TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

LIEUT.-COLONEL F. BAILEY, F.R.S.E.,
HONORARY EDITOR.

ROBERT GALLOWAY, S.S.C.,
SECRETARY AND TREASURER.

VOL. XXIII.

EDINBURGH:
PRINTED FOR THE SOCIETY.
SOLD BY DOUGLAS & FOULIS, CASTLE STREET.
1910.

CONTENTS.

The Society does not hold itself responsible for the statements or views expressed by the authors of papers.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

VOL. XXIII.—PART I.

January 1910.

LIEUT.-COLONEL F. BAILEY, F.R.S.E.,
HONORARY EDITOR.

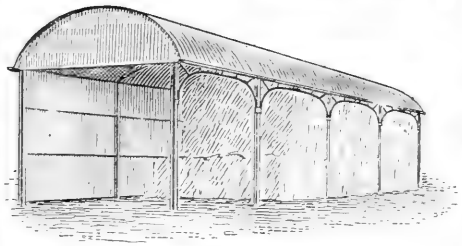
ROBERT GALLOWAY, S.S.C.,
SECRETARY AND TREASURER.

EDINBURGH:
PRINTED FOR THE SOCIETY.
SOLD BY DOUGLAS & FOULIS, CASTLE STREET.

Price to Non-Members, 3/-

A. & J. MAIN & Co., LTD.,

MANUFACTURERS OF
HAY & GRAIN SHEDS.

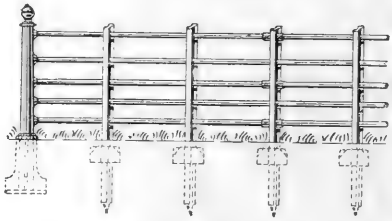


Design No. 661.

In this SHED the HAY or GRAIN can be stored to within a few inches of ROOF.

FOLD YARD COVERINGS,
STEEL AND IRON BUILDINGS,
of every description.

CONTINUOUS BAR FENCING,
IRON & WIRE FENCING,
WROUGHT IRON RAILINGS,
GATES, HURDLES,
PALE FENCING, TREE GUARDS,
Etc., Etc.



Roofing and Fencing Catalogues
on Application.

GALVANIZED WIRE NETTING & FENCING WIRE
at Lowest Prices.

SPECIAL QUOTATIONS ON APPLICATION.

CLYDESDALE IRON WORKS,
POSSILPARK, GLASGOW.

49 CANNON STREET, LONDON, E.C.

CORN EXCHANGE BUILDINGS, EDINBURGH.

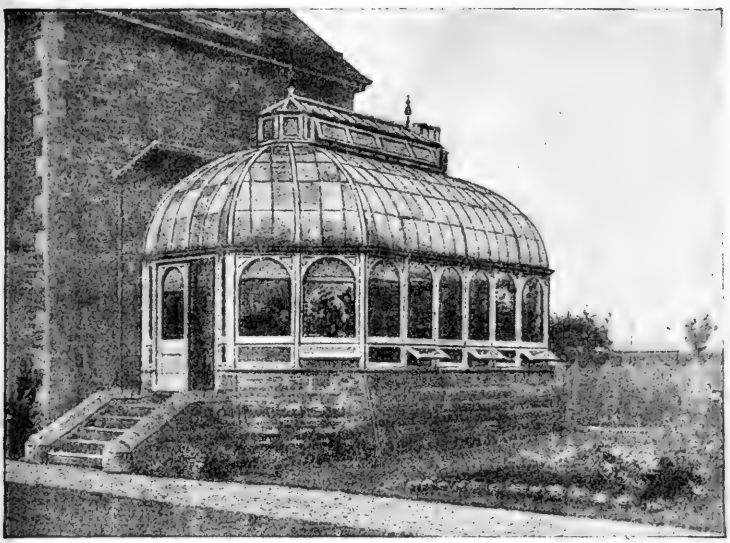
By Special Appointment to His Majesty the King.

Telegrams:—"Hothouse," Edinburgh. "Iron," Edinburgh. "Treibhaus," London.
Telephone Nos.:—Edinburgh, Central, 2674; Do., 2675; Do. (Foundry), 4665.
Glasgow, Argyle, 2336 (National); London, 2117 P.O. Hampstead.

MACKENZIE & MONCUR,

HOTHOUSE BUILDERS, LTD.

Heating, Ventilating, and Electrical Engineers, and Iron Founders.



Erected at Herman Lodge, Broughty Ferry.

HOTHOUSE BUILDING.—Hothouses of every description designed and erected in any part of the country, with improved Ventilation Gearing, Staging, and Heating Apparatus complete.

HEATING.—Churches, Public Buildings of all kinds, Schools, Mansions, Villas, &c., heated efficiently by Low Pressure, Hot Water, or by Steam. Also by "Barker's" Cable System of Hot Water Low Pressure Heating, with small bore pipes and no sunk stoke-holes.

LIGHTING.—Complete Installations for Lighting by Electricity fitted up in any part of the country. Petrol Gas Lighting Apparatus fitted up complete on approved lines.

FOUNDRY.—Architectural Ironwork of all kinds, Stable Fittings, Sanitary Castings, Manhole Covers, Ventilators, Gratings, &c.

PLANS AND ESTIMATES ON APPLICATION.

EDINBURGH— { Registered Office and Works, Balcarres Street.
Foundry, ... Slateford Road.

GLASGOW—121 St Vincent Street. LONDON—8 Camden Road, N.W.

By Royal Warrant.

FIRST-CLASS
GOLD
MEDAL

International Forestry Exhibition, Edinburgh, 1884.

THOMAS METHVEN & SONS,

Nurserymen, Seedsmen, & Florists

TO HIS MAJESTY THE KING,

INVITE the attention of intending Planters to their large Stock of Seedling and Transplanted **Forest and other Trees and Shrubs.** They are this season in a healthy and vigorous condition, and well suited for successful transplanting.

Evergreen and Deciduous Shrubs.
Shrubs for Game Covert, and Underwood.
Trees and Shrubs for Sea-Side Planting.
Thorn and other Hedge Plants.

SPECIMEN ORNAMENTAL TREES FOR LAWNS & AVENUES.

RHODODENDRONS—all the Best Varieties.
FRUIT TREES of the Best Kinds. - - -
ROSES—all sorts worthy of cultivation. - -

Samples on Application. *Special Prices for Large Quantities.*

THOMAS METHVEN & SONS undertake **Landscape Gardening and Forest and Covert Planting** of every description in any part of the Kingdom, also the **Laying Out of Parks, Gardens, etc.**

Plans, Estimates, and Specifications will be forwarded on Application.

Seed Warehouses: 15 PRINCES STREET & LEITH WALK.

Nurseries:

LEITH WALK, WARRISTON, INVERLEITH, and BANGHOLM.

EDINBURGH.

Membership.

THE Roll contains the names of over 1300 Members, comprising Landowners, Factors, Foresters, Nurserymen, Gardeners, Land Stewards, Wood Merchants, and others interested in Forestry, many of whom reside in England, Ireland, the British Colonies, and India.

Members are elected by the Council. The Terms of Subscription will be found on the back of the Form of Proposal for Membership which accompanies this Memorandum.

The Principal Objects of the Society,

and the nature of its work, will be gathered from the following paragraphs:—

Meetings.

The Society holds periodical Meetings for the transaction of business, the reading and discussion of Papers, the exhibition of new Inventions, specimens of Forest Products and other articles of special interest to the Members, and for the advancement of Forestry in all its branches. Meetings of the Council are held every alternate month, and at other times when business requires attention; and Committees of the Council meet frequently to arrange and carry out the work of the Society.

Prizes and Medals.

With the view of encouraging young Foresters to study, and to train themselves in habits of careful and accurate observation, the Society offers Annual Prizes and Medals for essays on practical subjects, and for inventions connected with appliances used in Forestry. Such awards have been granted continuously since 1855 up to the present time, and have yielded satisfactory results. Medals and Prizes are also awarded in connection with the Exhibitions aftermentioned.

School of Forestry, Afforestation, Etc.

Being convinced of the necessity for bringing within the reach of young Foresters, and others interested in the Profession, a regular systematic course of Instruction, such as is provided in Germany, France, and other European countries, the Society, in 1882, strongly urged the creation of a British School of Forestry; and with a view of stimulating public interest in the matter, a Forestry Exhibition, chiefly organised by the Council, was held in Edinburgh in 1884.

As a further step towards the end in view, the Society, in 1890, instituted a Fund for the purpose of establishing a Chair of Forestry at the University of Edinburgh, and a sum of £584, 3s. 10d. has since been raised by the Society and handed over to the University. Aided by an annual subsidy from the Board of Agriculture, which the Society was mainly instrumental in obtaining, a Course of Lectures at the University has been delivered without interruption since 1889. It is recognised, however, that a School of Forestry is incomplete without a practical training-ground attached to it, which would be available, not only

for purposes of instruction but also as a Station for Research and Experiment, and as a Model Forest, by which Landowners and Foresters throughout the country might benefit. The Society has accordingly drawn up a Scheme for the Establishment of a State Model or Demonstration Forest for Scotland which might serve the above-named objects. Copies of this Scheme were laid before the Departmental Committee on British Forestry, and in their Report the Committee have recommended the establishment of a Demonstration Area and the provision of other educational facilities in Scotland.

The Government has recently acquired the Estate of Inverliever in Argyllshire; and this, it is hoped, may prove to be the first step in a scheme of afforestation by the State of unwooded lands in Scotland. The Society has submitted to the Government Resolutions urging the further provision of more accessibly situated tracts carrying a fair proportion of growing woods, which may fulfil the objects for which State Demonstration Forests have so long been needed. Meantime Mr Munro Ferguson, M.P., for a part of whose woods at Raith a Working-Plan has been prepared, and is now in operation, has very kindly agreed to allow Students to visit them.

The Society's Resolutions also ask for Example Plots or Forest Gardens in connection with the various centres of Forestry instruction and other educational facilities, and further, recommends that a Board of Forestry should be established to foster and promote State and Private Afforestation in the country, with special power to survey and indicate all land suitable for afforestation, and should be provided with sufficient funds to carry on its work efficiently.

Excursions.

During the past thirty-one years, well-organised Excursions, numerously attended by Members of the Society, have been made annually to various parts of Scotland, England, and Ireland. In 1895 a Tour extending over twelve days was made through the Forests of Northern Germany, in 1902 a Tour extending over seventeen days was made in Sweden, during the summer of 1904 the Forest School at Nancy and Forests in the north of France were visited, and during the past summer a visit was undertaken to the Bavarian Forests. These Excursions enable Members whose occupations necessarily confine them chiefly to a single locality to study the conditions and methods prevailing elsewhere; and the Council propose to extend the Tours during the next few years to other parts of the Continent. They venture to express the hope that Landowners may be induced to afford facilities to their Foresters for participation in these Tours, the instructive nature of which renders them well worth the moderate expenditure of time and money that they involve.

Exhibitions.

A Forestry Exhibition is annually organised in connection with the Highland and Agricultural Society's Show, in which are exhibited

specimens illustrating the rate of growth of trees, different kinds of wood, pit-wood and railway timber, insect pests and samples of the damage done by them, tools and implements, manufactured articles peculiar to the district where the Exhibition is held, and other objects of interest relating to Forestry. Prizes and Medals are also offered for Special Exhibits. In addition to the Annual Exhibition before referred to, a large and important Forestry Section organised by this Society was included in the Scottish National Exhibition which was held in Edinburgh in 1908.

The Society's *Transactions*.

The *Transactions* of the Society, which extend to twenty-two volumes, are now published half-yearly in January and July, and are issued *gratis* to Members. A large number of the Prize Essays and other valuable Papers, and reports of the Annual Excursions, have appeared in them, and have thus become available to Students as well as to those actively engaged in the Profession of Forestry.

Honorary Consulting Officials.

Members have the privilege of obtaining information gratuitously upon subjects connected with Forestry from the following Honorary Officials appointed by the Society.

Consulting Botanist.—ISAAC BAYLEY BALFOUR, LL.D., M.D., Sc.D., Professor of Botany, Royal Botanic Garden, Edinburgh.

Consulting Chemist.—ALEXANDER LAUDER, D.Sc., 13 George Square, Edinburgh.

Consulting Cryptogamist.—A. W. BORTHWICK, D.Sc., Royal Botanic Garden, Edinburgh.

Consulting Entomologist.—ROBERT STEWART MACDOUGALL, M.A., D.Sc., Professor of Entomology, etc., 13 Archibald Place, Edinburgh.

Consulting Geologist.—R. CAMPBELL, M.A., B.Sc., Geological Laboratory, University of Edinburgh.

Consulting Meteorologist.—ANDREW WATT, M.A., F.R.S.E., Secretary Scottish Meteorological Society, 122 George Street, Edinburgh.

Local Branches.

The Society, at a recent Meeting, approved of the formation of Local Branches in suitable districts, and Local Branches have now been established in Aberdeen and Inverness for the convenience of Members who reside in the districts surrounding these centres.

Local Secretaries.

The Society is represented throughout Scotland, England, and Ireland by the Local Secretaries whose names are given below. They are ready to afford any additional information that may be desired regarding the Conditions of Membership and the work of the Society.

Register of Estate Men.

A Register of men qualified in Forestry and in Forest and Estate Management is kept by the Society. Schedules of application and other particulars may be obtained from the Local Secretaries in the various districts, or direct from the Secretary. It is hoped that Proprietors and others requiring Estate men will avail themselves of the Society's Register.

LOCAL SECRETARIES.

Scotland.

Counties.	
Aberdeen,	JOHN CLARK, Forester, Haddo House, Aberdeen.
	JOHN MICHIE, M.V.O., Factor, Balmoral, Ballater.
Argyle,	JOHN D. SUTHERLAND, Estate Agent, Oban.
Ayr,	ANDREW D. PAGE, Overseer, Culzean Home Farm, Ayr.
	A. B. ROBERTSON, Forester, The Dean, Kilmarnock.
Berwick,	WM. MILNE, Foulden Newton, Berwick-on-Tweed.
Bute,	WM. INGLIS, Forester, Cladoch, Brodick.
	JAMES KAY, Forester, Bute Estate, Rothesay.
Clackmannan,	ROBERT FORBES, Estate Office, Kennet, Alloa.
Dumbarton,	ROBERT BROWN, Forester, Boiden, Luss.
Dumfries,	D. CRABBE, Forester, Byreburnfoot, Canonbie.
East Lothian,	W. S. CURR, Factor, Ninewar, Prestonkirk.
Fife,	WM. GILCHRIST, Forester, Nursery Cottage, Mount Melville, St Andrews.
	EDMUND SANG, Nurseryman, Kirkcaldy.
Forfar,	JAMES CRABBE, Forester, Glamis.
	JAMES ROBERTSON, Forester, Barnhill, Broughty Ferry.
Inverness,	JAMES A. GOSSIP, Nurseryman, Inverness.
Kincardine,	JOHN HART, Estates Office, Cowie, Stonehaven.
Kinross,	JAMES TERRIS, Factor, Dullomuir, Blairadam.
Lanark,	JOHN DAVIDSON, Forester, Dalzell, Motherwell.
	JAMES WHITTON, Superintendent of Parks, City Chambers, Glasgow.
Moray,	D. SCOTT, Forester, Darnaway Castle, Forres.
Perth,	JOHN SCRIMGEOUR, Doune Lodge, Doune.
Renfrew,	S. MACBEAN, Overseer, Erskine, Glasgow.
Ross,	JOHN J. R. MEIKLEJOHN, Factor, Novar, Evanton.
	Miss AMY FRANCES YULE, Tarradale House, Muir of Ord.
Roxburgh,	JOHN LEISHMAN, Manager, Cavers Estate, Hawick.
	R. V. MATHER, Nurseryman, Kelso.
Sutherland,	DONALD ROBERTSON, Forester, Dunrobin, Golspie.
Wigtown,	JAMES HOGARTH, Forester, Culhorn, Stranraer.
	H. H. WALKER, Monreith Estate Office, Whauphill.

CONDITIONS OF MEMBERSHIP (excerpted from the Laws).

