sowing pure seed

Storing the Seed.

The cleaned seed should be stored before sowing in open glass vessels in exsiccators with crystalline calcium cholride ($CaC1_2$). Although poplars can be stored for three months this way and aspen for one, without germination reduction, it is recommended to sow immediately after collection in order to make use of the vegetative period for raising the seedlings.

Quality of the Seed.

Freshly gathered seed of aspen and poplars are flesh-coloured. The shape varies from ovate, as with aspen to elongated oval. The average weight of 1,000 seeds of poplar ranges from 0.85 to 1.1 grammes and of aspen from 0.09 to 0.14 grams. In 1 gm, there are about 1,000 seeds of Canadian poplar, 1,300 seeds of balsam poplar, 1,050 seeds of black poplar and 6,600 to 8,500 seeds of aspen.

After collection, seeds of poplar and aspen have a germinating capacity of 100%.

GROWING SEEDLINGS OF POPLARS AND ASPENS IN NURSERIES

Preparation of the Soil.

Deep sandy loams and light clay loams are best nursery soils for raising seedlings of aspen and poplar and in all circumstances the soil must have optimal moisture conditions and be well aerated.

The nursery soil is worked in the very same way as the ground under poplar plantations, that is, it is worked in the same way as for any nursery forest stock. Under ample moisture conditions, the seed beds are raised above the alleys to a height of 4" to 5"; and in dry regions they are level with the soil. The beds are prepared the evening before sowing and just before sowing the surface of the beds is broken with a rake and well watered. The moisture content of the soil must be raised to about 40% of its full moisture capacity, so that a sample of soil can readily be squeezed into lumps.

Sowing of Cleaned Seed.

Immediately after the watering of the bed, the seeds are sown by hand either along or across the bed, in bands of 2" wide and spacing between the middle of the bands of 8." The bands are indicated on the beds by light marking. When it is oozing down into the soil the water

takes the seed with it and covering of the seed with earth is not permissible. Occasionally a light pressing of the seed with a board is necessary.

The seed of poplars are sown pure, those of aspen are sown with sand or the remains of withered capsules which have come through the sieve. They are sown in three doses in order to secure even distribution.

With a width of bed of 3¼', bands of 2" wide, and a distance between their middle of 8" and a germinative capacity of not less than 85% pure seeds of the poplars should be sown at the rate of .6 to .9 ozs. per square yard and of aspen of .9 to 1.2 ozs. per square yard of productive area of seed bed with the 5 sown bands mentioned above. Seeds of 100% germinative capacity should be sown at approximately half these rates.

Sowing of Catkins.

This method, though less effective, gives good results. The bed is prepared in the same way as for pure seed.

The full catkins should be sown in the mornings in calm, sunny weather, spread out in 3 or 4 rows in bands from ½" to 3¼" wide with 8" between the centres. From 5 to 7 catkins are laid out in a row depending on their length. In order to prevent the removal by wind of the down with the seeds, the catkins are protected by light leafless twigs.

In sunny weather the catkins open in 3 to 4 hours and free the seed—the best quality seed. In order to make the down adhere with the seed to the soil, the bands should be watered with a fine rose on the watering can.

The seedlings appear about the 2nd or 3rd day after sowing, and the twigs should be removed carefully. The wet down lying over the seedlings should be carefully picked off. On the 4th and 5th days the down is removed from the seedlings and laid between them so as to cover the bed—it is removed at the first weeding.

Covering the Seed Beds.

In order to prevent rapid drying up, packing straw and, after that, wood sawdust makes the best covering material.

Under moist conditions, the soil should be able to be seen through the covering; under dry conditions, the straw may be increased to a thickness of about 1¼" and the sawdust to a thickness of 3/16." With the mass appearance of the seedling (about three days after sowing) the covering is thinned out and pushed between the rows until the third pair of leaves appear on the seedlings, after which, under sufficient moisture conditions, it is removed at the first weeding, when the soil is loosened between the rows. It is left longer under dry conditions. During the growing period, the rows can be covered with mulch or laths in order to preserve moisture.

In the case of catkin sowing, the catkin remains and the down fulfil the covering necessity.

Watering.

In the case of poplars the moisture content of the soil must be kept up about 35% of its full moisture content for about ten days after sowing and in the case of aspen for about 20 days. This is achieved by watering at about 8 o'clock in the morning and after 6 o'clock in the evening, at the rate of 1 to 1½ gallons of water per square yard of productive surface. After appearance of third pair of leaves the moisture content of the soil must not fall below 20% of its capacity, in which case watering once per day or on alternate days is necessary. This watering continues for 11 days after the seed sowing, after which only slight watering is done on dry periods and no watering is done in August.

Shading the Seedlings.

Poplar seedings and especially aspen seedlings must be protected from sun scorch and heavy rain downpour, over a period after sowing of 60 to 80 days for aspen and 10 to 15 days for poplar.

The screens are made of laths about 9/32" wide in equal proportions of light and shade, a suitable size of a screen being about 4' to 6½'.

The screens are fixed horizontally on props at a height of about 18" above the seed bed surface. The seedlings are gradually accustomed to the light of day by removing the screens and replacing them, for lengthening periods in the mornings and afternoons, until finally they are all removed.

Treatment of the Soil.

This consists in removing weeds and loosening the soil several times during the growing period, especially during June, July and first half of August.

Tending the Young Plants.

The aim here is bring the density of the young plants in good time to the optimum and complete ripening off. To achieve this, poplar seedlings should be thinned from 20 to 25 days after their appearance and aspen seedlings in 10 days. The thinning should leave about 125 plants to a square yard of seed bed.

Young plants of poplars can be planted out in a permanent site after the age of one year, and the lifting should be done in early spring provided the soil has thawed out. The plants are graded and packed, etc., in the usual sylvicultural manner.

Principal Diseases and Pests of Poplar and Aspen Seedlings.

It has been found that Canadian, balsam and black poplars are more resistant to fungoid attack than the other poplars.

A *Fusarium* type of fungus attacks the plumules and the seedlings begin to die off in patches, becoming widespread later. The affected seedlings should be removed and the beds then sprayed periodically with Bordeaux mixture.

Rust fungi, notably *Phytophthora*, attack aspen seedlings and young plants quite often. In the middle of July the leaves blacken on the seedlings and the seedlings die.

The rust fungus, *Melampsora pinitorqua* Rostr., usually begins to attack the leaves in mid-August at the time of leaf fall commencement. This weakens the young plents but does not kill them. White poplar suffers less than aspen. The remedy is the same as for *Fusarium*, a 1% Bordeaux mixture being used. Die-back accompanies this disease though this withering may be caused by a fungus *Fusicladium*, in which case the same treatment is used.

Prophylactic measures against fungoid attack on white poplar and aspen are:—

(1) Growing aspen away from the alternative rust fungus host such as aspens, poplars, Scots Pine, Larch, Cherry, Rowan, Apple and Juniper.
(2) Growing young plants in unshaded places in nursery.
(3) Timely thinning of seedlings.
(4) Regular watering and intermittent spraying.

Insect damage is caused by:—

Melolontha hippocastani and the caterpillar of the Pine Owlet Moth, both of which eat the roots of the seedlings and are dealt with by collection of the larva and insect or a paradichlorbenzole injection in the soil.

Several species of caterpillars do damage by eating the leaves of poplar and aspens and are dealt with by collecting the adults and spraying the plants with toxic chemicals.

NOTE—When using Bordeaux as recommended above, the mixture should not reach the roots of the plants as this causes death.

THE CULTIVATION OF POPLARS IN THE FOREST.

This is a new business and the technique is still in need of prolonged investigation. What data there are come from various experimental plantations laid down by different persons. All of these have shown that it is essential for full growth development to have light, well-moistened soil and deep working.

Highest survival proportion of the cuttings and the best growth of poplar plantations, have been found on deeply worked soil or on soils

which have been used agriculturally. In order to have abundant rooting in planted poplars, sufficient aeration and moisture are necessary in well worked up soil.