III. Any person interested in Forestry, and desirous of promoting the objects of the Society, is eligible for election as an *Ordinary* Member in one of the following Classes:—

1. Proprietors the valuation of whose land *exceeds* £500 per annum, and others, subscribing annually . . One Guinea.
2. Proprietors the valuation of whose land *does not exceed* £500 per annum, Factors, Nurserymen, Timber Merchants, and others, subscribing annually . . Half-a-Guinea.
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, subscribing annually . . . Six Shillings.
4. Assistant-Foresters, Assistant-Gardeners, and others, subscribing annually . . . . . Four Shillings.

IV. **Subscriptions are due on the 1st of January in each year, and shall be payable in advance. A new Member's Subscription is due on the day of election unless otherwise provided, and he shall not be enrolled until he has paid his first Subscription.**

V. Members in arrear shall not receive the *Transactions*, and shall not be entitled to vote at any of the meetings of the Society. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.

VI. Any eligible person may become a *Life* Member of the Society, on payment, according to class, of the following sums:—

1. Large Proprietors of land, and others, . . . £10 10 0
2. Small Proprietors, Factors, Nurserymen, Timber Merchants, and others, ... 5 5 0
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, ... 3 3 0

VII. Any *Ordinary* Member of Classes 1, 2, and 3, who has paid *Five* Annual Subscriptions, may become a *Life* Member on payment of *Two-thirds* of the sum payable by a *new* Life Member.

XII. Every Proposal for Membership shall be made in writing, and shall be signed by two Members of the Society as Proposer and Seconder, and delivered to the Secretary to be laid before the Council, which shall accept or otherwise deal with each Proposal as it may deem best in the interest of the Society. The Proposer and Seconder shall be responsible for payment of the new Member's first Subscription. The Council shall have power to decide the Class under which any Candidate for Membership shall be placed.

CONTENTS.

The Society does not hold itself responsible for the statements or views expressed by the authors of papers.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY

1. The Duty of the State as regards Afforestation.

By A Correspondent.

The last issue of the *Transactions* contained a remarkable collection of opinions on the duty of the State in relation to silviculture. The opinions expressed were not those of only one class of silviculturists, but included contributions from scientists, landowners, and practical foresters—all of them men of prominence in their class; and what was specially noticeable was the large degree of unanimity, even in matters of detail, which the articles and speeches published disclosed. Along with the articles we had reproduced, very properly, the views of the Chancellor of the Exchequer and of the deputation he met.

It seems well worth while to attempt to summarise the opinions expressed on the subject of what the State can do to assist in developing silviculture in this country. That the State should so assist, and indeed that no substantial progress can be made without State assistance, all appear to heartily agree. But the question of interest is what form such State assistance should take.

In the *first* place, it is the opinion of all the contributors that we have a large extent of land well suited for planting, which is at present devoted to less useful purposes, and several of the articles propose that the State should at once proceed to select and survey this suitable land, so that we may know to begin with exactly what material we have to work upon for planting.

In the *second* place, there appears to be general agreement that in this country we are a long way behind other countries in knowledge and in opportunity to acquire knowledge, and that it is a pressing duty on the State to provide the means of teaching and training a sufficient body of practical foresters to carry out efficiently the work of afforesting the land we have which is suited to that purpose.

In the *third* place, all admit that private owners cannot finance any extensive scheme of afforestation. It is only the State that can afford to lie out of the large sums of money necessary for the many years that must elapse before a return can be obtained, and can ensure meantime that continuity of good management which is so essential. Three methods of State finance are proposed—(1) Government purchase, compulsorily or by agreement, of land suitable for planting; (2) Loans to private owners at low interest; and (3) Co-operation with private owners by the State providing the Capital required for planting privately-owned land, the profits to be divided proportionately to the money and the value of the land provided. While some of the articles under review express dislike of large land purchases by the State, others express doubt as to any extensive system of joint management, but there seems pretty general agreement that in varying circumstances all three systems might be applied, and that any system of State finance must involve a large measure of State control.

In the *fourth* place, it is taken to be essential that some expert Committee or Board of Forestry be established to enable the above purposes to be carried out with success.

While of course it would be neither to be expected nor desired that complete unanimity should exist as to the best methods to be adopted in all circumstances so as to further silvicultural development in these islands, it is significant and encouraging that so much agreement exists as to the methods which may be followed, and this seems to indicate that conditions are now ripe for State assistance on definite lines. On this view the Government's Development Bill may afford a basis on which to proceed. It seems no disadvantage at this preliminary stage that the Bill does not attempt to define in detail the methods to be followed, but rather contemplates a gradual growth of ideas so that progress may be made and assistance given in whatever direction experience points to as most promising. If this policy is adhered to it will leave open to such societies as ours the opportunity of constantly assisting by advice and suggestion in the working out of the National scheme of which we hope a commencement is now to be made.

In several of the articles in the last issue reference is made to the effects of the death duties in checking silvicultural progress, and in present conditions there is no doubt that the

death duties often result in the destruction of silvicultural schemes. It is worth pointing out, however, that if such a system of co-operation were adopted as was sketched in the article contributed by the present writer in the July issue of 1908, and which is ably developed in the article contributed in the last issue of the *Transactions* by Lord Lovat, death duties would cease to affect the problem. Under such a scheme the successor's interest on death would become what is known in the Death Duties Acts as an "Interest in expectancy," and accordingly no duty could be claimed till the timber was realised.[1] This of itself affords a strong inducement to private owners to adopt such a system of forestry finance, provided the State will assist in the way proposed.

2. Afforestation and Local Taxation.

By Sir Kenneth Mackenzie, Bart.

Nothing very definite seems to have been stated as to the effect a National Scheme of Afforestation would have upon the incidence of local taxation. Little is said in the Report of the Select Committee of the House of Commons, which sat in 1885-87, as to the effect of rates, though it is mentioned that in America all land planted is exempted from taxation and a bounty is offered for planting. The Departmental Committee sat in 1902, and had evidence as to the incidence of local taxation from Mr Maxwell of the Local Government Board; but this particular detail as affecting the question of afforestation is scarcely noticed in the Report, and the Committee were "not prepared to make any recommendation on the subject." Clearly the question of local rates affects the initial cost of a plantation and its maintenance for a considerable period, and it is a consideration which warrants careful investigation from the tax payer's point of view. It seemed, therefore, desirable to make some inquiry as to how afforestation on a national scale would affect those parts of the West Highlands with which I am well acquainted, as it is probably in those districts that land can be obtained most economically for a national scheme. Possibly the general result of such an inquiry is more or less applicable

[1] Since the above was written effect has been given to this principle in the Budget Bill, much to the satisfaction of silviculturists.

to other areas in Scotland which are capable of being similarly treated, and it may be of interest to others.

Rates in Scotland are imposed under the County Authority (*i.e.*, for police, roads, public health, etc.) on the gross rental as it appears in the Valuation Roll; and under the Parish Authority (*i.e.*, for poor, school, registration, burial ground, etc.) on the so-called "annual value." "Annual value" is arrived at either by a system of deductions from the gross value of the various kinds of property, or by classification of those different kinds of property. So far as the present subject is concerned, this is rather a matter of detail, but parochial rates fall half and half on owner and occupier, and certain of the county rates are only charged on owners, in the proportion approximately of 11–8 on owner and occupier, as regards the county rates in the districts I have examined. The occupiers of agricultural subjects, which are marked (*a*) in the Valuation Roll, are only rated on three-eighths of their value by both rating authorities—but plantations do not come under this heading—and they are taxed on what the assessor chooses to fix as the grazing value of the land they occupy.

The assessable valuation of a typical West Highland parish is made up from the following main sources, the actual values being extracted from the Valuation Roll:—

(*a*) Houses, Shops, etc.,	£728
(*b*) Hotels and Inns,	1351
(*c*) Crofts and Land in Crofters' Occupation,	1790
(*d*) Glebes, Churches, Mission Halls, etc.,	98
(*e*) Plantations,	40
(*f*) Sheep Farms,	1395
(*g*) Shootings and Deer Forests,	5000
(*h*) Fishings,	1050
Total Valuation,	£11,452

Thanks to the courtesy of the county and parish collector I have ascertained that the average rates for the past three years have been:—

	Owner.	Occupier.
Parish Rates,	27·83d.	28·3d.
County Rates,	11·5	8·5
A total of	39·33d.	36·8d. per annum

in the pound on a Valuation of £11,452.

As all the land occupied by crofters is by statute earmarked for their occupation in perpetuity, the only lands left capable of afforestation must be taken from subjects *f* and *g*. Sheep farms and deer forests are usually composed of both high and low ground, the latter being necessary for wintering purposes, and unfortunately the low ground is much smaller in area than the high ground.

I think one may fairly take the area below the 800 feet contour line as less than one-fourth of the total area in such districts under sheep and deer—so that if there are 120,000 acres occupied by them at present, the practical planting area will not exceed 30,000 acres, from which a very considerable deduction will have to be made to allow for lochs, burns, bogs, peat mosses, and rocky bits which are of no value for either wintering or afforestation.

If these portions are eliminated, the area capable of afforestation will be reduced by about one-fifth, but possibly 25,000 acres might be found capable of being planted.

Suppose the whole of this area were taken for afforestation it would mean that no wintering would be left for the sheep and very little for the deer. The sheep grounds would become valueless, as they could only be used for summer grazing; the grouse-shooting rents would practically disappear, and the rents from the deer forest areas would be very greatly reduced—at any rate for some fifteen or twenty years till the plantations grew up sufficiently to admit of deer being allowed into them for wintering. Now how would this work out?—the substitution of plantings for sheep would entail firstly, the removal of the twenty-two sheep farmers, their families and shepherds, who are presently in possession. Of the eight shootings four are grouse moors, these would disappear together with the lodges, gardens, keepers and under-keepers, which they presently maintain. The four remaining shootings, which are partially grouse but mainly deer forest, would remain, but with no grouse ground and a very reduced number of deer. This would mean a further reduction in gamekeepers, and also a very reduced rental. I calculate that if all the 25,000 acres were taken for afforestation, it would mean the abolition of the whole of the sheep farm rental and a reduction by about four-fifths of the shooting rental. That means £1395 + £4000 = £5395 out of a total rental of £11,450. Presumably the 25,000 acres would be rated at a prairie value of

1s. per acre = £1250, so that the assessable value of the parish would be reduced by the sum of £4145. As on the present valuation of £11,450 it takes a rate of 3s. 3d. on owners and 3s. on occupiers to produce the amount necessary to maintain the poor, the schools, the roads, etc., it is easy to calculate how greatly the rate would have to be increased if the valuation were to be reduced to £7305; and as the outlay on these local requirements is an ever-increasing quantity, one realises what a heavy burden on the crofters, shopkeepers, and householders such an experiment would entail.

It seems to me that it would be more profitable to the community if owners of estates could be encouraged to plant areas in different places, which, under estate management, could be done without disturbing existing sources of valuation to any appreciable extent, rather than to endeavour to afforest in big blocks under a national scheme.

There is a premium offered at present against planting—as long as an owner occupies his land with sheep he only pays rates on three-eighths of its valuation. If he fences and plants it, he has to pay rates on the full value appearing in the Valuation Roll.

In addition to the rating question as affecting the local ratepayer, the further point arises as to whether the afforestation of the whole area would provide employment for a greater population than it does under its present conditions, when one thinks of those who would disappear—sheep farmers, shepherds, gamekeepers, ghillies, gardeners, caretakers, considered along with the greatly reduced employment given to carpenters, slaters, masons, painters, plumbers, and all such tradesmen, in maintaining the buildings, water supplies, paths, etc., inseparable from shootings and sheep farms. Eventually no doubt it would, but I fear not in the time of the present generation.

These remarks do not apply to a parish where the *whole* area is capable of afforestation, and of course the reduction in the assessable value of a parish which I have brought out above is not a reduction which would occur all at once. The whole area could only be planted gradually: and if the planting was done very gradually it might be possible to open up some of the planted ground to deer and sheep before the whole of the wintering ground had been planted, and so to provide them with shelter. This, however, could not be earlier than fifteen years

under the most favourable circumstances for the growth of timber, and might easily be very much longer.

Let it not be thought that I am opposed to afforestation either by the State or by the individual, as that is not so. My object is to show that in either case there are many and diverse interests which should be very carefully considered and safeguarded before it can be adopted.

[The Hon. Ed. hopes to secure the further discussion, in the next issue, of this question.]

3. The Sitka Spruce as a Tree for Hill Planting and General Afforestation.

(*With Plate.*)

By JOHN D. CROZIER.

Amongst the many species of coniferous trees of economic importance introduced into Britain from Western North America, and now to be found distributed over the country of an age and in numbers sufficient to test their value for afforestation purposes, none seem capable of producing a growth of timber, on high elevations and moisture-holding soils, equal in volume and value to that of the Sitka spruce or Menzies fir (*Picea sitchensis*), or as the tree is locally named, the Tideland spruce.

It is indigenous to the tract of country lying between the western slope of the Coast Ranges and the Pacific coast, where the climate closely resembles that of the western shores of Great Britain and Ireland generally, while its altitudinal range seems to be governed more by its demands on moisture of soil and atmosphere than by the depth or quality of soil, or by temperature. Its range, occurrence, and demands on climate are stated in a silvicultural study of the Sitka spruce, by Mr Giffard Pinchot, chief of the United States Forest Service, to be as follows:— "Sitka spruce occurs in the forests of the Pacific Coast from Caspar, Mendocino, County Cal., northward through Oregon, Washington, and Alaska to the base of the Alaska Peninsula. It confines itself chiefly to the vicinity of the coast, and in its entire range of over 1300 miles from California to Alaska extends nowhere far inland. Where it

extends inland at all, it does so only along arms of the ocean, and along the courses of streams. In Alaska it extends farther north and west than any other Pacific coast forest tree.

"Sitka spruce occurs generally in moist situations along the coast, on alluvial and sandy bottom-land, along the courses of streams, and also on moist slopes facing the sea. In parts of British Columbia, Alaska, and the islands along the coast, Sitka spruce thrives on very thin and light soils, where there is an abundance of atmospheric and soil moisture. It follows the moist soils in its extension eastward, and on the mountain slopes. For its best development it requires constant soil moisture, humid air and good soil. In situations deficient in moisture the Sitka spruce is more or less stunted, and the quantity and quality of soil becomes more important as the moisture supply decreases. It can endure inundation along the flood plains of the coast, but generally grows a short distance from the water's edge, to avoid too wet situations."

These then are the conclusions with regard to the demands of the Sitka spruce on site and soil arrived at by the United States Forest Service, as the result of a prolonged study of its habit in its natural state; and if these conclusions be added to the experience gained in this country of the tree in a cultivated state, a sufficiently reliable estimate of its physical requirements may be formed to guide us in the selection of sites and soils most favourable to its growth. That ample moisture, both soil and atmospheric, is essential to its well-being in the British Isles has already been abundantly proved, and hence we find the largest and most vigorous trees of the species in the humid climate of the Scottish Highlands, in the west coast of England and Wales, and in Ireland, where the climate generally seems favourable, and where also the largest trees are to be found.

The lowlands of the south of Scotland, and the midland and eastern countries of England generally, are not so suitable for the growth of Sitka spruce, owing no doubt to the dryness of the atmosphere, and it is also a noticeable fact that height-growth is much slower on open plains than on the lower slopes and valleys of a hill country; it is only when planted on the latter positions that full advantage of its inherent tendency to produce rapid and sustained upward growth can possibly be taken.

On low elevations and moist soils, a rainfall of from 30 to 53

inches seems sufficient to meet the requirements of the tree; but on such soils as generally occur at high elevations on our moorlands and mountain slopes, a rainfall similar to that of Argyllshire and the west coast generally (80 to 100 inches), will, I believe, be required for its best development. My own experience leads me to believe that little danger is to be feared from excess of moisture, provided it be not stagnant; and also that an amount which, under ordinary conditions, would prove fatal to the Norway spruce, would not appreciably affect the Sitka spruce.