It has not yet been ascertained which is the more successful, the planting out of rooted cuttings or the planting out of unrooted cuttings, that is without their being in the nursery at all.. Much of the data to hand has shown that the planting out of unrooted cuttings *in situ* has yielded as satisfactory results as the planting out of the rooted ones which have been developed in the nursery. as well as the fact that this method is economically cheaper since it does away with lining out and such-like operations. It is, however, too soon to come to any definite decision regarding either of these two ways.

The particular types of poplar plantations is also a matter which will have to be dealt with cautiously and very little is so far known about it. The growing of such poplar plantations is recommended by some, while underwood mixtures such as willow, elder and shrubs of all kinds is recommended by others.

The Aim in View.

Plantations of poplars should serve the following objects:—

While providing useful timber for industry. they should as far as possible meet the water-conservation and soil-protection roles of the forest. They should be grown as a protective canopy in advance, for such species as pines and other more economical species, as wind-breaks, shelter belts, edgings and the like and should also serve to arrest erosion and landslides in plantations grown with such an object in view. They should be widely used for parks and such-like places.

Poplar stands grow best in low-lying sites and river valleys where the water is near the surface, on well watered sands, sandy loams and light clay loams. They grow less successfully on elevated sites under infertile conditions and even on fresh soils, if the ground water level is deep down in these soils.

Types of Poplar Plantations.

In respect of the object of management a distinction should be made between poplar plantations for forestry purposes and those for rural improvement, such as shelter belts, windscreens, anti-erosion stands.

The working out of poplar stands for forestry purposes is new and the technique of establishing them has not been sufficiently investigated. When growing poplars for forestry purposes one must take into account the aim in view of the stands. their economies, local conditions, light demands, soil moisture, and soil aeration, etc. The following shows the type of tree species and shrubs which will grow with poplars under favourable climatic and soil conditions for the latter.

(a) *Tree Species.*

Norway Spruce—*Picea excelsa* LK.
Small leaved lime—*Tilia parvifolia* Ehrh.
Hornbeam—*Carpinus Betulus* L.
Wild Apple—*Pirus Malus* L.
Wild Pear—*Pirus communis* L.
Field Maple—*Acer campestre* L.

(b) *Woody Shrubs.*

Guelder rose—*Viburnum Opulus* L.
Hazel—*Corylus avellana* L.
Tatarian maple—*Acer tataricum.*

(c) *Fruit-bearing Shrubs.*

Red Currant
Black Currant.
Golden Currant.
Warty spindle tree—*Euonymus verrucosa* Scop.

Poplars and the species mixed with them must be planted at such a distance to allow the following in the early years of their growth:—

It must be possible to handle the soil mechanically by horse-drawn implements or tractors; to allow full illumination to the poplar crowns and finally to avoid, if possible, competition between the roots.

These requirements are best met with by planting the plants 6½ ft. between the rows and 3¼ ft. between the plants in the rows.

Pure stands of poplars are recommended to be planted thus:—

```
P  P  P  P
  P  P  P
P  P  P  P        P = Poplar.
```

Poplar with shrubs are recommended thus:—

```
P  S  P  S  P  S
S  P  S  P  S  P        P = Poplar.
P  S  P  S  P  S        S = Shrub.
```

Poplar with shrubs and a shade-bearing species are recommended to be planted thus:—

```
P  S  P  S  P        P = Poplar.
S  I  S  I  S        S = Shrub.
P  S  P  S  P        I = Intermediate species
```

The distances apart are as mentioned above, for all three types of plantations.

Working of the Soil.

This consists in improving the physical and chemical condition of the soil, removing weedy vegetation and its root stocks, accumulating and regulating stores of water in the soil and inducing crumbly structure.

The idea is to strive to aim at conditions as far as possible akin to the conditions of the poplar stock plantations; this should certainly be the case when planting out unrooted poplar cuttings and, to a less extent, when planting out rooted ones; plants from seedlings have a better chance on unprepared soil. How far is it necessary to work up the soil for planting cuttings? Distinction should be made between complete soil preparation and partial soil preparation under poplar stands; the former is, of course, the better.

Complete mechanised soil preparation can only be carried out on areas which are free from stumps and all such hindrances, while partial soil preparation can be carried out when it is impossible to do the former.

The complete working up of soil which has only been slightly grassed over is carried out in autumn with a tractor or horse-drawn ploughs, to a depth of 10" in moist regions and about 11" in dry regions. The ploughed areas are unharrowed from the winter and should be given three or four harrowings as soon as it is possible to work the soil later on.

Old felled areas which are strongly grassed over and waste lands should be given over to temporary con-acre for one or two years or they should be left during the preceding year under bare fallow. Under dry climatic conditions it is recommended that grassed-over soils be twice ploughed. The first ploughing, to a depth of 5", should be done during hot weather—June and July—which furthers the burning off and death of the sward. According to weather conditions and the time taken for the weeds to wither, a harrowing is carried out with toothed harrows or, if the weeds are considerable, with spring harrows. The vegetation collected from the harrows should be removed from the planting area. A second ploughing to a depth of about 11" is carried out in autumn and is followed by a harrowing in spring.

Partial working of the soil in a form of belts is done by horse ploughs which make a furrow to a width of not less than 3¼ ft. or by hand with spades to the same depth, accompanied by lifting out roots and weedy vegetation. The season and order of working the ground is the same as for complete preparation mentioned above, as also are the depths of working. According to the type of planting adopted for the stands the distance betwen the belts equals in width the intervals between the rows of the plantation (6½ ft. and so on). Along ravines, the belts should be worked strictly along the contours. Partial soil preparation for established stands on places which carry natural regeneration is done by plots which measure from 3¼' by 3¼' to 4' by 4' with a spacing between the centres of 13' by 13'. Working is done by hands and the technique is the same as that for the belts.

The Planting Material.

Planting of poplars should be planted out with well-graded material —with seedlings and rooted cuttings from 1 to 2 years of age and with stem cuttings of the highest grade.

Planting according to the belt method and on ravine slopes should be done with well-rooted seedling stocks, or if these are unavailable, with rooted cuttings.

Planting material for species to be intermixed with poplar should be put out from 1 to 2 years of age.

Early spring is the best time for planting. The plants must be put out before the buds burst, better still before they begin to swell.

Planting Technique.

This is done by making pits with a spade, in the case of seedlings and cuttings which have developed a fibrous root system. Cuttings of poplar are planted out with a special dibble exactly as in the parent stock plantations.

Tending the Stands.

This has for its object the loosening of the soil between the plants and between the rows and the maintenance of it in bare fallow condition for the first two or three years under ample moisture and preserves aeration.

The loosening of the soil must be done four or five times during the growing season, depending on the growth of weeds and crusts formed after rainfall. This treatment can be carried out with a tractor or horse-drawn disc cultivator or planet and horse hoes.

S. M. O'SULLIVAN.

REVIEWS

TECHNICAL COMMUNICATIONS

No. 2—Co-Operation in Forestry (4s.)

No. 3—Forestry Credit (no price quoted).

BY I. KISSEN, M.A., D.Phil. (Oxon).

(Published by Imperial Forestry Bureau, Oxford, England)

Dr. Kissen's bulletins make refreshing reading. These are times of State planning, State control and State interference in all walks of life and not least in forestry, and we in Ireland, are in danger of forgetting the importance of individual action and neglecting the advantages which individuals with a common aim find in banding themselves in groups for voluntary co-operation.

Communication No. 2 is a comprehensive survey of the history, objects and achievements of forestry co-operative bodies in many countries. The societies in Great Britain receive most attention because, as the writer says, they had never received any before and also because he was on the spot to do the work. Denmark, Finland, Sweden, America are also dealt with as well as some account being given of workers' societies in Russia and some Balkan countries.

Co-operation has been applied mainly to Management and Marketing, the principal difficulties of the small woodlot owner throughout the world. Management covers advisory services in many branches such as preparation of ground for planting, drainage, selection of species, and establishment of plantations, but probably the most valuable service, and the one most in demand, is in the marking of thinnings. This service must be a boon to the inexperienced woodland owner with plantations needing thinning, and it is one capable of doing great good. Some societies undertake the entire management of members' woods. They work to an agreed plan and are responsible for engaging labour and carrying on all operations.