It is a matter of regret that, while Sitka spruce has, for a period of nearly eighty years, been known and appreciated in pineta and pleasure grounds, on account of its ornamental value, so little has been done, in a practical way, to ascertain its commercial value; but probably, as in the case of the Douglas fir, a prejudice, based on insufficient knowledge of the real value of its timber, may have accounted for the lack of interest shown in the tree. No doubt such specimens of timber as had from time to time become available, had usually been the product of specimen trees grown purely for ornamental purposes, and valued in accordance with the depth and spread of their crowns; from such trees the lowest grade of timber only could possibly be produced. The fact, however, should be borne in mind that silver fir, spruce, or larch, planted and cultivated under similar conditions, would yield timber only slightly inferior in density to that of these quicker-growing exotics. Yet no one would be likely to contend that an annual ring of timber, of threequarters of an inch or over in width, represented a fair sample of average density of any of those species. It should hardly be necessary, at this date, to point out that quality of timber, at least as far as closeness of grain and freedom from knots are concerned, is purely a matter of control, and may be heightened or lowered in degree just as the method of management in the forest is of an approved order or the reverse; with coniferæ generally, the more rapid the growth the greater the need proportionately for high density of stock. Sitka spruce responds readily to cultural management, and while in isolation the trees usually carry the maximum proportion of branch to bole, in close canopy stem-cleaning can be brought about by the minimum of side shade.

Amongst the earlier experiments in planting Sitka spruce out

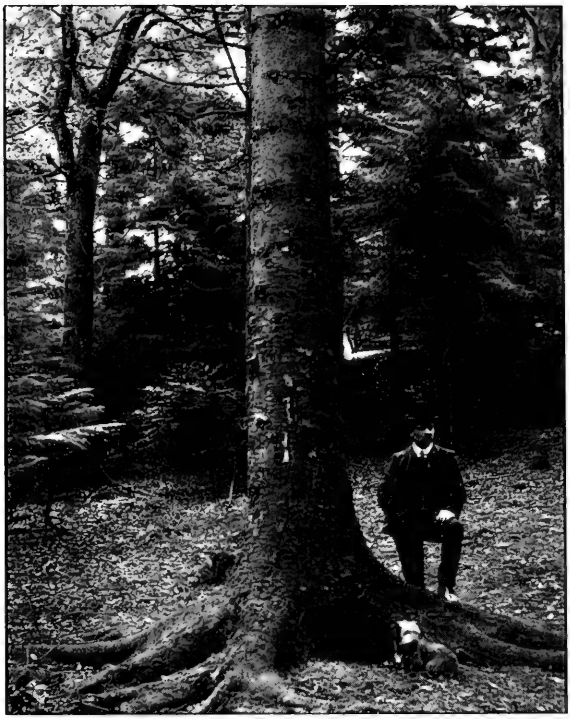
in the woodlands as a commercial tree, probably those begun on the estate of Durris, the property of Henry Robert Baird, Esq., about sixty years ago, are amongst the most noteworthy, and are valuable as a test of its utility for general forest planting; and if the results obtained can be regarded as what would be the outcome generally of planting on similar sites and soils, there can be little doubt regarding the capability of the Sitka spruce as a revenue-producing species over the greater part of the plantable area of this country. Of the earlier planted trees, many have now reached considerable dimensions, stems of upwards of 90 feet in height, with a girth of 6 to 9 feet, and having their branches shed to a height of 30 feet, being of frequent occurrence. In youth the Sitka spruce is liable to develop strongly buttressed roots and a somewhat tapering stem, especially on shallow soils; but with the rising crown of approaching maturity, the upper part of the bole swells out, and the result is a well-balanced column, yielding in the process of conversion the maximum proportion of sawn timber.

The timber, of which an increasing volume is becoming available on the estate for manufacture, is light, straight-grained, satiny in appearance, and easily dressed. The sapwood is white and the heart-wood a light red, a feature peculiarly its own, as none of the other spruces in cultivation exhibit any difference in colour betwixt heart and sapwood, but are white throughout. The medullary rays, as in the case of Douglas fir timber, show prominently, and impart a lustre to the finished article which makes the timber especially suitable for interiors. It is not liable to warp, is susceptible of a beautiful polish, and when varnished mellows down, in time, to a rich yellow brown. For structural timbers, such as beams and joisting, where length and straightness of bole are necessary features, in order to obviate great waste of material in manufacture, the Sitka spruce will probably find one of its principal uses. Otherwise, it may be used for any purpose for which Continental whitewood is suitable, and locally, as thinnings of pole and spar sizes, it has been found suitable for manufacture into curing-barrel staves, dry-goods boxes, etc. On the Pacific coast, the Sitka spruce is regarded as the largest, as it is also the most important, of all the spruces, and is of great commercial value. Its timber is used for a multiplicity of purposes, including structural work of all kinds, interior finishing, boat-building, cooperage and

packing-cases, and it is now also becoming largely used for wood-pulp. Its applicability for this purpose alone is of great value, as, grown in this country specially with a view to the production of pulp, it would, I have good reason to believe, produce more than double the volume of any other tree suitable for the purpose; while as thinnings from growing plantations also, a considerable volume of suitable material could be reckoned upon. As a tree for hill planting, Sitka spruce has proved here its superiority over larch, Scots pine, and Norway spruce in a marked degree, its power of resistance against winds and its general reliability on exposed sites far surpassing those of any of those species. On Strathgyle, the eastmost projection of the Grampian Range, rising to about the 1000 feet contour line, an extensive area of poor heath-clad land was planted, thirty-one years ago, with a mixture of Norway spruce, Scots pine, larch, and Sitka spruce. The soil, subsoil, and geological formation are those common to the Grampians generally, viz., peaty soil mixed with grit, boulder clay, and gneiss, with an occasional outcrop of granite. The exposure is from north-west round to south-east, and, in the higher elevations, the conditions are particularly unfavourable. The north side of the hill is open to both the north and the west winds, while the east and south-east sides are exposed to the cold east winds off the German Ocean, which is about six miles distant. The planting was carried up to within about a hundred and fifty feet of the crest, and as a sufficient period has now elapsed to make possible a comparison of the relative hardiness of the different species, it is important to note the result. The larch and Scots pine at the higher elevations proved an entire failure, the crop over a considerable part of the area having developed into stunted lichen-covered scrub. The Norway spruce, although slow in growth, forms a more hopeful crop, and may be expected to grow in time to a useful timber size. But the Sitka spruce, even at the highest elevation, has withstood the blast, and indicates that on exposed moisture-holding soils, and sites, such as are common to the highlands of Scotland generally, the altitudinal line for economic planting may be raised to a higher level than has hitherto been possible by the planting of any other tree. On lower elevations and on better class soils, where the species generally has shown a disposition to grow, the Norway spruce has again taken the lead over Scots pine and

larch; but where the Sitka spruce had been mixed in the proportion of about a thousand plants to the acre the spruce in turn had mostly been suppressed by it before the seventeenth or eighteenth year after date of planting. At an altitude of about 750 to 800 feet, where the best soils occur, the Sitka spruce has now reached an average height of from 46 to 50 feet, with an average diameter at breast-height of 8½ inches, while a proportion of the larger stems contain from 15 to 16 cubic feet. The average cubical content, arrived at by the measurement of all the stems standing on an area of half an acre of average growth, proved to be 6½ cubic feet. Against those averages it may be pointed out that the tallest Norway spruces in the whole plantation do not exceed 35 feet in height, nor do they reach the average diameter of the Sitka spruce, while their average size, even in the very best parts, is merely that of small poles (see Plate I.).

Owing to the irregular way in which the trees stand on the ground, they are, as may be seen from the above measurements, also somewhat irregular in size, and as they stand with too much head room, they have developed unduly spreading crowns. They have, however, divested themselves of the suppressed branches on the lower part of the stem to a much greater extent than the more shade-enduring Norway spruces have done under similarly dense conditions of crop. As the result of carefully selecting and measuring a number of trees, typical in form, and each standing on an area of thirty-six square feet (which gives 1210 trees to the acre, a normal density for Sitka spruce up to the fortieth year), I have good reason to believe that, on suitable soils and with a full stand of trees on the ground, a volume of 6000 cubic feet per acre is well within the possible timber-production of this tree at thirty-one years after date of planting; and that by the time the fifty-fifth year has been reached, this volume will have increased to 10,000 cubic feet, representing a money value, at the rate of 6d. per cubic foot, of £250 per acre. If judged by the rate of growth of Norway spruce, this volume may appear well nigh unattainable; but the fact must be remembered that for Sitka spruce, as for Douglas fir, no yield-statistics have as yet been compiled, and tables dealing with the ordinary commercial forest trees are valueless as an index of what either of those trees are capable of producing under cultivation. But while Douglas fir would give generally



A TYPICAL STEM AND ROOT OF SITKA SPRUCE ON MOIST SOIL.
Age, 55 years; height, 102 feet; girth at 35 feet above ground, 4 ft. 6 ins.

SITKA SPRUCE AND NORWAY SPRUCE ON EXPOSED SITE.
(The Sitkas are the taller trees.)

[*To face page* 12.

the greater return on a low elevation, and a deep soil, Sitka spruce would undoubtedly yield better results at high elevations, and on moist soils.

For Sitka spruce, pure planting offers advantages which cannot be obtained by mixing it with other species, both on account of the greater inducement towards height-growth, and with regard to simplification of management. Unfortunately, the present high price of plants precludes the possibility of pure planting; but with an increased and steady demand for them, there is no apparent reason why plants should not be produced in the public nurseries at a price not greatly in excess of that ruling for ordinary commercial conifers. For extensive planting it is better in every respect, however, to raise the plants in the estate nursery. On good soils, 3556 plants per acre will generally be sufficient to insure the necessary density of crop; but on high-lying sites the number would require to be increased to 4840 plants per acre. Should it be found necessary to select a cheaper substitute to mix with the Sitka spruce, Norway spruce, although slow in growth, seems best fitted for the purpose, and on moist soils little choice is left in the matter. In a mixed plantation of the two species, 1210 Sitka spruce, placed at 6 feet apart with the intervals filled in to 3 feet over all with Norway spruce, will generally give satisfactory results; but any less proportion of the Sitka would most likely repeat the result obtained in the hill plantation already alluded to, and would allow the crowns of the dominating species too much freedom before they themselves had formed close canopy. On low elevations and good soils, a mixture of larch and Sitka spruce would also be likely to lead to good results. In that case, however, the proportion of the latter would require to be increased to about one-half in order to obtain sufficient density of crop to effect timely branch-shedding. The two species seem to associate well together; in height-growth they are about equal, until the pole stage has been passed at least, and the Sitka spruces, thus compelled to fight for crown space, are drawn up with a cleaner stem than when they overtop the slower-growing Norway spruce. The greater value obtained from thinnings is also an inducement to make the experiment, wherever practicable. The management of such a mixture would of course be governed by the success or failure of the larch, but the usual objections to the planting of spruce and

larch together on account of the supposed danger of spreading larch disease, through the medium of the spruce gall aphis, would not in this case at any rate hold good, as the Sitka spruce is singularly free from attack by that pest. When planted on dry, gravelly soil, the Sitka spruce has here proved its aversion to such conditions by early becoming stunted in growth, losing most of its foliage, and by the stem, thus exposed to too much light, frequently exhibiting a growth of epicormic shoots, a feature also noticeable in older woods, where the stems have been suddenly exposed to light through thinning operations or otherwise.

What the most profitable rotation period for Sitka spruce may be has yet to be ascertained, but, so far as can at present be judged, a long rotation will probably yield the highest financial results; for, as the timber is specially suited for structural purposes, a sufficiently long period must be allowed for its maturation, and any rotation less than 100 to 120 years need not, I believe, be calculated upon as being likely to produce the quality of timber desirable for these purposes. In this country, the tree has all the appearence of being very long lived, and a large annual increment may be expected up to a great age. With the extension of forestry, it will be necessary, in order to develop the market for home-grown timber, to provide a higher-grade timber than has hitherto been produced under cultivation, and thus to comply with builders' specifications; and this can only be accomplished by the adoption of a rotation period of sufficient length to enable the timber to mature thoroughly. Should a home demand for pulpwood arise, as it seems certain to do in course of time, a period of 40 years would be sufficient to produce the class of material required for the purpose; and as a pulpwood tree the Sitka spruce has, I believe, a great future in store. Norway spruce is the principal species for pulp at present, but Sitka spruce can be produced on a shorter rotation, and is also much freer from knots than that species.

As a pitwood tree it is not likely to compete seriously with larch or Douglas fir: it does not mature its timber so early, and in a young state it breaks under strain with a short fracture.

In the north of Scotland, one of the principal drawbacks to forestry has been the difficulty of finding a remunerative market for small thinnings, as the excessive haulage rates have precluded the possibility of sending pitwood, other than larch, to

the coalfields in the south of Scotland. With the development of the Aberdeen and north-east coast fishing and box-making industries, however, a good market has been opened up, and the demand for clean-grown Scots pine and spruce exceeds the supply. Unfortunately much of the timber produced is not sufficiently clean grown to meet requirements, and a steady import trade from continental sources has arisen in manufactured staves, and also in pulpwood billets, which are now being manufactured locally into barrel staves, boxwood, etc. Wide planting and early thinning, it will therefore be understood, have their disadvantages; and in this part of the country they are being felt at a comparatively early period in the life of the plantation.

As a shade-bearing species, Sitka spruce does not rank high; it seems intolerant of both overhead and close side-shade, and might be classed as a moderate light demander rather than as a shade-bearer. Where planted densely, in mixture with Douglas fir and Norway spruce, it has become thin in foliage and stunted in growth, while the other species are both making good growth. As an understory, it would, therefore, seem capable of use only under a very high canopy of light-crowned oak or larch; and as Douglas fir would produce both a larger volume of timber and further improve the condition of the soil, it should under such conditions always be planted in preference to Sitka spruce.

As regards the reproductive capacity of the tree in this country, it does not seem particularly prolific. Cone-bearing does not become general until about the thirty-fifth to the fortieth year, and good seed years are somewhat infrequent The cones are small in size, but contain from 300 to 350 seeds, and should be collected immediately on ripening in early October, as in presence of a drying wind the scales open up, and the seeds may be shed within a few days. Acclimatisation has, however, become so far assured as to promise a sufficient supply of seed in the country; and as a proof of this I may say that, a few years ago, I had the cones collected from a tree of about thirty-five years of age, and the seeds sown separately, the result being that close on 20,000 seedlings were produced from them.

In its nursery management, a considerable amount of attention is required during the first year after sowing the seeds, both as regards drought in summer and frost-lifting in winter.

The first year's seedlings are very small and shallow-rooted, and unless some protection is given to the beds the whole crop may easily be ruined from either cause. The common practice of lining the sides of the beds with 9-inch boards and stretching a covering of tiffany or very thin packsheet overhead is usually a sufficient precaution, the covering being used only when necessary. In the second or third year the seedlings should be lined out in nursery plots, and there grown on for one or two years more, by which time they become sufficiently strong to be put out to the forest. If the ground to be planted is bare of herbage, 2- or 3-year seedlings may be notched or dibbled into the ground by the planting-spade or hand-iron; but if rank herbage exists, and pitting is necessary, 4- or 5-year-old plants may be used in order to save the expense of repeated cleaning from rank growth.

So far, Sitka spruce has, on this estate, proved immune from attack by insect or fungoid pests; but it would perhaps be too much to hope that it will always remain so, and therefore, failure should not be courted by planting it on sites such as are known for the time being to be infested with pine weevil, or where fungoid diseases, parasitic on the spruce tribe generally, are prevalent.

The conclusions arrived at, as the result of a study of the habit of the Sitka spruce over a wide area and under varying conditions of management, may be summarised as follows:—(1) it is suitable for afforesting exposed sites, in humid localities, such as occur in various parts of the kingdom, and particularly in the Scottish highlands; (2) grown in high-forest, it has great productive capacity and yields a high quality of timber; (3) it enjoys practical immunity from attack by insect and by fungoid pests.

These qualities, combined with the great size it attains, tend to make the Sitka spruce in this country what it is recognised to be in its native habitat, "The largest of all the spruces and of great commercial importance."

4. The Financial Aspect of Forestry.

By Percival Trentham Maw.

Now that the subject of forestry and the advisability of more extensive planting in Great Britain is being somewhat freely discussed by politicians and others, a critical discussion on the methods adopted for showing the financial results likely to accrue from afforestation will be welcomed by some and act possibly as a timely warning to others.

I have no hesitation in saying that much of the advice offered by enthusiasts in the cause of forestry can only lead, if followed, to grave financial losses. While in many cases their estimates as to the growth of timber, the amounts likely to be received for thinnings, and the final crop, are quite likely to be realised, yet their estimates of the ultimate profit which they anticipate would appear in most cases to be made in ignorance of the correct principles that should be applied in making actuarial calculations.

As I have previously pointed out,[1] it is of no uncommon occurrence for those seeking advice as to the possible profits that may be derived from operations of afforestation to be informed of the results achieved in continental forests. For instance, an owner contemplating planting is told of some existing forest where the average net annual receipts per acre amount perhaps to 30s. or £2. Then he is advised that the cost of planting will be perhaps £8 an acre, and the land is now valued at £12 an acre, and that on this proposed investment of £20 an acre, he may thus hope to secure the same net profits. An increased rental of say 25s. an acre with an additional capital expenditure of only £8! Over 15 per cent. interest; what more profitable undertaking can be embarked upon!

Fortunately, a remark of Mr Healy's showing his high appreciation of the intelligence of the Upper House may also be applied to the majority of British landowners, but I should hesitate to make such a flattering statement concerning those who offer advice such as has been instanced above. As well might one compare an agricultural rent with a rent received from a fully developed building estate.

Not infrequently it is suggested that the value of the final crop divided by the number of years in the rotation will represent

[1] Surveyor's Institution, *Professional Notes*, vol. xv., part iv.

the annual net return on the initial outlay, it being presumed that the payment of annual outgoings is equivalent to the various sums of money received from time to time from the sale of thinnings.

Or, again, the gross annual return on capital invested is assumed to be the value of the average annual production of timber, including that removed as thinnings, and from such a sum a deduction of perhaps 2s. to 5s. is made on account of rates and other annual outgoings, and the amount remaining is stated to be the net annual return on the invested capital.

To take an example, let it be supposed that land which can be bought for £10 an acre is to be planted with a mixed crop of trees. It is estimated that the cost of planting, fencing, cleaning for the first three or four years and replacing deaths will be £8 an acre; that when 30 years old the thinnings will yield 10s. an acre; at 40 years, £2, 10s. an acre; at 50 years, £4; at 60 years, £5; at 70 years, £6, 5s.; and that, when 80 years old, there will be a final crop of 3450 cubic feet over 6-inch quarter-girth measure, which at an average price of 7d. a foot will yield £100, 12s. At the end of the rotation the value of the land is presumed to remain unaltered. The total number of cubic feet (down to 3 inches top diameter) which will be produced is estimated at 5050 cubic feet, which gives an average annual production of 63 cubic feet. And the average annual outgoings over and above any sum received as a sporting rent or by the sale of faggots are estimated at 2s. per acre.

Now, by adopting the first method which has been instanced, it would appear that the initial outlay of £18 would yield a net annual return of approximately £1, 5s.,

$$\text{for} \quad \frac{\text{value of final crop}}{\text{number of years in rotation}} = £1,\ 5s.,$$

or apparently nearly 7 per cent. interest.

And by the second method, the average annual production of 63 cubic feet would be worth, at 7d. a cubic foot, £1, 16s. 9d. From this gross annual value is deducted 2s. for annual outgoings, and the net return that should be realised on the invested capital is stated to be £1, 14s. 9d. per annum.

Both these methods of expressing the financial result of the operation are absolutely fallacious, but unfortunately they are of very common occurrence. They savour of the finances of some progressive County Council. A moment's consideration

will reveal the fact that it has been assumed that money can be borrowed for 80 years without any interest at all being paid upon it, which is utterly absurd.[1]

Now, in order to arrive at the correct annual value, it will be necessary to determine the credit sum which will have accumulated at the end of the rotation, if all sums of money received or spent are deemed to have been invested or borrowed at compound interest. From this sum the original cost of planting—viz., £8—should be deducted, as the crop will be debtor to this amount of capital. The remaining sum will represent the accumulated net profits, the annual value of which is found by discounting the amount at compound interest into a yearly payment throughout the whole rotation. In the above instance, if 4 per cent. compound interest is assumed, there would be a net yearly return of 3s. 2d.[2] on the invested capital of £18 per acre. If the calculations are made at $3\frac{1}{2}$ per cent. compound interest the return will be 4s. 5d., and if at 3 per cent. compound interest 6s. 1d.

Another method sometimes adopted in presenting financial statements concerning forestry, is to state the rate of compound interest which will be yielded at the end of the rotation on the initial expenditure.

In the case under consideration, if monies received and spent during the rotation were credited and debited with 4 per cent. compound interest to the end of the rotation, a return equal to approximately $2\frac{1}{4}$ per cent. compound interest would be realised on the invested capital. If 3 per cent. compound interest were calculated on monies received or spent, the return on the invested capital would be equal to approximately $2\frac{1}{2}$ per cent. compound interest.

Again, if the land could be bought for £5 an acre, the return would be just under $2\frac{3}{4}$ per cent. compound interest in the former case, and just over $2\frac{3}{4}$ per cent. compound interest in the latter case.

Now although this method of showing the financial aspect

[1] [We think that there are few persons, likely to be consulted as experts on a question of this sort, who are unaware that compound interest has to be employed in the calculation the various formulæ for which are given in Vol. III., Part II., of Schlich's *Manual of Forestry*.—Hon. Ed.]

[2] This yearly return is not influenced in any way by the original cost price of the land. If, however, the cost of planting, fencing, and cleaning the young crop were only £4 (instead of £8 as instanced), the yearly return would be 3s. 4d. instead of 3s. 2d.

of forestry operations is theoretically correct, I much prefer to state the net annual rental which can reasonably be expected, according to the method previously described. There are several objections that can be raised against the former method: it is somewhat ambiguous to those who are not accustomed to actuarial calculations: for, if the rate of compound interest is low, it is apt to cause an unduly favourable opinion to be formed of the undertaking; whilst the reverse is the case if the rate of compound interest is high. Then again for practical purposes, although the productive capacity of the land may have been accurately gauged, it will nearly always be necessary to refer to tables to ascertain the probable rate of interest that will be yielded by any planting operations, for whenever the value of the land or the initial expenditure varies so does the rate of interest, although the growth of timber may remain the same.

But if the latter method, namely, that of showing the net annual value, be pursued, any advocate for afforestation will be able to furnish data which are more or less directly comparable with existing net agricultural rents; though, before a strict comparison can be made, a portion of the estimated annual rental value of the land when planted must be deducted as representing the yearly interest on the cost of planting and fencing. Also, it should not be forgotten that a portion of any large area of land, if afforested, must be devoted to roads and drives, and there is always a certain amount of other unproductive land.

I urge all who contemplate planting and obtaining advice thereon, to insist upon being advised as to what annual rental can be expected from the capital invested, and to ascertain also what rate of compound interest has been assumed in making the calculations. For, as will have been gathered from what has already been said, the rate of compound interest assumed will make an enormous difference in the estimated results which are likely to accrue from planting operations: if a low rate is taken a profit can often be shown, but seldom otherwise.

Conscious of this, over-zealous experts and others who tender advice, habitually adopt a low rate of interest, and it seems to be their almost universal practice to take $2\frac{1}{2}$ per cent. or at most 3 per cent. This is especially the case when they are advising municipal and other corporate bodies.

Now, I admit there was a time when the public were willing to

lend money to the Government at $2\frac{1}{2}$ per cent. interest, or to municipal corporations at about 3 per cent., but these conditions do not prevail at the present time, and although a period of cheap money has now[1] returned, I am inclined to think that the investing public will never again lend their money at the same low rate of interest, especially if public bodies embark upon such risky undertakings as afforestation.

From time to time proposals are made that the Government should lend money for afforestation purposes to public bodies and even to private owners at a lower rate of interest than they themselves can borrow from the public. But I fail to see any justification for such a course. Why should the credit of the nation be mortgaged in order that a bounty may be granted on home-grown timber? For this is really what such a scheme would result in. Why should the Government foster and favour this industry in preference to others? Except from the æsthetic point of view, forestry should be looked upon as a commercial undertaking, to be carried out on sound commercial principles. Regarding it in this light, I cannot, in the case of oak, beech, Norway spruce, and Scots pine form a very favourable opinion concerning the realisation of future profits, if the present prices which prevail for timber remain unaltered. Under such circumstances the aim of foresters must be, not "what profits they can make," but "how little shall they lose."

I am quite willing to admit that there is a possibility that prices for home-grown timber, at any rate for coniferous timber, may rise substantially. An export duty imposed by foreign countries, or a duty levied at home on imported timber, would have this effect. But these anticipations are perhaps beyond the sphere of a forester.

It should be remembered that he who embarks upon timber growing is really "dealing in futures." Great risks are incurred from danger wrought by insects, fungi, fire, and storm: and hidden dangers which cannot be foreseen are almost legion. Again, who shall be bold enough to deny the possibility that, at some future date, any enhanced value of timber may be regarded as unearned increment and penalised accordingly by taxation imposed by some Socialistic Government? For, be it remembered, growing timber is "real property"—it is part of the land in the eyes of the law.

[1] Midsummer, 1909.

5. Afforestation of Catchment Areas.[1]

The supply of water obtained from land forming a "catchment area" is materially affected by the planting of trees. It has been found that the moisture in the soil underlying trees is much better conserved than it is in open country, so that more water drains from a wooded area than from one devoid of trees; while, in addition, the flow is maintained more equably throughout the year, thus tending to prevent floods on the one hand, and water-famines on the other. In addition to the direct improvement of these areas in point of suitability for the supply of water, the sale of timber may become after a time a relatively important source of revenue.

These considerations induced the Departmental Committee on British Forestry in 1902 to recommend that the attention of corporations and municipalities should be drawn to the desirability of planting with trees the catchment areas of their water supply, and in communicating this recommendation to the Local Authorities the opportunity was taken to ascertain some particulars as to the area and character of their catchment areas. These particulars were given in the *Journal of the Board of Agriculture*, November, 1904, p. 468; and with a view to ascertaining what steps have been taken since that date, the Board of Agriculture and Fisheries have recently asked the Local Authorities principally concerned for an account of any work in the direction of planting the areas under their control which has since been carried out.

The result of the inquiry shows that in the majority of cases, even where Local Authorities are in possession of the freehold, or have long leases of their catchment areas, very little progress has yet been made. In a few cases, on the other hand, the work has been taken up seriously, and planting is being done on a systematic plan.

Leeds.—The catchment area of the Leeds Corporation is situated in the Washburn Valley, and extends to over 11,700 acres, varying from 350 feet to 1550 feet above sea-level, and lying on the Millstone Grit overlaid with boulder clay. The work of afforestation was begun here with a view to giving work to the unemployed, and has been carried out for three seasons

[1] Reproduced from the *Journal of the Board of Agriculture*, by permission of H. M. Stationery Office.

with men drawn from the Unemployed Bureau, assisted by a few permanent men. In 1908-9, however, a permanent staff was engaged, though planting by the "unemployed" is to be continued. In all 514 acres have been planted, and a further 141 acres are being planted this season (1908-9), 115 acres by the unemployed and 26 acres by the staff. The average cost for the three seasons for preparing the land, draining, fencing, and planting, including expenditure on the nursery, was £11, 19s. 5d. per acre, but the Waterworks engineer, Mr C. G. Henzell, observes that the cost of planting should not have been more than £7, 10s. to £8, 10s. per acre, the excess being due to the employment of inexperienced men. Much of the work was badly done, and the failures have been quite 30 per cent. The men were not accustomed to spade-work, and few were able to stand the rough weather. The permanent staff are now engaged in replanting the gaps caused by dead trees in the existing plantations, the number of trees requiring to be replaced being 551,000. The planting has been done with beech, ash, oak, alder, sycamore, Scots pine, spruce, and larch. The larch has not been at all successful, and more than 30 per cent. of the plants are dead.[1] The Scots pine and the hardwoods have done very well, but the spruce has not been so satisfactory. No insect pests have been noticed except a slight attack of larch Aphis (*Chermes laricis*).

Mr Henzell, in his report to the Corporation for 1908, observed that the work of afforesting the drainage area was of great importance, and suggested that 100 to 150 acres should be planted annually. To do this it was estimated that a permanent staff of ten men, used to spade-work and experienced in planting, would be needed, together with six additional men in the planting season, to be drawn from among the small tenants on the estate. The men during the summer months would be employed in keeping up the nursery, cutting down the growth round the young trees, putting up fencing, etc.

Liverpool.—According to evidence given before the Royal Commission on Coast Erosion by Mr Joseph Parry, engineer-in-chief to the Liverpool Corporation Waterworks, the Corporation possesses two catchment areas: one at Rivington, in South-West

[1 It is feared that the percentage of deaths recorded will not be found to be a full measure of the loss incurred by the employment of unskilled labour.—Hon. Ed. *Transactions*.]

Lancashire, covering an area of 1000 acres on the Millstone Grit formation, and the second at Vyrnwy, in Montgomeryshire, with an area of nearly 23,000 acres. The work of afforestation on these areas has been mainly undertaken with a view to utilise the ground, and at the same time to prevent any pollution of the water supply. Operations at Rivington were begun about 1904 with an experimental area of about 600 acres, and in 1908 408 acres had been actually planted. At Vyrnwy the area actually planted (in 1908) was 400 acres, and, in addition, there were a number of old woods covering some hundreds of acres. Nurseries have been established at both places, which are now able to supply the trees required for planting. The average cost of planting has been about £6 per acre, but this includes some expenditure which will not be necessary in future.

Mr Parry has furnished the Board of Agriculture with the following general statement of the afforestation work carried out by the Liverpool Corporation since the year 1904 :—

The top water of Lake Vyrnwy is 825 feet above Ordnance datum, and the catchment area around the lake rises, by slopes generally moderate, to a height of over 2000 feet. At the north-west end the slopes are steeper, and in places precipitous. The Silurian rocks around the lake are of a slaty nature, and disintegrate into a loamy soil, which is retentive of moisture. The number of trees of various species planted in the plantations round Lake Vyrnwy since the year 1904 and up to 30th June 1908, has been as follows : — Larch, 203,600; Douglas fir, 131,225; spruce fir, 163,100; silver fir, 20,000; Scots pine, 36,500; Corsican pine, 176,425; Weymouth pine, 39,070; Austrian pine, 5200; oak, 7600; ash, 2700; sycamore, 9350; beech, 105,300; total, 900,070. The planting for the year 1908–9 was completed early in May. The area planted was 117 acres, and the number of trees was 326,000 (including the filling of blanks), making a grand total planted since 1904 of 1,226,070. The total amount spent on the nurseries and plantations at Lake Vyrnwy (including fencing) last year was £1467, 15s. 8d., but a considerable amount of this was incurred in clearing scrub from old abandoned woods, and in the drainage of peat lands. The Rivington reservoirs are situated in Lancashire between the towns of Bolton and Blackburn, and the total area of the gathering ground is 10,000 acres. The Corporation

decided to commence planting this area in the year 1904, and the work is now proceeding at the rate of between one and two hundred acres per annum.

The following general statement has been prepared by the forester (Mr M'Beath) :—

The land planted on the Rivington watershed is nearly all, in the northern part, in the parishes of Tockholes and Withnell, and extends to 420 acres. This land was formerly let as grazing land. The soil varies from peat to a peaty loam and stiff clay. In places it overlies the Millstone Grit, and it varies in depth from a few inches to 2 feet or more. About 200 acres of these lands form the sides of the Roddlesworth Valley, covering well-drained slopes facing S.W. to W. and N.E. to N. About 42 acres of this were pit-planted. Casual labour was employed from the village, and pits were opened by contract at 1s. 8d. per 100; a few good workmen earned 5s. per day, while many others did not earn 2s.; 3000 pits were opened to the acre, and 4-year-old plants, beech oak, ash, sycamore, and spruce were put in. The spruce were planted along the sides of the plantations next the reservoirs, to prevent leaves from blowing into the water, at a cost of £8, 5s. per acre, including enclosing and purchase of plants.