The small owner is at a serious disadvantage when it comes to marketing. In many cases he does not know the value of his produce or how to go about obtaining the best price for what he has to sell. A member of a co-operative society is saved all this uncertainty. The society's skilled staff will measure up and value his trees and give advice on advertising and sale agreements. By combining several lots belonging to members in one district they may attract larger buyers and obtain an enhanced price. At all times by keeping closely in touch with timber supply and demand they can advise members on the advisability of selling.

Considering the benefits derived from membership of co-operative societies, it is surprising that in 1939 only 500 landowners in Great Britain were members of the three societies operating there, and that the total area of woods involved amounted to a bare 254,000 acres.

Communication No. 3 on Forestry Credit, deals with the facilities for credit available in Germany, Norway, Denmark, U.S.A., Great Britain and some of the Dominions. Owing to the length of time between sowing and harvest credit is a greater necessity in forestry than in most industries. These loans are of two kinds, short-term credits for the purchase of implements or to tide an owner over a temporary financial crisis pending the realisation of an existing forest crop, and long-term credits for the purchase of forests, of land for afforestation or to meet the costs of laying down and maintaining forests and of undertaking various works in them.

Long-term loans against such an intangible asset as a growing crop in its early years are not easy to negotiate and commercial banks will not usually advance more than the value of the land and ignore the expectation value of the young trees. Some of the credit agencies which specialise in rural business have a similar limit to their advances, and those which accept growing stock as well as land as security do so only where a forest is mortgaged jointly with agricultural property. This disability is a serious drawback to private forestry, and the question has been under examination in America, where a Bill has been drafted to enable Federal land banks to make advances on forest property, provided that the wood is managed satisfactorily, or that proper management is established with the proceeds of the loan. In Great Britain the Forestry Commission is empowered by the Act of 1919 to make loans for afforestation and replanting, but they do not appear to have made use of this provision. In the recent White Paper on British Post-War Forest Policy it is suggested that public loans should be made available for private owners who conform to approved forestry practices, and it hoped to provide such loans to owners of "dedicated" woods at a reasonable interest rate.

POST-WAR FOREST POLICY—PRIVATE WOODLANDS.

Supplementary Report by H.M. Forestry Commissioners, January, 1944.

(H. M. Stationery Office: Price 2d.)

In their Report on Post-War Forest Policy, June, 1943, the Forestry Commissioners devoted Chapter 3 (Paras. 259 to 333) to the future of Private Woodlands. In paragraph 297 it was stated that, in working out and applying the details of the scheme, the Central Landowners' Association, the Scottish Land and Property Federation and the Royal Scottish and English Forestry Societies should be freely taken into consultation.

Private Woodland owners had already expressed their dis-satisfaction with the proposals so the Commissioners invited those four bodies to nominate two representatives each to meet them and discuss the proposals in greater detail. The Conference so constituted held four meetings in all, namely on 21st July, 22nd September, 27th October and 28th October, 1943.

The Basic Considerations and the seven fundamental principles derived therefrom for the dedication of woodlands were agreed. The undertakings to be assumed by Private Owners in return for State

financial assistance were defined and ensure that dedicated woodlands would be devoted permanently to timber production, that Private owners would prepare their own forestry plans to be approved by the Forest Authority, that skilled supervision should be employed or alternatively provided by the owners themselves, and that adequate forest accounts would be kept.

In return the Commissioners would be prepared to contribute 25% of the ascertained costs of establishment and maintenance until the woods became self-supporting. Alternatively the owners would have the option of availing themselves of the following proposals:—

(a) An initial Planting Grant of £7 10/- per statute acre.

(b) Loans in addition to (a), amounts depending upon individual circumstances, and to bear interest at the same rate at which the Forest Authority is financed plus a small operating charge.

(c) A Maintenance Grant for 15 years at 2/6 per acre per annum for every acre planted and properly maintained.

(d) A Maintenance Grant for 15 years of 2/6 per acre per annum from the date of dedication of all productive woodlands other than plantations covered by (a) above.

(e) Grants to be revised after 5 years on the basis of ascertained costs.

The Report also deals with discussions on the Dedication of Small Woods for which a satisfactory solution does not yet appear to have been found; State outlay on Private Woodlands, which is estimated to cost £2,000,000 in the first decade; Administration of Private Forests, Forestry Education and Miscellaneous Questions.

Little enthusiasm can be summoned for these niggardly proposals. Great Britain could not have maintained her war-time needs for timber without the contribution from native woodlands of which the Commissioners from their own resources provided a meagre 4%. Private estates have, in the past, contributed more to Forestry than the Commissioners, and will continue to do so in future. It seems to be a case of the tail trying to wag the dog. The only redeeming feature is that loans may be granted at nearly the same rate as the Forest Authority is itself being financed—an admission that Private Woodlands, from a national point of view, are almost a gilt-edged investment. Apparently the Commissioners will be the sole judges of what constitute adequate Forest Accounts for which a simple form is provided in Appendix I. Estate labour has to do all the estate work of which Forestry forms only a part. Allocation of wet time and holidays with pay will be troublesome and the Commissioners will be able to pry into every item of estate expenditure, particularly when the grants come up for revision at the end of five years. It would have been better to have made an out and out grant—the final instalment to be paid in five years when the plantations would be established. In Eire the grant is £10, what it should be in Great Britain we do not venture to express an opinion.

CONIFERS.

A Booklet issued in connection with a display of the different varieties of Coniferous trees growing in Newtown School Grounds, Waterford, 1945.

This is a well-arranged little booklet which describes the morphology of the commoner coniferous forest trees, portions of which were arranged in a display in the school show case by the pupils. The trees, most of which are apparently growing in the school grounds, are taken in turn and quite a full description of the form, twigs, flowers, cones is given, with a note on the usefulness of the timber and the natural habitat of each tree. Besides the common forest trees, Cedar, Ginkgo, Monkey Puzzle, Juniper and others are described and the booklet is decoratively illustrated with small pencil sketches. It is apparent that the compilers had a good elementary grounding in forest botany and the production seems a very good way of interesting young people in trees.

POST-WAR FORESTRY.

A Report on Forest Policy Prepared by the Royal Scottish Forestry Society and the Royal English Forestry Society, 1944

Price 1/- (8 Rutland Square, Edinburgh, or 48 Dover St., London W.1)

The report of H.M. Forestry Commissioners, Great Britain, which was issued in June, 1943, was reviewed in our last issue. This joint publication by the Forestry Societies of Scotland and England, the issue of which has been somewhat belated, puts the case for private forestry in these countries in the post-war period.

The report is a long one of sixty-two pages and comprises sixteen sections and an appendix. It conveys the impression of having been conceived and brought forth in the southern part of the island and of having received the blessing of the northern half on condition that due recognition of the order of precedence of the two Societies in respect of age and veneration, if not of vitality, should be made. The result is a report which does not always pay full attention to the differences existing between the two countries.

The report is a complete document and puts a good case for the development of, or should we say, for the arrest of the decay of, forestry on privately-held lands.

Section 3 describes the economic structure of rural land management and how the traditional system of tenure has tended to break down in recent years. It is claimed that the best managed areas of land in Britain are still those where a competent and vigorous landowner has been able to maintain the estate structure. It is stated, although it seems hardly credible, that the Societies believe that there are three fundamental conditions for the revival of rural industry namely, (1) that the Government should take an active interest in the problems of land ownership and land management, (2) that the "dedication" principle should be applied generally to agricultural and forest land and (3) that a system of taxation should be devised to allow continuity of estate management. The first two conditions amount to a plea for more and stronger State control. The third condition is one which certainly deserves attention.

In Section 4 the usual orthodox arguments for a great expansion of British forestry are put forward.

The condition of estate woodlands, the features which influence their management and the problems of their restoration after the war are discussed in Section 5. The apathetic attitude of the Government towards private forestry is stressed, but the fact really seems to be that the vast majority of private landowners have been woefully apathetic in respect of forestry. Very few owners made any real attempt to run estate forestry as a business concern on sound lines but the few who did, where local conditions were favourable, were reasonably successful. No one can deny, however, that estate woodlands have made very important contributions during serious national emergencies, not only in Great Britain, and there is general recognition that assistance is necessary to make good the loss these woodlands have suffered.

Section 6 begins with some plain speaking in respect of the constitution and policy of the State forestry authority in Great Britain. This recognition of the true position of the Forestry Commission is somewhat belated and especially of the fact that the State forestry authority must inevitably be a powerful competitor in the markets of the future with its forestry produce. The pay and conditions of service of many members of the Commission's staff are adversely criticised. In a brief history of the unsuccessful efforts of the two Societies to get the State authority to take a more active interest in estate forestry, it is claimed that the position has been worsened and not improved since the Forestry Commission was founded.

In Section 7 the report of the Forestry Commissioners on the post-war policy is fully discussed, especially those sections having a bearing on the working of private woodlands. There is full support for the pro-

posal to increase the forest area, to allocate grants to forestry and for the "dedication" scheme. The constitution of the post-war forest authority and the policy in respect of small woods is opposed, and modifications in respect of proposals for State assistance, marketing, education, research and for dealing with pests are considered necessary. The failure of the Commissioners to adopt a policy in respect of securing and growing the best strains of various species of trees and to deal with the problem of valuation of standing timber and immature plantations is commented upon.

The remaining sections deal with recommendations which the Societies make and these may be summarised as follows. It is proposed that the existing Forestry Commission should be replaced by a new forestry authority responsible to a Minister and composed of a Board with a President, the latter to be represented by an active chairman, who must not be a technical officer. The Board is to include four paid technical members and five unpaid members. Two of the technical members are to be responsible, with a separate staff, for estate woodlands and the other two for State woodlands. The country is to be divided into twenty or thirty regions each under a Conservator to be assisted by a regional forestry committee, appointed in part by the forestry authority and in part by the Forestry Societies. Obviously this elaborate scheme of control is bound to be cumbrous and unwieldy in the extreme and could only be applied, if at all, by the English end of the island. It is indeed the very antithesis of the autocratic control hitherto in force and no doubt some compromise will have to be reached. A determined effort should be made to bring "small woods" into the dedication scheme. Dedicated woodlands would not be subject to licence. More favourable planting grants are considered necessary and grants for clearing scrub and debris. Decontrol of existing controlled prices for standing timber is advocated or else a material increase in the existing maximum prices. The need for improved pay and conditions of service of men in the forestry profession generally is stressed. A considerably expanded education scheme is advocated and an expansion of expenditure to not less than £150,000 a year by the end of the fourth year on research work is proposed. These last proposals seem to err on the side of exaggeration. Finally recommendations are put forward for extermination of rabbits, squirrels and roe deer, based on certain assumptions which are at least open to question.

When one has read this report one is left with the feeling that there is a fundamental difference of outlook between those engaged on State afforestation on the one hand and the heirs of those who have engaged in private forestry in the past on the other. That there should be political differences of opinion one can understand but there certainly should not be that wide gulf between the day-to-day forestry work which goes on in private forests and that which is carried out in Government forests. The trouble seems to be almost entirely due to those responsible for State forestry acting on the assumption that the new State forests now being created are going to be something entirely different to any so far seen in these islands; to a deliberate attempt to build up ideal, self-contained forest units out of touch with the communities by which they are surrounded and certainly out of touch with existing "local" forests. If the State authorities could accept as a fact that their large-scale forests will not differ essentially from the smaller private forests or wooded estates, except in respect of size, and that much can be learned from the past experience of all such local forests on all aspects of forestry, there would be greater harmony and a brighter future for British forestry. The Forestry Societies have in the report begun at last to make a stand—too long delayed—for a forest policy which will be more in sympathy with the national instincts. The future of British forestry depends on a closer link-up of the older forest traditions with the newer enterprise, energy and technical ideas of the State service. It will be interesting to see if this can be done and how.

It would be wrong, however, to agree entirely with the severe criticism which the Societies make of the past attitude of the Forestry Commission, on which, after all, landowners have been well represented. The fact is, and it must be admitted, that only about five per cent of the present landowners in Great Britain are really interested in practising forestry as forestry. It has for the most part merely been an adjunct of estate management to meet purely domestic needs or to render landed property more attractive from the sporting or amenity aspects. In a changed and less wealthy world that is not enough and much more could

have been done by the Societies themselves in closer co-operation with more active associations of private owners actually engaged in forestry and not merely in "advancing" forestry, than has been done. Possibly it is too late now for this mistake to be remedied, but if the co-operation between the Forestry Commission and the private owners does not become too one-sided, the prospect for the eventual improvement of private forestry under whatever scheme of assistance is adopted, should be brighter. The advantage to any country of a healthy private forestry practice is too great to be lightly set aside. The position in Eire cannot be said to be a very happy one in that respect.

OBITUARY

DANIEL J. GAYNOR.

1-10-1892—19-10-1944.

The death of Mr. D. J. Gaynor, Assistant Junior Forestry Inspector, Forestry Division, Department of Lands, at Our Lady's Hospice, Dublin, on the 19th October, 1944, came as something of a shock to many of his associates, who were not aware of the serious nature of his illness, although the extreme discomfort and serious handicap under which he had been working for a number of years were well-known.

Mr. Gaynor was a native of Arklow and underwent the usual training course in forestry at Avondale under the Department of Agriculture and Technical Instruction during the period 1911-1914.

He obtained an appointment in the saw-milling concern of Mr. John Deans, Glenealy, Co. Wicklow, when war broke out in 1914 and Avondale School was closed down.

In November, 1923, he was appointed Grade II Forester in the State service; was promoted to Grade I in May, 1933, and was one of the first appointed to Head Forester grade in January, 1939. During his period of service he conducted operations in Bailieborough, Dundalk, Tuamgraney, Mountshannon, Roundwood, Woodford, Loughrea, Dundrum, Slievenamon and Clonmel Forests and it was on the last-mentioned area that he fell a victim to the rheumatic fever and rheumatism which necessitated a long interruption of service, and from which it seemed at one time that he would not recover sufficiently to resume duty. His cheerfulness and tenacity, however, pulled him through and he again took over Dundrum Forest in April, 1940. On 10th October, 1941, he was appointed Assistant Junior Forestry Inspector and was employed at Headquarters mainly on work concerned with firewood schemes, saw-milling and disposal of timber.

Unforeseen staff changes necessitated his taking temporary charge of District VII. and later of District VIII. and it was while he was stationed at Limerick that he was reluctantly compelled to give up work and go into hospital.

Mr. Gaynor was a sound, hard-working and conscientious Forester with a good knowledge of all aspects of the work, including sawmilling, and with a lively enthusiasm for forestry. He spent his holidays in an adventurous manner and had travelled a good deal outside Eire, which was probably one reason for his capacity for interesting conversation. From the first he was a keen supporter of our Society, the need for which he strongly advocated. He will be remembered most however, for the cheerfulness with which he successfully overcame the physical handicap of his later years, and for his outstanding devotion to duty.

Annual General Meeting, 1945

The third Annual General Meeting of the Society was held in Jury's Hotel, Dublin, on Tuesday, the 6th February, 1945, at 7 p.m., approximately 50 persons being present. The retiring President, Dr. M. L. Anderson, opened the proceedings by calling on the Secretary to read the minutes of the previous Annual General Meeting. The Secretary pointed out that the minutes of that meeting had already appeared in full in the last issue of the Journal which had been in the hands of the members for some time. The meeting, having agreed to accept the minutes as correct and as read, they were duly signed by the Chairman, who then read the report of the Council for the year ended 31st December, 1944.

COUNCIL'S REPORT.

Council Meetings.

Four meetings of the Council were held, all in Dublin. The strength of the Council was twelve and the average attendance was nine, which was even better than last year and speaks well for the enthusiasm of the members in these times.

Membership.

At the beginning of the year the membership was 156, of which 39 were Grade I technical, 83 Grade II. technical and 34 Associate members. I still think that there should be a considerable increase in associate membership, but we can only expect this to happen if we make the Society sufficiently attractive as we hope to do. There are also a number of possible technical members who have not yet joined us for reasons best known to themselves. Our membership stands now at 161—39 Grade I., 76 Grade II. and 46 Associate.