An area of 156 acres was notch-planted with 2-year seedlings of the same species, and the cost per acre, including purchase of plants, was £2, 11s. The workmen employed on this plantation were young men and boys trained in forest work. Another area of 36 acres was notch-planted, and the turf was skimmed off 14 inches square before notching to prevent the grass from smothering the plants. Turfs were taken off by contract at 7d. per 100. The cost per acre was about £3 inclusive. A portion of high-lying moorland, covering 186 acres, was planted with spruce and beech at a cost of £3, 10s. per acre, including fencing. These plantations vary in height from 550 feet to 900 feet above sea-level, and are all exposed to strong winds. At the commencement of the work the planting was done mostly during the autumn and early spring, but from experience gained on the ground it has been found that late spring planting gives much better results. During the first two years all the plants were purchased, but they have to a large extent been since replaced with plants from the Corporation nurseries. Of the beech that were purchased, very few are now alive. The cost of filling vacancies in the first year's work with

4-year-old plants has been heavy compared with areas planted with home-raised plants. Very few deaths occur in the plantations made with plants from the home nurseries. Voles or shrews are doing great damage to the plantations, and it is found that beech and sycamore suffer the most. A great many of the plants are barked completely round, and some are cut through. Rabbits are also troublesome on the moor, but no attacks of insect pests have been experienced. The total number of trees planted up to 31st May 1908 was 1,540,535.

Manchester.—The catchment area of the Manchester Corporation Waterworks is situated at Thirlmere, in Cumberland, and covers about 11,000 acres, at elevations varying from 500 to 3000 feet. The Corporation have consulted Professor Fisher, of Oxford University, who has drawn up a scheme for systematic planting, and they have also engaged a competent woodman to carry out the work. According to evidence given before the Coast Erosion Commission by Sir Bosdin T. Leach, chairman of the Waterworks Committee, planting has already been done, or is in progress, on some 388 acres, while the planting of a further 320 acres has been arranged. About twenty men are employed in the planting season, approximately 120 acres being dealt with annually. Large numbers of plants are purchased, but many are also grown in the nursery, which at present covers $1\frac{1}{2}$ acres, but is about to be enlarged by the addition of 3 acres. Some further particulars as to the work at Thirlmere are given in the *Quarterly Journal of Forestry* (January 1909), from which it appears that the cost of planting is estimated at £6 per acre for 100 acres a year; fencing at 12s. per acre at first, afterwards diminishing to nothing. The maintenance of nurseries and miscellaneous expenses are put at £400. The figure of £6 for planting is considered rather high, but is due to the prevalence of coarse grass and the necessity for using 4-year-old plants.

Birmingham.—The entire area of the watershed of the Birmingham Corporation Waterworks is 45,562 acres, a small proportion of which remains to be purchased. This area includes a large extent of lands held subject to common rights. only 4925 acres being on a freehold or long leasehold tenure, The area actually planted is $410\frac{3}{4}$ acres, situated in the Elan Valley, near Rhayader, and the work was carried out by contractors, who employed their own skilled men to do the work. Maintenance for two years was included in the con-

tract, and since the plantations have been taken over from the contractors practically no trees have died. Larch and Scots pine have been chiefly used, with some spruce. The average cost per acre for planting was £4, 2s. 8d.; for clearing, fencing, and incidental expenses, £3, 8s. 3d.; or £7, 10s. 11d. in all. No trouble has been experienced with insect pests, except in one case where 2 acres were destroyed by pine beetles. There are nine separate plantations at elevations varying from 900 to 1500 feet, and they are reported to be doing extremely well in every case. No further planting is proposed in the near future.

Oldham.—An area of 8 acres was planted by the Corporation of Oldham in the winter of 1904–5 in the urban district of Saddleworth, Yorks, West Riding. This area is peaty in character, and the land was partly ploughed and partly turned over by hand. The average elevation of the land is 950 feet above sea-level, with a south-westerly aspect. The trees were 40,000 in number, and consisted of mountain and common ash, Austrian pine, scarlet willow, beech, oak, poplar, alder, *Pyrus aria*, birch, wych elm, sycamore, and chestnut. They were planted in December and January by the Corporation's own staff. The cost per tree planted is stated to have been as follows:—Preparation of land, ·6d.; fencing off, ·2d.; cost of tree, ·7d.; and cost of planting, 1·4d.; making a total of 2·9d. per tree planted.[1] The plantations are said to be progressing very slowly, but no indication of damage by insect pests has been observed.

Llandudno.—A few trees have been planted on the catchment area, and the question of carrying out further work is now under consideration.

Bolton.—In 1905 the Corporation commenced to plant a small portion of the catchment area of one of their reservoirs, and have planted about 18 acres. Several "unemployed" have been taken on, and a further 20 acres of rough land is being prepared for planting next autumn.

Darwen.—The Darwen Local Authority have not planted much of their catchment area, as the part which is suitable for planting is let off for pasturage. In view, however, of the desirability of providing employment, and of testing the

[1 If the plants were put out at 5 feet apart, the planting of an acre of ground must have cost no less than £17.—Hon. Ed. *Transactions.*]

suitability of the watershed for afforestation, the Water Committee recently decided to plant an experimental area of two acres of land, having a northerly aspect, situated 900 feet above sea-level. This was done in January last by men from the Distress Committee's register. In all, 800 trees of various kinds were planted at a total cost of £26, 17s. 8d., made up as follows:—Cost of trees, £1, 16s.; preparing ground and planting, £6, 4s.; making fence, £4, 2s. 6d.; and fencing materials, £14, 15s. 2d. The cost of trees and of planting amounted to £4 per acre; the fencing was necessary to keep out cattle and sheep from the adjoining pasture land.

Bury.—The Bury and District Joint Water Board are planting a small area annually. Up to the present, three plantations of $38\frac{3}{4}$ acres in all have been planted at a total cost of £401, or about £10, 7s. per acre. Four-year-old trees have been put in 4 feet apart, and the cost of the various items has been as follows:—

	£	s.	d.
Supplying and planting . .	191	12	6
Cost of fencing . . .	161	12	6
Labour for erecting fencing . .	36	18	1
Carting, etc.	11	7	5
	£401	10	6

Heywood.—Trees have been planted on one acre of the catchment area, and there is a probability of further planting being done this year.

Cardiff.—According to a report made by the Waterworks engineer to the Cardiff Corporation, about half an acre of land at Rhubina was planted in 1904 with larch seedlings, and about 4 acres at Cantreff were planted with seedlings of Scots pine, larch, and spruce, and with Austrian pine $1\frac{1}{2}$ to 2 feet high. The situation at Rhubina was specially favourable, and the trees are now, after five years' growth, from 10 to 15 feet high, and there have been practically no losses. The ground at Cantreff, although at an elevation of 1000 feet above sea-level, was also favourable for planting, and good progress has been made there. In the autumn of 1906 some 8 to 10 acres of the mountain on the west side of the "Beacons" Reservoir were planted. This site was not so favourably situated as the others, and considerable loss has been experienced, but on the whole it is considered that the trees are doing fairly well for an

exposed position 1400 to 1500 feet above sea-level. A favourable opportunity for planting on a somewhat larger scale and in a good position will shortly occur when possession of some additional land is obtained, and it is proposed to plant some 20 acres annually.

Derwent Valley.—The Derwent Valley Water Board, after obtaining the advice of Professor Somerville, of Oxford University, have undertaken the planting of 38 acres of land in five separate plantations, and the work is now in progress. About 2 acres have been set aside for a nursery.

Plymouth.—The catchment area of the Plymouth Corporation covers 5360 acres, of which 348 acres (116 water) are freehold. No planting has been done since 1904, but before that date two attempts were made on a small scale to plant trees on the land owned by the Corporation surrounding the reservoir. These attempts, however, were only partially successful, failures being due to several reasons:—(1) Rabbits, which played havoc with the young larch; (2) neglecting to cut down the undergrowth, which tends to choke the plants; (3) the shallowness of the soil in places immediately overlying the rock; and (4) fires from passing locomotives. Where the trees were well planted and survived for two or three seasons they have grown well, but in one case 50,000 larch were planted of too small a size, and more than half of these have disappeared.

Torquay.—The catchment area of the Torquay Corporation Waterworks is 2241 acres, of which 105 acres were woodland in 1904. The Torquay water engineer, Mr. S. C. Chapman, states that since that date the afforestation work has consisted principally in rearing young trees for future use. The total area planted has been $24\frac{3}{4}$ acres, consisting of $4\frac{1}{4}$ acres of oak and ash mixed, and $20\frac{1}{2}$ acres of larch and Scots pine. With the exception of the oak and ash, which were purchased at 27s. 6d. per 1000, the trees have been taken from the Corporation's own nurseries. The establishment of the nurseries has proved of great advantage, as there is not only a saving in cost, but the trees do better, as at planting only a few hours elapse between the time the trees are removed from the nurseries and the time they are placed in the ground in their permanent positions. The seedlings are purchased at 2s. 6d. to 3s. per thousand, and are planted close together in rows 2 feet apart. The total outlay till they are ready for planting out is estimated at 15s. per 1000, made up as follows:—Seedling larch or Scots pine,

3s.; cartage, 6d.; planting, 3s.; weeding (three years), 6s. 6d.; fencing, 1s.; supervision, 1s.; total, 15s. The cost of planting in 10-acre lots with trees set 5 feet apart is £5, 13s. 3d. per acre —viz., cost of trees, £1, 6s. 3d.; labour, £1, 15s. 3d.; wire fencing, £2, 11s. 9d.; total, £5, 13s. 3d. Ordinary estate labourers are employed at 4½d. per hour. The fencing of the plantations with a rabbit-proof netting is found to be an absolute necessity. The fence now used consists of 42-inch galvanised wire-netting, 1¼-inch mesh, 18 gauge, stiffened by means of a galvanised seven-strand wire, No. 8 gauge, and supported upon angle iron standards 9 feet apart, and with straining pillars 120 feet apart. The wire-netting is sunk into the ground for a depth of 6 inches. The presence of the high Devonshire hedges affords great protection from the wind, and where this protection is not available the plantations are edged with Scots pines, which materially shelter the larch. The protection afforded by the hedges is most clearly shown, and the height of the trees decreases in a marked degree as the distance from the hedges increases. The elevation of the plantation is 800 to 900 feet, and the best results have been obtained on the slopes sheltered from the N.-W. wind. The growth of the trees varies considerably, and when a dry spring has come after the planting out, the trees have made little progress during the first year. The number of dead trees has been small, except in one or two instances when rabbits have gained access to the plantations in time of snow.

The cost of replacing dead trees is approximately 20s. per 1000 for labour only, but may vary slightly according to the number to be replaced in any plantation. The presence of disease has not been noted in the larch or Scots pine, but the gall-fly has appeared on the oak trees. The number of seedling larch planted in 1908 was 60,000, and fencing was ready for planting 24 acres of larch. The planting of from 20 to 30 acres annually is apparently contemplated until land which is at present unremunerative is covered. The Town Clerk of Torquay observes in this connection that the Council would like to do more in the direction of planting their land with trees, but are prevented from doing so owing to lack of available funds.

[Some of the Corporations appear to have badly needed a skilled forester to carry out their work.—Hon. Ed. *Transactions.*]

6. Vegetable Remains from the Site of the Roman Military Station at Newstead, Melrose.[1]

The following extracts are taken from a report by Mr Harry F. Tagg, F.L.S., on samples sent by Mr James Curle, of Priorwood, Melrose, to the Royal Botanic Garden, Edinburgh, for investigation :—

I. Examination of Samples of Deposits from the Pits and Trenches.

The plant remains identified among the samples are of three kinds :

(1) Specimens of woods and twigs identified by microscopic examination of their wood structure ;

(2) Leaves and bark fragments recognised by their external appearance ;

(3) Seeds and fruits.

1. The results obtained by the examination of the numerous twigs and branches are somewhat disappointing. These results tend more to indicate the general prevalence of certain well-known indigenous trees—some probably pre-glacial—than to afford evidence of the presence in Britain, at the period of the Roman occupation of this station, of species of exceptional interest. Thus, although a great number of twigs and branches have been examined, and the species of plant to which they belong ascertained, I am only able as a result to tabulate some seven separate species of trees, and these are kinds which have always been considered to be indigenous.

The number of specimens which turned out to be hazel was remarkable. The bulk of the twigs and branches among the material from the pits were of this tree, although twigs and branches of birch also were fairly common. Oak was less frequently found, and in most instances the specimens of this wood were in the form of chips of large timber. This is interesting, because while hazel fruits and birch catkins were found, no acorns or small twigs of oak were discovered among the material submitted. It may be noted that pieces of oak-bark were recognised, and Mr Curle, in a letter to me, says that "oak must have been fairly plentiful, I think, at Newstead. All

[1] The main period of the Roman occupation of Newstead is believed to have been during the second century of our era.—Hon. Ed.

along the west side the early rampart appeared to lie on a double layer of oak-branches." Ash was employed as shafts and handles of implements, but there is no evidence that it was procured locally. In two cases only was ash-wood found not associated with implements. A piece of wood from Pit VIII. proved to be ash, and a portion about two inches long of a branch about an inch in diameter, without bark, was found among the earliest material received. These may have been pieces of broken or discarded implement handles. A few specimens of branches of the rowan (*Pyrus aucuparia*) and of the white beam (*Pyrus Aria*) were found, and there seems little doubt that these trees have been wild in Scotland from very early times. One or two specimens of the wood of alder were encountered, and similarly a few of poplar (or willow).

Thus it will be seen that the trees, recognised by the wood anatomy of twigs and branches, with portions of bark, which one may regard as growing locally at Newstead at the time of the occupation of the Roman Camp, number seven only:—oak, birch, hazel, willow or poplar, alder, rowan, white beam.

2. Leaves and the soft parts of plants were not sufficiently well preserved in most cases to enable one to identify them. However, a few remains of this nature were in fairly satisfactory condition, and among them I was able to identify leaves of hazel and leaves of birch.

. . . . .

The pieces of bark recognised belong to the following species:—oak, birch, hazel, rowan.

. . . . .

The brushwood from below the log-pavement of the Locklee Crannog was, it appears, composed of woods belonging to one or other of the following trees:—birch, hazel, alder, willow. The twigs and branches of the nature of bushwood found in the material from the Newstead site are chiefly hazel and birch, while twigs of alder and willow, although not plentiful, were also found.

Alder and willow are trees preferring damp situations, so that their occurrence, perhaps in some quantity, in the vicinity of the Lochlee Crannog at the time of its occupation is easily understood. Hazel and birch, with alder and willow more plentiful perhaps in moist situations, were I am inclined to believe, somewhat dominant trees in the primeval woods of North Britain.

This opinion is supported not only by the results of the examination of the material from Newstead and the records from the Lochlee Crannog, but also by the results of similar investigations which at various times I have made of the plant remains of other sites of Roman and pre-Roman occupation. Thus, to quote the result of one such investigation only[1]:—"Of a number of logs from a prehistoric pile-structure in Wigtownshire, which I examined in 1903, seven were, I found, birch, five alder, three hazel, one poplar (or willow), and one oak."

Oak recorded from Newstead, from the Lochlee Crannog, from the Wigtownshire prehistoric dwelling, and from many other Roman stations, appears to have occurred plentifully in primeval woods of North Britain, in which were also scattered trees of rowan and white beam.

It is rather remarkable that no specimens of coniferous wood have been found in the brushwood deposits either at Newstead or at the Lochlee Crannog, and the absence of beech-wood in the material from both stations is worth noting.

. . . . .

3. The absence of seeds and fruits of common trees, with the exception of those of hazel, finds its explanation probably in the character of the deposits examined. These were, I feel sure, in most cases, the debris collected in refuse pits, and although small twigs and wood-chips are present, such are but a small proportion of the total debris, and represent, doubtless, scraps from clearings.

. . . . .

II. Woods of Implement Handles and other Articles.

(*For detailed Identifications, see Table at end.*)

Turning to the Table giving the kinds of woods used for tool handles and other articles, one finds that those perhaps most commonly employed were ash and hazel. The latter wood figures as the shaft of a spear, as the shaft of a javelin, and as handles to tools. It doubtless recommended itself for these purposes on account of the clean and straight stems of moderate diameter and light weight obtainable. Hazel, though not

[1] See Ludovic Maclellan Mann, "Prehistoric Pile-Structures in Pits," *Proceedings of the Society of Antiquaries of Scotland*, 1903.

durable, is fairly elastic. The value of ash for tool handles and the like is recognised at the present day.