The position with regard to the payment of subscriptions shows an improvement but the Secretary and Treasurer has been given a good deal of trouble from the fact that several members have not yet paid their subscriptions for 1944 and a number even for 1943. I have to remind such members that failure to pay their subscription for a period of two years means that they will be struck off the roll of the Society. The Council has decided to give such members a last chance to put this right. Thirteen members have been elected but not enrolled; five subscriptions are due for 1943 and thirty-three for 1944. May I also remind you that membership fees are due for payment on the 1st January, in each year?

Finance

The audited abstract of accounts has been distributed amongst members. The credit balance has risen from £54 8/7 to £72 18/6. This matter will be dealt with later in the meeting.

Journal.

At our last general meeting it was agreed that we should try to have two issues of the Journal during the year. The Editorial Committee found, however, that this would not be feasible owing to difficulties about the paper and the Council decided therefore to have one issue only of a larger size and of better quality in view of criticisms in respect of the first three numbers of the Journal. All members have now seen the recent issue and I think will agree that it is an improvement. The question of having two issues in the year is still, however, before the Council and is kept in view as desirable. May I add that the Editor elect is very aixious to have contributions for the Journal from as many sources as possible?

Excursion.

Following the decision of the general meeting last year the Excursion Committee made preliminary preparations for an excursion to Aughrim, Co. Wicklow, but in view of the serious transport difficulties which arose the Council decided that the holding of an excursion would not be practicable and these arrangements were cancelled. Instead a special General Meeting of the Society was held in June, 1944, at which Mr. G. F .Mitchell read a paper on "The Influence of the Ice Age on Irish Forests," which has been reported in the last issue of the Journal.

The paper was followed by an interesting discussion and the meeting was well attended considering travelling conditions.

Library.

A suggestion put forward to the Council by a member that the Society should have a library for the use of members was discussed by the Council, and it was decided that while a library was desirable, the difficulty of accommodation and the absence of suitable office accommodation made it impossible at present to consider the proposal. Arising out of that, the Council have under consideration the question of securing official accommodation in Dublin. This is largely a question of finance. I see the library question is down for discussion in our agenda for to-night.

Registration of Notable Trees.

The Council have had under consideration the setting up and maintenance of a register of notable trees in Eire and a special committee of the Council has been formed to put this proposal into effect. Our President-elect, Mr. Fitzpatrick, has been convener of this Committee and the necessary steps are being prepared. The intention is that every notable tree, whether native or exotic, should be registered with the Society and that full particulars in respect of each tree should be kept and that periodic reports in respect of each tree should be obtained so that information on the behaviour of various species can be made available and seed collections carried out with a view to encouraging the growth, not only of satisfactory species, but of races and strains of individual species which have special sylvicultural or arboricultural qualities. I see that this subject, too, is to be dealt with later on, so I shall say no more at present.

On the motion of Mr. T. Donovan, seconded by Mr. M. Swords, the report was adopted with acclamation.

The retiring President then read his valedictory address.

PRESIDENT'S ADDRESS.

Before I formally demit office in accordance with the Rules of our Society, I have to review, amongst other things, the advances in forestry or forestry knowledge during the year. The most important advance to be mentioned during the past year in this country is, I think, the amendments in the State Planting Grant Scheme announced by the Minister for Lands. This scheme has been amended in two very important respects. In the first place the grant paid has been increased from £4 per acre to £10 per acre, payable in two instalments of £5 each, the first immediately after planting and the second five years later, subject to certain conditions. The second change is that the minimum area necessary for qualification for the grant has been reduced from 5 acres to 1 acre. These alterations are very timely in view of the large amount of replanting which now falls to be done under the Forestry Act, and they represent such a definite encouragement to private planters that there should be a strong inducement to take a greater interest in planting trees.

You may remember that Colonel Magan dealt with this question in his very interesting address to us last year at our General Meeting, but I think it is only just to point out that the steps taken were decided upon, if not finally made public, before the measures recently adopted by the British Forestry Commission were made known. It was not, therefore, a case of following a lead in this matter.

In the remaining time available to me I should like to stress the essential importance of members of our profession taking a strong stand in support of that fundamental principle of sound forest management known as the principle of the sustained yield in forestry. It is well known that a fully productive forest must contain a certain amount of wood capital for the production annually of the highest volume or value increment possible and that it is a forestry crime to over-cut the forest and reduce the timber capital. Nevertheless, we still find at this time of day timber users and timber merchants preaching the doctrine that there is still plenty of timber in the world or in some particular country. These people, of course, have in mind the existing forest capital which they can see only as an immediate source of timber, ripe, in their opinion, for the axe. They do not see it as the capital producing a percentage of increment annually, which increment must not be exceeded by the amount of timber removed from the forest annually, if the forest is to

survive. They do not appreciate that that capital has been built up over a long period of years by successive small increases. They do not concern themselves as to where the forests and the timber of the future are to come from. It is men with that outlook who must be held responsponsible for the immense trail of devastated forests which covers a great part of both hemispheres.

We find that these ignorant people suggest that there is plenty of timber still available for distribution in the world. That is not quite the case. Nor is it only timber merchants alone who ignore this first principle of forest management. I regret to have observed that even some foresters have been advocating that Germany, should she lose the war, could very well be made to repay some of its costs, at least, by vigorous exploitation of her forest. The exploitation contemplated can only mean severe over-cutting or even clear-cutting of some of the best-managed forests in the world, with very serious consequences to forestry in general. This is a course of action which should be resisted strongly by every true forester. It is not a reduction of well-managed forests that is wanted, but an increase.

It is interesting, on the other hand, to read that the South African Forestry Department have recently taken one of the most drastic steps possible in harmony with the principle of the sustained yield. They have decided that certain natural forest areas in Cape Colony which have been devastated and over-exploited for nearly 60 years, are to be rested for about 200 years to enable the area to recover some of its original state. In this way and over that long interval of time the over-cutting is to be made good. This plan is a very far-sighted one and based on a faith in the ability of foresters to ensure that sound forestry principles can be applied and maintained in future. It is, in fact, based on a faith in the future of our profession. It is that attitude of mind which we have not only to develop here but also to induce in all those who have a responsibility in respect of forestry.

There is always, of course, the type of person who carries his objection to over-cutting of trees to the opposite extreme and who refuses, for one reason or another, to cut old trees which have not only reached commercial maturity, but have reached and passed biological maturity. He, or she, refuses to fell over-mature timber and to take the necessary steps to replace it with younger trese. The ultimate result of such a policy inevitably leads to the disappearance of woods and the policy defeats its own object because trees are unfortunately not immortal.

Many of the members who attended our first excursion to the Clonmel district will recollect that we had an interesting discussion on the treatment of a certain stand of mature hardwood, and that it was the unanimous view of members that it was time the wood was opened out to allow the younger generation of self-sown trees to develop, if the wood was to be preserved. This has recently been done and it is to be regretted that a measure taken in the best interests of the wood and of the local amenity should have led to ill-considered criticism and used as a peg on which to hang a general warning that the Forestry Service of this country is not to be trusted with the care of its own woods, let alone with that of all woods throughout the country. Nothing could be further from the truth, as the appearance and condition of the country's woods after five and a half year of severe strain, amply testify. It is a warning, however, to all professional foresters that they must always be ready to combat the views and opinions of persons inexperienced in forestry. There are a great many people who think that a nodding acquaintance with a tree or the reading of a book on forestry or an occasional walk through a wood raises them to the rank of forestry specialist.

What is desirable is that as many people as posssible should have a direct interest in owning and maintaining woods, in producing timber and other forest produce and in replanting their woods as and when necessary, and they certainly have a strong inducement to do all this both by the operation of the Forestry Act and by the financial encouragement offered by the new scale of grants under the Planting Grant scheme. They would also, I believe, find it some advantage to become members of this Society.

On the motion of Mr. T. Ryan, seconded by Mr. T. McCarthy, the Abstract of Accounts for the year ending 31st December, 1944, which appears below, and which had been sent to all members along with the notice calling the meeting, was approved, without question.