Pyrus aucuparia, used as a shaft for a hammer (No. 1, Table), and also as a shaft for a gouge (No. 3, Table), was probably procured locally, for twigs of this species were found, in some cases with bark attached, among the material from the refuse pits. It is probable also that the birch used as a pick-handle (No. 2, Table) was similarly derived. Both birch and rowan are hard and tough woods which do not readily split.

. . . . .

TABLE.

Definite Objects received for Identification.

No. 1.	Shaft of hammer from Pit VIII., ...	Rowan	(*Pyrus aucuparia*).
2.	Shaft of pick, . . .	Birch	(*Betula alba*).
3.	Shaft of gouge from Pit VIII., ...	Rowan	(*Pyrus aucuparia*).
4.	Fragment of a spear shaft from Pit VIII., . .	Hazel	(*Corylus Avellana*).
5.	Shaft of an axe, . .	Hazel	(*Corylus Avellana*).
6.	Shaft of a large hammer, .	Hazel	(*Corylus Avellana*)
7.	Handle of a chisel, . .	Hazel	(*Corylus Avellana*).
8.	Shaft of a large pick, .	Ash	(*Fraxinus excelsior*).
9.	Wood from Pit VIII., .	Ash	(*Fraxinus excelsior*).
10.	„ „ .	Oak	(*Quercus robur*).
.	. . . .	.	.
12.	End of a shaft taken from the socket of a javelin head of iron, from ditch in earlier part of fort, .	Hazel	(*Corylus Avellana*).

7. Underplanted Larch Plantations at Novar.

By William Mackenzie.

It is a silvicultural impossibility in these days to grow a full healthy crop of larch. This has been found to be the case at Novar, and it may be said to be the case in most parts of Scotland, England, and Ireland. Larch, as is generally known, is peculiarly susceptible to a fungoid disease, which if given full sway would do an irreparable amount of damage. Attempts have been made heretofore to fight this disease, with only mediocre success, but the system employed at Novar we find, so far, to be a satisfactory solution of the difficulty—that is, we anticipate having a fuller crop of larch at the end of the rotation than would otherwise be the case. All arboriculturists aspire to the successful cultivation of the larch, because, when compared with other wood, the profit from its sale is considerable, and it can be placed on the market at almost any age, which makes larch plantations particularly fitted for planting with an undercrop.

It is my purpose to describe succinctly, but I hope comprehensively, this system of underplanting, also the history of the development of the undercrops, and the condition of the plantations as a whole. We have, as I have already indicated, to fight against larch disease, and we aim at having the fullest possible crop of larch.

The larch is now planted pure. When the plantations reach the age of from 12 to 15 years the diseased stems are cut away, and none but the soundest and healthiest are allowed to remain, these usually numbering 350 to 600 per acre, according to the activity of the disease. The cut stems can be utilised down to those $1\frac{1}{4}$ inches in diameter, which goes to show that the havoc wrought by the disease can be made good to a certain extent. Scots fir at that age, it may be here remarked, is quite useless.

All sizes of larch posts find a ready market. Posts of $3\frac{1}{2}$ inches diameter are sold at 4s. per dozen; 2 to 3 inches diameter, 3s. per dozen; $1\frac{1}{2}$ inches diameter (sheep net stakes), 2s. per dozen; and $1\frac{1}{4}$ inches diameter, 1s. 6d. per dozen. The first thinnings realise something like £5 an acre, and as time goes on the value of subsequent thinnings grows proportionately greater. What cannot be used is gathered into small heaps

and burned. No time is lost in stocking the thinned area with an undercrop, 2-years' seedlings raised in the home nursery being used for the most part. The species used are those that can endure the shade of the 350 to 600 larches that have been retained per acre.

Areas have been planted with *Abies Menziesii*, *Thuja gigantea*, *Abies Albertiana*, *Abies grandis*, *Cupressus Lawsoniana*, *Cupressus macrocarpa*, *Cupressus sempervirens*, *Picea nobilis*, *Picea abies concolor*, spruce, silver fir, Douglas fir (Colorado, blue), and beech. Their cost is not much more than that of the more common forest trees. In fact the revenue from the first thinnings covers the cost of the cultivation of the plants from the seed and the cost of their subsequent planting-out as an underwood. An acre can be planted at from 20s. to 30s. The ground being in a fine friable condition for the reception of the plants, a man by using a dibble can plant 1000 trees a day.

Usually about 2000 trees go to the acre, and the undercrops are introduced at the rate of 30 acres a year. One thing that tends very materially to aid the development of the undercrops is the immunity of the estate from rabbits, hares, and deer, which has been brought about by persistent and unremitting attention. The system would be quite impracticable if a different state of affairs existed, unless of course one set about enclosing the areas. When planted, the young trees make rapid headway, and one noticeable effect throughout the plantations is the destruction of the rank grass and similar herbage; this is productive of no end of good. Another effect brought about through the agency of the underwoods is the formation of a valuable humus which aids the growth of the larch as well as of the younger trees. Once the underwoods have attained a certain height, and the destruction of the herbage has taken place, there need be no apprehension of the disease spreading to any serious extent. The system is as simple as it is effective. A plantation thus cultivated is much easier to manage than one composed of a variety of even-aged species. The former practice of thus mixing the larch with species having denser foliage—Douglas fir, *Albertiana*, spruce, silver fir, beech, etc.—for combative purposes has, when compared with the present system, very little to recommend it. The contention was that by surrounding each individual larch with other species immune to disease, the chances of the disease spreading would be very remote. This isolation

of the individual larches no doubt acts as a barrier to the spread of the disease and the density of the plantation is undoubtedly effective in the destruction of herbage, and in the formation of valuable humus; but when we consider that, by this method, only a comparatively small number of larches can be accommodated on an acre, and when we remember how profitable is the successful cultivation of this particular species, and the uncertainty of there being a great demand for other species, we realise that the system calls for improvement. The substitution of the present system for the one just referred to is a step in advance which will yield, we hope and believe, a satisfactory return. The even-aged mixing of larch with other species is now, so far as concerns Novar, an effete phase of silviculture.

The underwoods range in age from 1 to 10 years. The first undercrop was planted in 1899, in the Crosshills, where larch disease was at one time very prevalent, and the species used were *Abies Menziesii* and silver fir. The *Abies Menziesii* forged ahead at a greater rate than the silver fir, and in their case left nothing to be desired. The silver firs on the other hand seemed to be kept back on account of attacks by *Aphis*. They however continued to develop, till now they range in height from 4 to 14 feet. In 1903 plots of Douglas fir, *Thuja gigantea*, and *Abies Albertiana* were planted out. The larch is now 23 years old, and the underwoods 10 years and 6 years. The growth of the *Abies Albertiana* and Douglas fir was remarkable, the average rate of growth of the different species being from 1 to 2½ feet per annum. The following table will give an indication of the heights of the various species and the number of larch standards per acre.

CROSSHILLS.

Silver fir, 4 to 14 feet high.
No. of standards per acre, 350.

Abies Menziesii, 10 to 21 feet high.
No. of standards per acre, 350.

Douglas fir, 5 to 15 feet high.
No. of standards per acre, 500.

Thuja gigantea, 4 to 10 feet high.
No. of standards per acre, 460.

Abies Albertiana, 5 to 10 feet high.
No. of standards per acre, 480.

The first undercrop of *Abies grandis* was planted on Assynt Hill in 1904. Here, too, the disease had made great headway.

The larch is now 24 years old, the number per acre being 600, and the height of *Abies grandis* ranges from $3\frac{1}{2}$ feet to 8 feet. On the whole satisfactory results have been attained from all the species, but particularly from the underwoods of *Abies Albertiana*, *Abies grandis*, and Douglas fir. The plantations give every indication of doing very well in the future, and if the underwoods maintain a reasonable rate of development until the end of the 80-years' rotation, when they are expected to come up to the larch, there will be an enormous crop of wood for utilisation, with the fullest possible supply of larch. The rotation need not necessarily be one of 80 years, as the felling will depend more or less on the condition of the wood, the locality, and the state of the market at that time. What revenue may be derived from the wood as a whole can only be conjectured at this stage, but there is no reason to anticipate anything but a profitable and satisfactory return.

8. Continental Notes—Germany.

By B. Ribbentrop, C.I.E.

(*With Figures.*)

1. On the Use of Manure with Cultural Operations in Nurseries and in the Open Forest.

Various manures have been experimented with for years; but, though decidedly favourable results were obtained with many composts, none were better, at least in the case of conifers, than those produced with raw humus (dry peat) pure and simple, which at the same time is cheaper than any of the compounded artificial manures. Some foresters will probably look down upon the results obtained from experiments made in laboratories and botanical gardens as entirely unsuitable to practical silviculture; but, nevertheless, such home tests give incontrovertible information in regard to the influence that certain components of the soil have on the growth of certain species, and they show the most advantageous manner of preparing and mixing soils which in nature are almost invariably found in distinct layers. Whether, and to what extent, such knowledge can be applied in practice, are questions which the silviculturist must decide on the merits of each case.

Dr A. Moeller has made exhaustive experiments with box

cultures. The soil he used, in the first instance, was a fairly fresh, deep sand, of mean fertility, overlaid by a dry, bilberry-growing, peat. He sowed Scots pine separately in pure peat and in pure sand. The growth of the seedlings in the peat averaged 15 centimetres during the first, and 14·8 centimetres during the second year; but in the sand they reached only 4·3 and 5 centimetres respectively. It will at once be understood that this experiment is of purely scientific value only, for in practice malgermination and drought would almost invariably render sowing on pure dry peat futile.

Moeller next mixed dry peat and sand in varying proportions, and in every instance found that sowings on this mixture were satisfactory. By an ingenious arrangement with lamp glasses, one of which was filled with peat the other with sand, he proved that the roots of the young plants would always follow the former. He also changed plants from sand to peat, and *vice versâ;* and by the results he demonstrated that the frequently expressed belief that plants intended for poor soils should be raised under similar conditions is untenable.

Stress has often been laid on the existence of numerous varieties of raw humus and dry peat; and on the strength of this it has been argued that, though some of them might be harmless and even useful, others were inimical to arborescent vegetation. Dr Moeller obtained a fairly large consignment of the admittedly worst description of dry peat from the Lueneburger Heide, which, in its place of origin, had been under a cover of *Polytrichum*, *Leucobryum*, *Calluna*, *Arctostaphylos*, *Molinia*, *Vaccinium Myrtillus*, and *Vaccinium vitis idœa;* but the experiments made with this gave results no less favourable than those with other varieties of peat considered to be of a milder character.

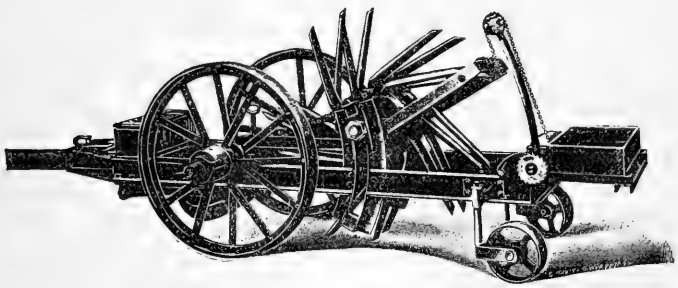
Amongst other experiments in the forest garden, Dr Moeller planted a few equally developed three-year-old Scots pine, some in unprepared sand, and others in sand richly and repeatedly manured with dry peat; the results, as regards the best plant in either case, were recorded as follows :—

Length of annual shoot—	Unmanured.	Manured.
1903 .	12 centimetres	13 centimetres
1904 .	7 ,,	26 ,,
1905 .	7 ,,	26 ,,
1906 .	5 ,,	40 ,,

	Unmanured.	Manured.
Average length of leaves—		
1903 .	2·8 centimetres	5·6 centimetres
1905 .	3·5 ,,	7·5 ,,
1906 .	2·5 ,,	6· ,,
Increase in diameter—		
1903 .	1·2 centimetres	1·3 centimetres
1905 .	1·3 ,,	3·5 ,,
1906 .	1·3 ,,	4· ,,

In October 1903, a circular was issued from the Prussian Ministry, directing that, in all suitable localities, experiments should be made to ascertain the practical value of raw humus as a forest manure. Areas were to be selected which had the same conditions of growth throughout; on parts thereof the raw humus was to be mixed with the underlying soil; in others the dry peat covering was to be removed, and the soil was to be prepared in the customary manner. Both portions were to be cultivated with conifers in an identical way either by sowing or planting. The experiments were to take place both in nurseries and in the open forest. The reports on three years' experiments, received from a large number of forest divisions, were placed by the Government at the disposal of Dr Moeller, and extracts from them are now before me. In nurseries, where the necessary attention can be given to the preparation of the soil and to weeding, dry peat has, almost unanimously, been accepted as preferable to all artificial manures. But the necessity of covering the prepared soil with a thin layer of sand was soon recognised as advisable, in order to ensure a more regular germination, to protect the young seedlings against drought, and to give them a start of the weeds, which also grow more luxuriously on manured soils. As might have been expected, the reports regarding the advisability of peat-manuring in open forests vary considerably; for whereas the opinions received from some thirty forest divisions are decidedly favourable, those from an even larger number are against it. The chief objections urged are:—bad germination of the seed on a surface of which dry peat forms a large part, greater danger from drought, a more vigorous growth of weeds, and, finally, the increased cost. However, it is frequently acknowledged, even where adverse opinions prevail, that plants which have escaped the calamities to which manuring with dry peat has exposed them, show a development superior to that of those grown on corresponding unmanured areas.

Schroetter and von Oertzen, well-known silviculturists, have, under favourable local conditions no doubt, for years manured their open pine cultivations with peat, and have found that a thin covering of soil mixed with sand entirely removed all the dangers complained of. The question of additional cost is a grave reality with which the silviculturist has to reckon; for it is not sufficient that the dry peat should be turned under, which can be affected by some kinds of steam plough, but it should be well mixed with the mineral soil, and, in the case of sowings, it should be covered with a layer of sand or virgin soil. The instruments constructed in Germany for mixing a deep layer of dry peat with the mineral soil avowedly fall short of the purpose; for either they are not effective enough, or they require too much draught power. Unquestionably, however, the problem



THE KAEHLER WUEHLGRUBBER.

will ere long be solved, since two facts have been realised, viz., that a universal manuring with dry peat is desirable, and that the present forest ploughs are entirely useless for this purpose. In Denmark great advances have already been made in this respect, and instruments of Danish construction are being introduced into Germany.

Since writing the above, I have ascertained that a grubbing plough of German construction has been on trial for some years past in various forest districts in the north of Germany, and that, as the results were in every instance entirely satisfactory, it was quite recently brought to general notice in a publication by Senator Geist of Waren.

It is called the "Kaehler Wuehlgrubber," and is constructed at the iron foundry of Heinrich Kaehler-Guestrow in Mecklenburg. The above sketch gives a very fair idea

of its construction. The first trials with the grubbing plough took place in 1902-1903, in the town forests of Waren, on an area of 30 hectares (66 acres). The soil of the trial area is described as dry, firm, gravelly sand, overlaid by dry peat up to a thickness of 12 centimetres, and covered with a somewhat dense growth of grass and shrubs, characteristic of such localities. Since then similar cultivations of Scots pine have been made over more extensive areas, with broadcast sowings, sowing in strips, and in drilled furrows, and with planting. In some cases the whole area was grubbed, but more recently this has been done only in strips 50 centimetres broad with the same distance between them. The plough thoroughly loosened the soil to a depth of 50 centimetres, and the results were in every instance quite exceptional. Experience in Waren has shown that it is absolutely essential, especially when sowing is contemplated, that the grubbing should take place in the preceeding summer or autumn, and that the levelling of the area or strips should be done as early as possible in spring. The cost of grubbing 50-centimetre strips varies in accordance with the surface cover, but the maximum in Waren has not exceeded 36 marks for 10,000 running metres. The same applies to the cost of levelling. When the surface cover is light, and does not contain many roots of heather, bilberry, etc., this can be done with small 50-centimetre-broad harrows at a cost up to 10 marks per 10,000 running metres; when sowing is contemplated, three to four harrowings are to be recommended. When the surface cover is dense, and the soil contains many hard roots, levelling by hand labour is preferable; and this has the additional advantage that the surface can at the same time be covered with a thin layer of sand, thereby giving a better bed for germination. The cost of this operation has varied in Waren from 10 to 15 marks per 10,000 running metres. When planting is resorted to, the levelling need not be so thorough, but the strips should be well trodden down before the plants are put in. The growth of grasses and herbaceous plants, unquestionably encouraged by the deep grubbing, has been easily kept in check at the cost of from two to six women's day's-wages per hectare; in some cases a repetition of this was found necessary in the second year. Drought has caused no trouble in Waren, which is notoriously one of the driest places in Germany.

The young Scots-pine cultures at Waren show, even on the driest and poorest spots, an absolutely exceptional growth, and are characterised by an early and healthy development of their tap-roots, which may be ascribed to the fact that the grubbing plough not merely mixes effectively the dry peat and rich surface with the soil, but thoroughly disturbs and loosens it to a depth of 50 centimetres. The cost of the grubbing plough is given by Senator Geist as 1250 marks, but a price list can doubtless be obtained from the manufacturers. In Waren a team of six ordinary agricultural horses has in every instance sufficed. Oberforstmeister von Maltzan, the head of the Mecklenburg forest service, inspected the Waren cultivations on several occasions, and in 1908 wrote:—"A new and original method of preparing the soil for pine cultivation, by means of the so-called Kaehler grubber, has during the last five years been in progress in the town forest of Waren, at first on a trial area of some extent, but later on a larger scale. The advantage of this method is that, whereas the old forest plough threw the rich surface soil aside, the grubber thoroughly mixes the food-materials contained therein with the soil, and renders them directly and easily accessible to the plants. The advantages of this are very evident. The young plants are extraordinarily luxuriant and healthy, and I have never seen a better growth of Scots pine. On my recommendation, cultivation with the grubber has been introduced into the forest district of Malchow, and equally brilliant results have been obtained. The extraordinarily rapid growth of plants on grubber-prepared soil, and the absence of blanks, render these cultivations independent at a very early age. These excellent results make the more general use of the grubbing plough desirable, and I should consider it entirely wrong to return to the old forest plough." The officer in charge of the Malchow forest division had evidently to do with conditions somewhat more difficult than those at Waren, as he had to employ eight horses, and in almost every instance had to resort to levelling by manual labour; but, nevertheless, his maximum cost did not amount to more than 55 marks per hectare. As regards the results, he writes that he has cultivated considerable areas on grubber-prepared soils, that repairs were nowhere required, that the various ailments from which pine culture so frequently suffers were absent, and that the appearance of the grubber cultures is absolutely phenomenal in comparison with that of

other pine cultivations in the same district. The initial cost of cultivating with Kaehler's grubbing plough is perhaps somewhat in excess of that with the forest or deep soil plough; but any practical forester knows that, in the latter case, the original cost represents but a fraction of the total. The grubbing plough has since been introduced into several forest divisions in the north of Germany, but it is too early to expect detailed reports.[1]

2. On Methods of Planting.

The answers to the ministerial inquiry contain, as yet, but little information on planting with dry peat; but, as far back as 1896, the late Dr Ebermayer made experiments on a fairly large scale, adding a mixture of raw humus and sand in each plant-hole. The results have proved entirely satisfactory, and show a marked difference from the poor and disappointing cultivation on adjacent unmanured ground. Numerous similar planting operations were, in the course of years, carried out in the Upper Palatinate and elsewhere with invariable success.

It is evident that individual manuring is quite incompatible with notch-planting. This ghastly, unnatural method has been practised in Germany for nearly three score years and ten, and even now dies hard and all too slowly. It was introduced because it required the smallest initial outlay and was believed to save time, and it was, for these reasons, adopted and prescribed in numerous working-plans. Many years ago, some of Germany's leading silviculturists protested against it, but cheapness carried the day, and liberty in regard to individual action was then much more restricted than now Of late years, a good many foresters have obtained the best results from planting in dug-out holes with properly chosen soil. Forstmeister Splettfloesser is particularly qualified to lead a renewed attack on notch-planting, as he has in his forest division over 2000 acres of Scots pine planted in this manner, and has during the last twelve years made this subject a special study. He has, during this time, dug out annually thousands of dead, diseased, and sickening young pines, has examined their root development at various stages of growth from the age of one to twelve years, and has compared it with that of trees of corresponding age naturally reproduced or planted in holes. In the case of notch-planted specimens, he invariably found a badly developed tap-root

[1] [We hope to see the Grubber tried at Inverliever.—Hon. Ed.]

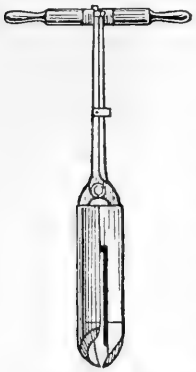
with side roots, many of which were overlaid, doubled up and wounded, growing in two directions only, whereas in more rationally grown young trees the tap-root was much better developed, and was, from the first year's growth, entirely surrounded by numerous side roots.

Splettfloesser gives, amongst many, an interesting example which is worth quoting. On a forest soil, in a locality very favourable to the growth of grass, Scots pine was sown some twenty-five years ago; it germinated irregularly, and many of the young seedlings were smothered. During the next and the following years, the blanks were restocked with notch-planted yearlings. The original seed-grown pines have reached an average height of 8 metres, with a 14-centimetre diameter, and a tap-root 2·5 metres long; whereas the notch-planted trees are at least 3 metres shorter, with a diameter of only 4 centimetres, a tap-root only 0·5 metres long, and a two-sided root development. On waste lands this two-sided root development causes an earlier and more certain death than usual; but even on forest soils, though the young trees make the most strenuous efforts to regain that balance which nature intends them to have, they but rarely grow into structurally valuable timber, and are always more liable to be blown down than trees grown with an all-round development of side roots. Splettfloesser concludes his indictment with the, perhaps a little overdrawn, but generally just, statement: "If 15,000 pine yearlings are notch-planted per hectare, there will be 15,000 young trees with a two-sided root development, 15,000 with more or less twisted, overlaid, and wounded roots, 15,000 stricken by chronic infirmity." Taking everything into consideration, the cost of repeatedly filling up blanks, the inferiority in size and quality of the material produced, the probability of lowering the productive power of the forest soil, and the possibility of ruining it permanently, *notch-planting* is, unquestionably, the most penny wise and pound foolish silvicultural method ever introduced.[1]

In numerous forest divisions in Germany and Austria, planting with a hollow borer has been adopted, mainly because it is considerably cheaper than planting in holes dug with the spade. The best known amongst the various instruments of this kind used are "Heyers Hohlbohrer" and the "Jansa." This latter is an Austrian invention, and is very widely used in

[1] See page 111.

that country, especially for planting seedlings with the original earth round their roots. As the plant is taken up by the same instrument with which the plant-hole is made, the ball of earth round the roots fills the latter exactly and no disturbance in the growth is experienced. On forest soils of the better classes, where neither a deep working up of the surface nor manuring are required, the Jansa answers well, but like most implements of its kind, it has two serious defects. It requires considerable force to press it into the ground, especially when the soil is penetrated by numerous small roots, and the holes cannot be made deeper than the length of the cylinder.



THE ROHRWIESER HOLLOW BORER.

The Rohrwieser Hollow Borer[1] has neither of these drawbacks. It enters the soil by means of a rotatory cutting motion which requires a minimum of force, and is effective even where the ground is full of roots, so long as the blades are kept sharp. It works easily up to a depth of 60 centimetres. The instrument, as will be seen from the accompanying drawing, is not complicated, and the use of it is very simple. It is pressed in to the ground, and a double turn fills it to a depth of 20 centimetres with soil, which, when the borer is withdrawn and one side of the cylinder loosened, is deposited near the plant-hole; a second such operation will deepen the plant-hole to 40 centimetres, which may be increased up to 60 centimetres. The best of the soil near the hole can then be selected for planting, and if it be insufficient more surface soil can be bored out in the immediate vicinity, or peat can be added, if it be obtainable.

The actual planting is done in the following manner:—The plant, being properly shaken, so that the roots may assume their natural position, is held by one hand in the middle of the plant-hole, at the proper height. The soil is then dibbled in with the other hand; long side roots are, where necessary, placed in their proper position, the hole is filled in to the top

[1] The only makers in Germany are Messrs Bach & Mahlow, Berlin, C. 54. Sophien Str., 32-33. Any good blacksmith in this country could easily copy it; the cutting edges must be of good steel and sharp. [A specimen of the implement may be seen in the Edin. University Forestry Museum.—HON. ED.]

and pressed flat. It is evident that such planting requires a certain amount of skill, which, however, experience has shown, is easily acquired in a few days, especially by women. If considered advisable, a very simple instrument may be used for holding the plant in the middle of the plant-hole and at the right height. This is naturally much safer, but slows down the rate of planting to some extent, and thereby adds four to five shillings per hectare to the cost. The roots are by this method of planting placed in their natural position, and though the longer ones may hang down a little, which is unavoidable, experience has shown that they begin at once to grow upwards and outwards, and that, even in the first year, the whole root-system has penetrated the walls of the bore hole.

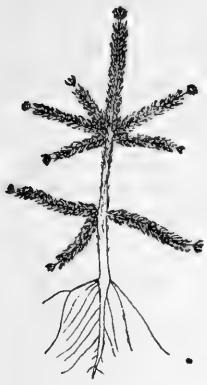


FIG. 1.

It has been observed that seedlings thus planted, frequently, in the first instance, devote their main energy towards the development of their root-system, and for this reason do not show immediately appreciable pro-

FIGS. 2 3 4

gress above ground. In many instances the first efforts of a notch-planted seedling are more evident in this direction, but there is no comparison in the second and third years. The accompanying sketches show three-year-old seedlings, drawn to scale:—1, planted with the Rohrwieser borer, the best soil obtainable from the bore hole being used, but no special manure being added; 2, 3, 4, notch-planted in the same locality.

In the forest division Rohrwiese, in West Prussia, planting with the borer has gone on for seven years, and practically no repairs have been needed. The operations are very extensive, aggregating some 85 hectares per annum; and as they are carried out on a great variety of soils, ranging from loose moving sands to loam, penetrated by beech and hornbeam

roots, and comprising both forest land and waste, a fairly accurate estimate of the cost can be gathered from the records. The scale of wages for unskilled labour is low in West Prussia—two shillings a day of ten hours for men, and half that sum for women. As planting with the borer requires no particular strength, women are almost exclusively employed on this work in Rohrwiese. If the conditions of soil and weather are particularly favourable, one woman can make 1200 bore holes a day, and a second can plant them up, especially if they change about. However this is by no means usual, and though, as a matter of fact, 17·5 hectares have been planted for 18 shillings per hectare, exclusive of the cost of the plants and their transport, the average cost works out to 55 shillings the hectare for old forest soil, full of roots, and to 31 shillings for waste land, bored to a depth of 45 centimetres. Even these rates are over 30 per cent. less than the cost of planting in spade-dug holes.

Considering that there are practically no failures, this method is probably the cheapest of all, and is well worth a trial in this country.[1] The same instrument, slightly modified so as to give room for the upper growth of the plant, can be used to take up seedlings, with 20 centimetres of the original soil, in the same way as the Jansa. Planting in this way has the advantage that it requires no skill whatsoever; but it is somewhat more expensive, mainly on account of the transport of the planting material. Though, by using the Rohrwieser hollow borer, the deeper bore hole can be filled with rich surface soil and manure up to 20 centimetres from the surface, the local authorities prefer planting with naked roots, but then they have by this time a trained, skilled planting staff at their disposal.

3. On Mixed Forests.

The following statement was made by Erdmann at a recent sitting of the North-West German Forest Union:—"No pure coniferous forests exist in the North-West of Germany, which have retained the same degree of perfection, through two, much less three or four rotations, with the same species." Similar complaints regarding the gradual deterioration of pure forests come from the Harz Mountains, and from other parts of Prussia, and remain uncontradicted and unchallenged.

[1 We hope to see it tried in the Plantations at Inverliever.—Hon. Ed.]

There is nothing new in this, for the advantages of mixed forests have been fully recognised, ever since forestry became a science. The reason why the correct theory was so frequently neglected in practice was greed. The pine and spruce promised, especially on inferior soils, a better and more rapid financial return than a mixed forest, and risks were taken. Well known facts, such as the amelioration of the soil by an intermixture with broad-leaved species, the protection insured thereby against storms, snow, drought, insects, fungi, etc., were ignored. In the hilly regions, the beech was deliberately driven back by pure spruce forests, planted on clear fellings of the former; in the plains, oak, beech, hornbeam, etc., were made to retire, on all but the best soils, before pure conifer afforestations, and that in face of the fact that, under proper treatment, these species can exist and thrive in silvicultural harmony with each other.

Now, since the mischief is done, and becomes more and more evident, the question of re-creating mixed forests gains day by day more adherents. Opinion, as expressed at several forest conferences, was generally in favour of under-planting the existing pine pole forest, even in cases where this was not rendered imperative by disease or by an inferior growth of the pine, with oak, beech and hornbeam, on pine soils of the first and second class; omitting the oak, and adding the acacia on poorer soils. This presents no great difficulty, and has already been carried out in many instances with good results, and even better prospects, for the growth of the pine has been visibly accelerated, and the improvement of the soil secures better conditions for the growth of the next generation.

As had already been pointed out by Dr Albert, experience has shown that such under-planting can easily be over-done, and that too dense a cover by broad-leaved species acts harmfully rather than otherwise, especially on inferior soils, by impeding the decomposition of the dead surface-cover. The re-establishment of the much desired mixture of beech and spruce in the hill forests of Northern Germany, which are at present occupied by pure spruce, is a very much more difficult problem. The planting up of clear-fellings, in alternative strips, with beech and spruce, has failed altogether, because, in accordance with the elevation, either the one or the other species has become dominant.

4. On Forestry in the German Colonies.

Forestry in Kamerun, Togo and South-West Africa is, as yet, in a purely experimental stage. Some actual progress had been made in the last-named colony, where large areas exist, with favourable conditions as regards soil and water, but all was destroyed during the recent rebellion and a new start had to be made.

In German East Africa, thirty forest reserves aggregating 220,000 acres have been secured, and settlements have been completed in regard to additional areas of 170,000 acres. Satisfactory progress has been made with road-making and cultural operations. The Indian Government has assisted with a liberal supply of seeds of various kinds, chiefly teak and bamboo.

The forest report from Kiautshao is very interesting in a small way, for, like everything else in that flourishing colony, it is alive and progressive. The growth of arborescent vegetation, including acacia, Scots pine, the Japanese larch and other conifers, is quite abnormal; only the oak lags behind. The market for all forest produce is very extensive, and the prices realisable, even for the smallest twigs, are extremely high. The afforestations, in the area acquired by the Government, extend as yet to only 200 acres, of which about 80 are occupied by acacia and the rest by mixed forest. Forest fires, almost invariably traceable to carelessness at funerals or other Chinese festivities, were in the beginning a great source of danger, but are now much less frequent, and have been entirely kept out of the newly afforested area by means of a broad safety-belt of acacia. The chief danger consists in invasions by *Gastropacha Pini*. On one occasion seventeen millions of caterpillars were collected in June and July, but until the projected transformation into broad-leaved forests of the old, comparatively valueless, malformed pine forests, of Chinese origin, which touch the present afforestations on two sides, has been completed, this danger from caterpillars will not cease to exist. Hares were another great nuisance, and for a time defied the most approved of patent mixtures, but they finally gave way before a very thin mixture of lime and carbol. Chinese thieves had also been very troublesome for a time, but have gradually found out that theft from a Government forest is not a profitable business.

Experiments with the cultivation of fruit trees have been very successful. The Chinese have large numbers of apple trees and pear trees, but neither kind bears edible fruit. Efforts have been made by the Forest Department, ever since 1902, to induce the people to graft their trees, and large numbers were budded for them, but the grafts were destroyed, because the inhabitants would not believe in the disinterestedness of these efforts, and thought that by grafting the Government intended to acquire some sort of a right over the trees. However, this mistrust has disappeared, and in 1906 the demand for grafts could not be met, though 66,000 were distributed. The fact that in 1905 the first fruit from grafted trees that came into the market was highly approved of, and realised good prices, had evidently considerable influence on this sudden demand for grafts. It has been suggested that fruit growing, which may involve a retail trade and perhaps canning, is hardly a legitimate Government business, and private enterprise is invited to step in where the Government has shown the way.