The retiring President then announced the selection, under the Constitution and Rules of the Society, of the following office-bearers and councillors for the year 1945:—

President: H. M. Fitzpatrick, Kendalstown Hill, Delgany.
Vice-President: J. A. K. Meldrum, Ben Wyvis, Lakelands Park, Terenure
Secretary: T. Clear, Albert Agricultural College, Glasnevin, Dublin
Treasurer: S. M. O'Sullivan, Aberfoyle, Orwell Road, Rathgar, Dublin.
Editor: M. L. Anderson, 16 St. Stephen's Green, Dublin.
Business Editor: T. McEvoy, Rathdrum, Co. Wicklow.
Auditor: Duncan Craig, 102/103 Grafton St., Dublin.
Councillors: M. O'Beirne, Casino House, Avondale, Rathdrum, Co. Wicklow.
N. Diver, Rathdrum, Co. Wicklow.

He declared them duly elected and, having thanked members for the co-operation and assistanece given him during his three years of office as President, he invited the new President, Mr. H. M. Fitzpatrick, to take the chair.

The new President, in taking the chair, thanked the Society for electing him to the office and paid a tribute to his predecessor for his work in the founding of the Society and in guiding it through its difficult years.

Register of Notable Irish Trees.

The President having explained the object which the Council had in mind in proposing to open a register of notable Irish trees, the keeping of which was very desirable in view of the fact that the country was very well suited to a great range and variety of tree species, a great many having been planted from time to time which were now in danger of being overlooked or destroyed, it was moved by Mr. O'Beirne and seconded by Mr. D. Horgan that the Society approve of the Council's plans for tree registration and of an expenditure from the Society's funds of £10 to defray initial printing costs. The proposal was agreed to.

Excursion, 1945.

The President reported that the Council had agreed to recommend that an excursion be held in the first week of June, 1945, but had not decided whether the venue should be at Aughrim, Co. Wicklow, or at Killarney. The meeting was unanimous in approving that an excursion should be held, and, on a show of hands, it was decided that it should be held in the Aughrim district.

Library.

Mr. T. Madden, in opening a discussion on the subject of the Society's starting a library for the exclusive use of members, which had been considered by the Council, as reported above, said that the desirability of having a library was self-evident. Books were scarce and dear and as a result, many foresters were out of touch with forestry literature. He was convinced that all members were anxious to keep in touch with forestry developments and this seemed to be the best way. The difficulty was one of suitable housing accommodation for the books and he suggested that, perhaps, some member would agree to do this for the present.

Mr. T. McCarthy supported the general proposal and thought that the Council should do its best to solve the problem, suggesting that members should be asked to pay postage. Mr. O. V. Mooney thought that no postage fee should be charged. Mr. Galvin suggested that the Central Library might be in a position to help, and Mr. F. McMahon said it was possible to get forestry books through the local libraries.

After some further discussion, business was concluded and the President, introducing Dr. P. H. Gallagher of the Albert Agricultural College, called upon him to read his paper on "Some Aspects of Soil Classification," which is printed elsewhere in this issue.

Discussion Following Dr. Gallagher's Paper.

Dr. M. L. Anderson, in proposing the vote of thanks, pointed out that the forester looked at the soil from an aspect somewhat different from that of the agriculturist. He had to regard the soil more broadly and was not in the same position to alter it after his crop was established.

He stressed the desirability of more intensive soil research by special investigators in close alliance with the general practitioners and of an institute in the country concerned not only with the classification of soils but with the study of the effect of cultural operations and especially of tree growth on the local soils. The capacity of tree crops for improving soils in contrast with farm crops which remove food substances from the soil needed to be emphasised and was also a subject worthy of special investigation.

Mr. J. A. K. Meldrum, in seconding, supported Dr. Gallagher's views on the importance of the relationship of the soil to the underlying geological formation with some striking examples from his own experience where selection of species had to be altered in conformity with changing rock formation. Factors of altitude and exposure were of great importance in restricting forestry operations on otherwise suitable soils.

Mr. T. McEvoy, in supporting the vote of thanks, pointed out that the vegetation had an influence on the soil besides being effected by the soil and that the same soil might carry different types of vegetations The use of vegetation in selecting species might in such cases lead to different selections. He expressed doubt as to the permanent effect of subsoiling of moorland soils with tractor ploughing which might in areas of heavy rainfall result in rapid leaching and a loss of any advantage gained by ploughing. He also drew attention to the varying effect of Beech on the soil depending upon varying climatic conditions. It was not always a soil-improving species and might have harmful effects. These were problems in which the soil specialist could help the forester.

Mr. M. O'Beirne also stressed the importance of the underlying rock in its effect on the soil, especially where it comes near the surface. Tree roots cannot penetrate downwards if the rock is not fractured or porous. The effect of underlying limestone on the soil is specially striking and the use of marl for improving peat lands both for farming and forestry is well known. The presence of mycorrhizal fungi in old woodlands was a point for consideration in selecting species for replanting. Intelligent use of the surface vegetation by the forester would result in few serious mistakes in planting.

Mr. T. McCarthy quoted an interesting case where soil analysis had determined a deficiency of manganese and potash in a soil where ornamental trees and shrubs had proved failures and where, on these minerals being introduced, excellent results were obtained. He thought that soil analyses were very essential when establishing new forest nurseries.

Mr. T. Clear, supporting, said that foresters had rather neglected the study of soils because they could not be simply classified and were remarkably variable. Reliance had been placed in the vegetation as a guide to selection of species. Vegetation reflected the nature of the upper soil layers which were important at the time of establishment but later on the deeper layers of soil would have important effects on the forest and on the timber and study of soil type becomes important. The forest and the individual species of trees had an important influence on the soil. The importance of humus in the forest soil could not be over-estimated and the nature of the soil had an important effect on the quality of the humus. Soils well supplied with a mild form of humus were good planting subjects. Difficult sites were those with a lack of humus or an accumulation of humus in the form of peat, etc. Species had to be varied accordingly. A better knowledge of the nature of the soil, types of humus and the living organisms associated with it was important to the forester. This would become all the more necessary the more the forester was forced to work upon poorer and poorer areas as the better areas became planted. It was very desirable that as a result of study and experience a tradition in forestry matters should be built up as it would be in time—such as already exists in agriculture and stock-raising.

The President in conveying the vote of thanks, said that Dr. Gallagher had somewhat shaken his faith in the value of plant indicators for soil classification. As a result of the lecture more attention would probably be paid to the soil itself, and not merely to the vegetation on top of it. He had been interested, in listening to the discussion, to note how many different aspects of the subject had been touched upon by the

speakers. To him the many contradictory views which he had come across in various text books were somewhat puzzling and he hoped that the lecturer would one day be able to give members to their benefit a practical demonstration in the field of some of the points dealt with in his address.

Dr. Gallagher, in reply, said:—

Certain matters which speakers mentioned, I was glad to hear them mention, because I was very conscious in coming along with this paper to-night that I had left a large number of aspects out of it. I had to try and draw the line somewhere and try and compress it within 5,000 or 6,000 words at most. One aspect of soils which I had in mind to mentioned, and left it out at the last minute was Dr. Anderson's point concerning the influence of vegetation. There had been quite a good deal of work done on that subject abroad and one finds it figuring a good deal in text books dealing with soil classification. In connection with the difference betwen the conifer and deciduous trees in this respect, one is supposed to be impoverishing the soil by accelerating podsolisation and the other to be retarding it. The conifer is injurious in this respect.

The question of grassland in ordinary farming was raised. There is a case where you have a crop showing material influence in soil improvement. I am inclined to attribute the effects of grass to the action of its root system penetrating the soil and in producing an abundance of organic matter of the same kind, capable of ameliorating the soil. There is another plant linked up with the conifer from the point of view of podsolisation, and that is heather. The question of geological relationship which my friend raised, I think I tried to do full justice to in the paper. The soil scientist for a number of years has been inclined to look down on geology where soil is concerned. I had occasion, not more than ten years ago, to meet some of the prominent workers in England and practically none of them paid any attention to geology at all. Climatic processes dominated soil formation, according to them, but I do not think so.

Geology has always figured rather prominently in any attempt at soil classification in this country. Kilroy published a text book on the subject and what I tried to do in this paper was to try and reconcile climate with the establishment of different soil tyes.

The President, in his few remarks, raised the question of the contradictions one meets with, more particularly in popular books which are very plentiful in Britain nowadays on farming, and the verdict which I would be inclined to give in this matter is that these people are all probably quite right up to a point, but where they are wrong is in trying to apply results to all soils which only apply to some. There was the question of manganese for instance. There are some soils which are deficient in manganese, and in the same category would be trees which do not do so well without it, and the condition is curable here by applying the manganese. It would be quite wrong to apply it in all cases—only where it is deficient. I would like to emphasise the necessity for treating soils individually. There are tremendous differences between them and the remarks of various other speakers showed that. The question of the favourable effect of marl taken from the bogs is a case in point. There is a little benefit derived from marl on some soils and not on others. One finds it on some bogs and not on others.

Then there is the question of the value of plant indicators. I did not try to decry this for a moment, but I would leave it entirely in the hands of the forester as something founded entirely on his own experience, but it may occur that the plant indicator can let you down an odd time, for after all, it is only an indicator. There is a lot to be said for the spade in the long run to verify what the plant indicator will not tell you. A more simple expedient than the spade, I think, is the inch augur which carpenters use. It is very good for getting down to about 2½ feet in the soil, though, of course, it is sometimes difficult to get it back now and again.

One point I personally would like to see emerge out of this summary presentation of the soil position here to-night is that those engaged on forestry work would keep an eye out for peculiarities and not immediately forget about them but take some steps to bring them to the notice of people who might be interested in them from the soil

point of view. I feel that the field man does come across problems and does not know where to bring them, but the few people in the country engaged on soil study would be glad to hear of interesting circumstances throughout the country. It is the only way in which we can build up a thorough knowledge and is a procedure which is also bound to be of inestimable benefit to the forester in his work.

STATEMENT OF ACCOUNTS FOR THE YEAR ENDED 31st DECEMBER, 1944

Income.

Jan. 1.—1944.	£	s.	d.	£	s.	d.
To Balance from last account.						
In Secretary's Hands ...	1	7	6			
At Bank on Current Account	3	1	1			
At Bank on Deposit Account	50	0	0			
				54	8	7
Dec. 31.—1944						
To Subscriptions received.						
3. 1st Grade Techical— 1943	3	0	0			
33. 1st Grade Technical— 1944	33	0	0			
5. 2nd Grade Technical— 1943	2	10	0			
48. 2nd Grade Technical— 1944	24	0	0			
3. Associate. 1943	2	5	0			
32. Associate. 1944	24	0	0			
3. Associate. 1945	2	5	0			
				91	0	0
To Sales of Journal ...				5	0	0
				£150	8	7

Expenditure.

Dec. 31.—1944.	£	s.	d.	£	s.	d.
By Stationery				8	7	1
,, Printing and despatch of Journal				52	15	3
,, Postages				3	5	3
,, Hire of rooms for meetings				1	11	6
,, Bank Charges				1	1	0
,, Secretary's Honorarium				10	10	0
,, Balance—						
In Secretary's hands ...	7	15	4			
At Bank on Current A/c.	15	3	2			
At Bank on Deposit A/c.	50	0	0			
				72	18	6
				£150	8	7

I have examined the above Account, have compared same with vouchers and certify it to be correct, the balance to credit of the Society being £72 18s. 6d., of which £15 3s. 2d. is on Current Account and £50 os. od. is on Deposit Receipt with the Ulster Bank, Ltd. Credit has not been taken for subscriptions for 1943 £3 os. od., and for 1944 £25 os. od., which were due at 31st December, 1944.

D. M. CRAIG, Auditor and Accountant,

15th January, 1945.

102/3 Grafton Street, **Dublin.**

SOCIETY OF IRISH FORESTERS

List of Members — 31st December, 1944

*—Technical Member Grade I.

a—Associate Member.

h—Honorary Member.

Foundation Members in Italics.

Allman, David, Ballyshonock, Clonegal, Ferns, Co. Wexford.
Allman, James J., Glenart, Arklow, Co. Wicklow.
* *Anderson, Mark L., 16 St. Stephen's Green, Dublin.*
a Anderson, Miss Catherine H., 16 St. Stephen's Green, Dublin.
a Anderson, Mrs. Mabel, 16 St. Stephen's Green, Dublin.
a Annesley Grove, Richard Arthur, Annesgrove, Castletownroche, Co. Cork.
Barret, William J., Lahardane, Ballina, Co. Mayo.
* *Barry, Patrick, 94 Malahide Road, Dublin.*
Begley, Timothy, Woodlawn, Co. Galway.
a Blake, John J., Ballyglunin, Co. Galway.
a Bland, William, Rath House, Portarlington, Laoighis.
Blighe, Thomas, Main St., Killeagh, Co. Cork.
a Bogue, Maurice, Drogheda. Timber Merchant.
Breslin, William J., Avondale, Rathdrum, Co. Wicklow.
a Brigham, John E., Newtown School, Waterford.
Briody, Thomas J., Brittas House, Clonaslee, Co. Leix.
a Brunner, Miss Nora, 9 Upper Clanbrassil St., Dublin.
a Buckley, John L., Rockwell College, Cashel, Co. Tipperary.
Butler, Peter J., Abbey Street, Wicklow.
a Cahill, Miss Sarah, 4 Mount Street Crescent, Dublin.
a Cameron, John Grigor, Weather-house Haugh, Dowhill, Selkirk, Scotland.
Canning, John, Ballinafid, Mullingar, Co. Westmeath.
a Carlin, John, 55 Plevna Street, Belfast.
a Carr, Michael L., 11 Clare Road, Drumcondra, Dublin.
Cassidy, Philip, Ballintogher, Co. Sligo.
* *Chisholm, William V., Oxmantown Mall, Birr, Co. Offaly.*
Clarke, Francis P., Dartrey, Cootehill, Co. Cavan.
* *Clear, Thomas, Albert Agricultural College, Glasnevin, Dublin.*
a Cleary, Thomas, 28 Vavasour Sq., Sandymount, Dublin.
Collins, Patrick J., Currantarmid, Monivea, Athenry, Co. Galway.
Collins, Timothy, C/o Mr. Coupar, Cronroe, Ashford, Co. Wicklow.
Conway, Joseph, Creeslough, Lifford, Co. Donegal.
Corboy, Daniel J., Castleboro', Clonroche, Co. Wexford.
Cox, Thomas P., Gort, Co. Galway.
a Craig, Duncan M., 102, Grafton Street, Dublin.
* Crammond, Joseph A., Model School, Clonmel, Co. Tipperary.
* *Crerand, Roderick J., Mill View, Portlaoighise, Co. Laoighis.*
Cronin, Patrick, Aughrim Forestry Centre, Aughrim, Co. Wicklow.
h Crozier, John, 62 St. Lawrence's Road, Clontarf, Dublin.
Curran, Cornelius, Glendav, Carriganima, Macroom, Co. Cork.
Curran, Edward, Mullan, Kinawley, Co. Fermanagh.
Cusack, William F., Mountpleasant, Dundalk, Co. Louth.
* *Dalton, Matthew, Baunreagh, Mountrath, Co. Leix.*
a Darby, John J., 88 Merrion Square, Dublin.
Deasy, J. J., Wilton, Enniscorthy, Co. Wexford.
a Deegan, Michael, 23 Upper Merrion Street, Dublin.
Delaney, Patrick, Kilbeheny, Mitchelstown, Co. Cork.
Devereux, Nicholas, Ballymacmague, Dungarvan, Co. Waterford.

* Diver, Neil, Rathdrum, Co. Wicklow.
Dolan, Thomas Joseph, Broomfield House, Kilpeddar, Co. Wicklow.
* *Donovan, Timothy, Cairbre, Sutton, Co. Dublin.*
Donovan, Timothy, Dundrum, Co. Tipperary.
Dooley, Michael E., C/o Mrs. Doyle, Carrickbyrne, Newbawn, New Ross.
Dowds, James Patrick, Emo Park, Portarlington, Co. Laoighis.
Doyle, John P., Newtownmountkennedy, Co. Wicklow.
Dungan, William, Cappoquin, Co. Waterford.
Farrell, George, Forester's Lodge, Adare, Co. Limerick.
Farrelly, Joseph, Newcastle, Ballymahon, Co. Longford.
* *Fitzpatrick, Hugh M., Kendalstown Hill, Delgany, Co. Wicklow.*
Finnegan, Thomas, Gort, Co. Galway.
Flanagan, Michael C., Chair Hill, Bansha, Co. Tipperary.
* Flanagan, W. J., 29 Borris Road, Portlaoighise, Co. Leix.
h Forbes, A. C., Longleat, Killiney Road, Killiney, Co. Dublin.
a Galvin, James, Park Cottage, Wexford.
Gavigan, Hugh, C/o Mrs. Curtin, Henry Street, Kilrush, Co. Clare.
* Haas, George, Ard Aluinn, Rathdrum, Co. Wicklow.
Hackett, Patrick J., Dovehill, Birr, Co. Offaly.
a Hamilton, John S., Brownhall, Ballintra, Co. Donegal.
a Hamilton, Noel Carlton, Lareen, Kinlough, Co. Leitrim.
Hanahoe, Anthony J., Ballybofey, Co. Donegal.
Hannon, John, Cardiff, Kilconly, Tuam.
Harte, Patrick Joseph, Inistioge, Thomastown, Co. Kilkenny.
Hayes, Dennis Gerald, Shannonbridge, Ballinasloe, Co Galway.
Healy, Peter, C/o Miss Kiersey, Abbey Height, Carrickbeg, Carrick-on-Suir, Co. Waterford.
Hendry, James M., Tiglin, Ashford, Co. Wicklow.
a Henry, Mrs. Alice H., 21 Clyde Road, Dublin.
a Hood, Lt.-Col. Edward, Dromore Castle, Kenmare, Co. Kerry.
Hudner, Martin, Crow Hill, Cappoquin, Co. Waterford.
Kearney, James C., Belrock House, Avoca, Co. Wicklow.
Kelly, James C., Forest View, Cratloe, Co. Clare.
Kelly, Thomas, 43 Main Street, Gorey, Co. Wexford.
Kennedy, Garrett, Baunreagh, Mountrath, Co. Leix.
a Kenny, Martin, George, James St., Westport.
Kerrigan, Patrick J., Virginia, Co. Cavan.
a Langley, Henry R., Archerstown, Thurles, Co. Tipperary.
a Legg Bros. (Teresa Connolly), 10 Hill Street, Dublin.
* Leonard, Alfred, Ashford, Cong, Co. Mayo.
Madden, Patrick, Lurganboy, Manorhamilton, Co. Leitrim.
Madden, Thomas, Donadea, Co. Kildare.
a Magan, Lt.-Col. Arthur Tilson Shaen, Killyon Manor, Hill-of-Down.
* Maher, James J., C/o Mr. Shorten, Rathdrum, Co. Wicklow.
Mahon, Michael J., Woodford, Loughrea, Co. Galway.
* Mangan, Dermot P., "Graigue," Richmond Avenue, Milltown, Dublin
* Meldrum, John A. K., Ben Wyvis, 7 Lakelands Park, Terenure, Dublin
Moloney, Thomas, Ballyfarnon, Co. Roscommon.
* *Mooney, O. V., 88 Merrion Square, Dublin.*
Moore, Andrew J., The Demesne, Mount Bellew, Co. Galway.
Moore, Thomas H., 21 Stella Maris, Ballysodare, Sligo.
Morris, Niall, 161 Howth Road, Clontarf, Dublin.
Moynihan, Timothy, Kilcoran, Cahir, Co. Tipperary.
* *Muir, G., Clonad, Killurine, Tullamore, Co. Offaly.*
* Munnelly, Edward, Dunmore, Durrow, Co. Leix.
* *Murphy, F. J., Ballybofey, Co. Donegal.*
Murphy, Joseph, The Green, Stradbally, Leix.
MacCarthy, John, Bailieboro', Co. Cavan.
MacCarthy, Michael, Boolymore, Banteer, Co. Cork.
* *MacCarthy, Timothy H., Athy, Co. Kildare.*
a MacLoughlin, John F., Cloghan, Co. Donegal.
MacMenamin, Seamus, Rose Field Cottage, Pettigo, Co. Donegal.

McCarthy, Timothy, Cahergal, Burncourt, Cahir, Co. Tipperary.
* McCormack, Christopher H., Forestry Dept., Thomas St., Sligo.
* McCool, Gilbert, 72 Main Street, Mallow, Co. Cork.
* McEvoy, Timothy, Avondale, Rathdrum, Co. Wicklow.
a McGillicuddy, The, Beaufort, Co. Kerry.
* *McGlynn, D., Forestry Office, Annefield, Enniscorthy, Co. Wexford.*
McGuire, Daniel, Convent Road, Tullamore, Co. Offaly.
McMahon, Felix, Annagh Bay, Hazelwood, Sligo.
McNamara, Michael, Jenkinstown Park, Co. Kilkenny.
a McNeill, Norman, 21 St. Helen's Road, Booterstown, Dublin.
a McNeill, William Martin, University of Aberdeen, Old Aberdeen, Scotland.
a McPherson, Cameron, Shannon Hotel, Banagher.
a Nally, William Francis, 62 Merton Drive, Dublin.
* *O' Beirne, Michael, Avondale, Rathdrum, Co. Wicklow.*
a O'Boyle, James, Ton-Roe, Killala, Co. Mayo.
a O'Carroll, Rev. James, Hales Terrace, Kinsale, Co. Cork.
* O'Carroll, Joseph, Customs House, Galway.
* O'Carroll, Thomas, 2 Upper Mallow Street, Limerick.
a O'Connell, Thomas A., 89 Griffith Avenue, Dublin.
O'Donnell, John, Kilfinnane, Kilmallock, Co. Limerick.
O'Donoghue, J. P., C/o Mrs. Quinton, Church St., Athenry, Co. Galway.
O'Grady, Peter P., Mucklagh, Ballinglen, Co. Wicklow.
O h-Aragain, D., Kinnitty, Offaly.
* *O' Leary, John, Green Road, Portlaoighise, Laoighis.*
a O'Lundy, Art, Dunfanaghy, Co. Donegal.
O'Neill, Thomas, 73 McCurtain St., Fermoy, Co. Cork.
* O'Rourke, Edward C., Main Street, Newbridge, Co. Kildare.
O'Suilleabhain, D. S., West Street, Tallow, Co. Waterford.
* *O'Sullivan, S. M. Aberfoyle, Orwell Road, Rathgar, Dublin.*
a Perry, George V., Camden Row, Dublin.
* *Petrie, Stuart M., 58 St. Lawrence's Road, Clontarf, Dublin.*
* Prior, Thomas, Glasha Lodge, Kilsheelan, Co. Tipperary.
Quinn, Simon, Cong Sawmills, Cong, Co. Mayo.
* *Quirke, Denis A., Monard, Tipperary.*
a Robinson, George J., Estate Office, Cahir, Co. Tipperary.
a Ross, Andrew B., 80 St. Alban's Park, Ballsbridge, Dublin.
a Ross, John W., 3 Wilton Terrace, Dublin.
Rouine, J., Main Street, Graiguenamanagh, Co. Kilkenny.
Ryan, John Francis, Kilnacarrow, Killoe, Longford.
* Ryan, Patrick, 168 Kimmage Road West, Dublin.
a Salter, Rose Marie E., The Mall House, Castletownshend, Co. Cork.
a Scally, Gerald, Sth. Lotts Road, Ringsend.
a Schorman, Karl Louis, 88 Merrion Sq., Dublin.
Silke, Henry L., Ballygar, Roscommon.
Shorten, William, Glendalough, Co. Wicklow.
* *Swan, Maurice, Killakee, Rathfarnham, Co. Dublin.*
* *Swords, Michael, Killaodain, Adelaide Road, Glenageary, Co. Dublin.*
a Trench, Robert Power, Woodlawn House, Co. Galway.
a Twigg, R. H., Bank of Ireland, Dundalk, Co. Louth.
Verling, Patrick, 5 Brown Street, Portlaw, Co. Waterford.
a White, H. M., Holly Park, Craughwell, Galway.
White, James, Castlemorris, Knocktopher, Co. Kilkenny.

(The Secretary will be glad to have any corrections that may be necessary, especially in respect of change of address.)

LEINSTER LEADER, LTD., NAAS.