California is as yet the only source of supply for the whole of the Chinese coast and the numerous steamers plying in those regions.

9. The Timber Trade Conference.

By Geo. U. Macdonald.

A British Timber Conference, under the joint auspices of the Royal English Arboricultural Society and the Timber Trade Federation of the United Kingdom, was held on Wednesday, the 16th day of June 1909, in the office of the London Chamber of Commerce, Oxford Court, Cannon Street, for the purpose of discussing "Questions of interest bearing upon the improvement and development commercially of the growing and utilisation of native timber in the British Isles."

At the present time, the whole question of forestry is receiving more attention in the country, and more favour and support from the British public, than it has hitherto done. It was, therefore, a happy thought on the part of those responsible for the convening of the Conference, to bring together for the discussion of common objects men whose whole lives and interests have been devoted in one form or another to this

subject. Judging from the number of valuable papers read, and the discussions which followed on the various points raised, one is forced to the conclusion that the Conference has given a further gratifying stimulus to the forward movement.

No better way can be conceived in which to help forward the cause of forestry than to see the growers, sellers, buyers, and converters of timber, meeting on one common platform, and by their united efforts seeking to devise the best means of promoting their common interests. Unity is strength, and if only all those who are personally interested in the British Timber industry would realise the enormous influence which, acting in a body, they would command if all were working for one common end—that of helping one another—then many of the obstacles which now hamper the commercial development of forestry would soon be overcome In the words of the President of the London Chamber of Commerce (Sir Albert Spicer), "Legitimate differences will no doubt always exist between buyers and sellers as to the price and merits of the article in which they deal; enlightened self-interest in these strenuous times should bring them more closely together where they have common difficulties and common grievances."

The subjects dealt with were—"Railway Rates for Native as compared with Imported Foreign Timber;" "Extraordinary Traffic;" "The Rating and Taxation of Woodlands;" and "The best means of encouraging the Consumption of Native Timber." All will agree that these questions are of vital importance in connection with the commercial development of forestry.

With regard to "Railway Rates," it has for long been a standing grievance with both growers and buyers that round timber is charged for at a much higher rate than if it were sawn or "converted." Mr Hopton, the author of the paper on the subject, quoted various instances proving this to be the case, and showing that in every instance a decided preference is given to imported timber. He gave the actual rates on timber from the South of Ireland to London, *via* Milford Haven, from Dublin, *via* Holyhead, and from Belfast, at 15s. per ton. On the other hand, the rate from the Continent, *via* Southampton, is only 12s. 6d.; and he went on to say that since the rates for timber to any of the points between the ports mentioned and London, or over any equal distance are far in excess of the rates to them

from the Continent, it would be cheaper for the merchant to procure his raw material from places outside England, than to attempt to buy within a fair distance of his mills or factory. This applies to all lines having continental connections.

Railway managers, he said, have often stated that they are guided in fixing rates by such considerations as the following:— 1. Bulk as compared with weight. 2. Value. 3. What the traffic will bear. With regard to the last of these, the writer heartily concurs with him when he says, "It is well known to growers of timber and merchants that, owing to the high through rates quoted for native timber in its rough or partially manufactured state, practically nothing is left to the growers after all charges are paid. It is therefore necessary, in the general interest of the community, to make such alterations in the present conditions of transit that if more favourable terms are given to any one they should be granted for the benefit of home products upon which revenue has been obtained." He stated also that on the Continent a system contrary to that pursued by the English companies is in operation, more favourable rates being given for exported than for imported timber, a rebate of 25 to 50 per cent. on the rates being allowed when timber is sent abroad.

To remedy the injustice of existing timber rates, Mr Hopton suggested the adoption of equal mileage rates applicable to all descriptions of unconverted timber, and that these rates should be lower than those for manufactured or partially manufactured wood.

In the discussion which followed the reading of Mr Hopton's paper, most of the speakers were agreed that it would be of incalculable value to all interested in the British timber industry if the railway companies would fix a uniform mileage rate which could be published in the rate book, in order that the cost of transport between any two points could be accurately arrived at, instead of the rates varying from every point as at present. Several instances were quoted to show the absurdity of existing rates. One gentleman gave the following example:—"For English sawn timber I have one rate for 183 miles at 20s. 10d. per ton; then I have another rate for 199 miles at 15s. 10d., which is 5s. per ton less. So that they carry the stuff fourteen miles further and charge 5s. less."

In Scotland we find that similar conditions prevail, and an owner having considerable quantities of timber to dispose of is

put to great trouble before he can ascertain from the railway companies the rates that are in force in the different localities.

On the motion of Mr Springall, seconded by Mr Elwes, the following resolution was thereafter adopted:—"That in the opinion of this Conference, representing growers, agents, merchants, and others interested in the production, sale, distribution, and conversion of native timber, it is desirable, with a view to the encouragement of native industries, that the rates and arrangements applicable to the carriage of timber by rail should be the same for native as for foreign timber (following the Canal Acts); and that the Associated Railway Companies should be urged to remove the existing anomalies: that the Royal (English) Arboricultural Society and the English Section of the Timber Trade Federation should be recommended, jointly and separately, to take steps with this object in view: that copies of this resolution be sent to the Associated Railway Companies, to the Board of Trade, and the Board of Agriculture; and that the latter department be approached with a view to promoting legislation to amend the existing Acts of Parliament."

"Extraordinary Traffic" was the subject of a paper read by Mr Ernest Charles, barrister-at-law. All are agreed that the law on this subject, which is applicable both in Scotland and in England, often bears very harshly on both landowners and timber merchants. The different district authorities apply various interpretations to the Act of Parliament, with the consequence that buyers of timber have to be very chary of offering a reasonable price for large quantities, by reason of the risk that after the wood has been removed the district authority may step in and make a claim against him of several hundreds of pounds for extraordinary traffic. Some people are under the impression that it is only when traction engines are employed for haulage purposes that a claim of this description can be set up: but this is by no means the case, as only recently the writer knew of a claim made against a timber merchant for extraordinary traffic although the haulage was all done by horses, and the weight of the loads rarely exceeded one ton. If the afforestation of large areas of waste land in Scotland and England is ever to become an accomplished fact, then it must be seen to that this obnoxious Act is either amended or expunged from the Statute Book.

Mr Charles said: "Extraordinary traffic—according to the

plain use of the language—is traffic which is not of the common order of traffic; and it has been defined by Lord Justice Bowen as follows:—'Extraordinary traffic is really the carriage of articles over the road at either one or more times which is so exceptional in the quantity or quality of articles carried, or in the mode or time of user of the road, as substantially to alter and increase the burden imposed by ordinary traffic on the road, and to cause damage and expense thereby beyond what is common.'" Mr Charles explained this definition under the four headings, Quantity; Quality; Mode of User; and Time of User; after which the following resolution was adopted:—"That it is desirable, as far as is practicable, that the Royal English Arboricultural Society and the Timber Trade Federation should watch all claims in respect of alleged extraordinary traffic with a view to resisting them in approved cases, having regard to the common interests of vendors and buyers of native timber."

"Rating and Taxation of Woodlands" was very ably treated in a long paper by Mr Leslie S. Wood, F.S.I., which led to a lengthened discussion amongst the members. After defining the various methods by which these rates and taxes are at present levied, Mr Wood pointed out that if afforestation is to be encouraged, the rating and taxation of woodlands must be so adjusted as to relieve landowners of the present heavy burdens with which they are charged before the crop is fit to be realised at a profit; and he suggested that to encourage good and systematic management, the Government should make remissions to private owners to lighten their rates, taxes, and death duties. If such remissions were made, it would be entirely with the object of encouraging work in the woods and of providing additional employment in the country. Consequently, it would be advisable to divide the owners into classes, and to provide a scale accordingly:—Class 1 would comprise those who entirely neglect their woods, and who would not be entitled to any remission. Class 2 would be those who employ labour, but whose management is inferior, and who are entitled to benefit at the rate of say 6d. per acre per annum. Class 3 would be those whose management is good but is not conducted upon systematic lines, and who would receive say 1s. per acre. Class 4 would comprise those who are working their woods under a scheme or definite plan of cutting and replanting, and who would receive say 1s. 6d. per acre. There would thus be a

definite encouragement for every owner to carry out forestry operations, and to manage his woodlands upon systematic lines, in order to be put upon the higher scale, and with this would come increased employment all through the country, and encouragement to rural workers to remain upon the land.

On the motion of Sir Hugh Beevor, Bart., the following resolution was put to the meeting and carried unanimously:—"That it is desirable to appoint a committee, and to draw up a statement of the case of woodlands, as affected by the present system of assessment, for presentation to the Government."

"The best means of encouraging the Consumption of Native Timber" formed the subject of the paper read by Mr Murray Marshall, Deputy-Chairman of the English Timber Section, Timber Trade Federation, in which he pointed out the importance of setting out timber that is for sale as long as possible before the season for cutting, and of taking care to mark the trees so that they may follow on in rotation, and may be easily seen.

The right seasons for cutting timber should also be considered, as a great deal of timber deteriorates from being cut too late. The cutting of timber should also be regulated by the demand, care being taken to prevent a glut of any particular kind of timber; an overcrowded market is no good to either seller or buyer.

With regard to the substitution of foreign for home-grown timber, Mr Marshall remarked that "landowners, architects, and agents on many occasions use a large quantity of foreign timber when English-grown timber could be used; moreover, its use, while increasing the demand, would employ labour profitably and generally help the growth and consumption of native timber." He also drew attention to the recent tenders sent out by the Postmaster-General for the supply of telegraph poles, 2000 in all, and said he very much doubted if any native timber merchants tendered for these, as the conditions were so stringent. He then proceeded: "Now there must be thousands of larch poles in England and Wales suitable for this work, and yet they are not used. The following explanation will, I think, give the reason:—The contractor is required to send his poles to a certain port to be creosoted. This with cartage and railway carriage costs, on the average, 7d. per foot. Moreover, the poles have, before being delivered, to have the outer and under bark completely removed, and after this expense has been incurred, they may be rejected at the port, and the rejected

poles must either be returned to the suppliers or be sold at a poor price at the port. After the selected poles have been creosoted they have to be reloaded and sent to their destination by rail, and from there drawn out to the places where they are to be erected, costing another 6d. or more per foot."

After an interesting discussion, in which Mr Morgan, Controller of the Stores Department of the General Post Office, took part, the following resolution was proposed and adopted:—"That with a view to encouraging the utilisation of native timber, the various departments of His Majesty's Government concerned be urged to give a preference to such timber when inviting tenders for Government purposes, as far as practicable, consistently with adequate guarantees as to quality and suitability."

10. Continental Notes—France.

By A. G. Hobart-Hampden, late Indian Forest Service.

1. Although the State is an ideal forest owner, in view of its permanency, progress in the formation of Government forests is slow in these islands. There is, however, one direction in which we may possibly hope for more success. The municipalities of the United Kingdom are vigorous bodies, and not infrequently rich. They have the same qualification of permanency that the State has, and if the communes of the Continent can find in their forests a paying investment, as is the case, it may well be that when they see this our own municipalities may take to the idea. In this connection, then, it may be of interest to recount the action of the town of Pontarlier, in the French Jura. Fifty years ago the town owned 1185 acres of forest; to-day it owns 2018. During this period over three million trees have been planted. In the period 1868 to 1877 the forest brought in an average annual revenue of 41,000 francs, and ever since then the revenue has been slowly rising till it is now nearly 70,000 francs (£2800); and in all probability the rise will continue. The town has recently purchased for £3170 a private estate of 383 acres, a third of it already wooded, and in doing so has secured certain advantages, such as a water supply. The writer of the article from which we have been quoting, says—"Numerous and incontestable are, for communes, the advantages which the

ownership of forests has, as well for the communes themselves as for their inhabitants. The inhabitants of our eastern communes thoroughly appreciate the fact."

Apart from such things as water supply, or hygienic influences, the fact that a township owns woodlands, open to the public, attracts tourists, which is not without a practical value, and provides a pleasure-ground for its own people. When a municipality owns woods worked upon a regular sanctioned plan it has a property of which the capital is not touched, but only the interest. They see the value of this in Belgium, where, in the ten years 1896 to 1905, the communes bought 5246 acres for about £54,300.

It appears that now-a-days there are many instances of the purchase of forests by States, communes, or public bodies, and in this connection the words of M. Hüffel, a very experienced Professor at the Nancy Forest School, may be quoted—"In all countries people are becoming alarmed at the rapid impoverishment of private forests. The simplest and surest plan for stopping this is that the forests should be purchased by imperishable proprietors, notably the State. Several countries have resolutely started on this road. The Bavarian Government has recently bought a forest of 7400 acres in the Palatinate, paying roughly £112,500 for it. The Prussian forests were increased by 35,849 acres in 1907, and that Government spent £200,000 in that year in buying forests. The Wurtemburg State forests have increased from 464,800 acres in 1870 to 483,727 acres in 1909."

A steady purchase of such properties as, from time to time, come into the market on favourable terms, and are situated sufficiently near to supply the local market or town without interfering with the extension of building, would appear to be a peculiarly suitable investment for a municipality. But it is permissible to hope that perhaps the State will make a start on its own account before very long, and appoint a Board, or, preferably, a single person, under a Government Department, and allot a modest annual sum to be spent on the purchase and upkeep of woodlands. It would be the business of the Board, or official, to look out for suitable chances of purchase, and then, as time passed, the Government forests would steadily increase, and become more and more valuable. At present chances innumerable are lost, since there is no one whose business it is

to look out for them. When, as usually happens, a property for sale has a house attached, the latter, and a certain amount of ground round it, could be sold off again, the remainder being retained as a forest block.

2. In view of the threatened shortage of timber there is every reason for rendering utilisable every species that can possibly be pressed into service. The world contains enormous quantities of timbers of inferior quality—so far as durability is concerned—but which, nevertheless, have other attributes required in wood (as sufficient strength, or hardness, for example). Thus the Himalayas contain many firs and pines which, left to themselves, would quickly succumb to insects or fungi if used in the plains. Yet the railway companies of India, who very much prefer wood to iron for railway sleepers, do not appear to be able to make up their minds to set up antiseptic plant, and use these cheap woods after treatment. When they use wood they insist on having deodar, or Sal (*Shorea*) (for which the merchants can usually find a better market in house building), or the Australian Jarrah (at 6s. to 7s. each sleeper).

The Forest School of Nancy is now engaged on experiments with antiseptics under the direction of Professor E. Henry.[1] His great aim is to find a cheap antiseptic. He has found that *Carbolineum avenarius*, heated to 140° to 175° F. (to melt the thick liquid), can sink thoroughly into a sleeper of oak or beech, in ten minutes, and apparently a longer immersion does not increase the absorption. The oak will absorb 1·5 per cent. of the weight of the wood, and the beech as much as 4·5 per cent. This liquid costs 40 centimes the kilogramme (1 kilo. = 2·2 lbs.), and the total cost of treating a sleeper is only about 30 centimes. It has been found that an untreated oak sleeper will last nine years, while creosoted it will last thirteen or fourteen years. The full life of a sleeper treated with *Carbolineum* is not yet known, but that the preservative is efficacious we shall see below. Judging from a practical example, the cost of creosoting is to that of treatment with *Carbolineum* as 49 to 21. The process is simplicity itself, and a single workman can turn out 450 sleepers, soaked for 30 minutes, in a day; but since 10 minutes is apparently equally effective, the one workman should be able to turn out a great many more, though not, we think, as M. Henry calculates optimistically, three times as many. The

[1] *Cf. Trans. Royal Scot. Arboricultural Soc.*, xxi. p. 201.

plant can be carried on a truck to any point on the line where it is required, whereas other forms of antiseptic treatment often need large and expensive establishments. Experiments are also being made with green oil, cresoyle, phenol, and hylinite. Green oil can be used cold, though it is better to heat it. It is said to be a most excellent antiseptic, and is even useful when merely painted on. It costs only 20 centimes the kilo., and so far as can be judged a sleeper will only cost 15 centimes to treat.

Another set of experiments, instituted to find a simple and cheap preservative, has now been in force at the Nancy School for some five years. Fir, pine, oak, beech, and poplar have been tested. After drying they were simply immersed in the various preservatives, heated to 140° F., for one day, and then buried in manure and in vegetable mould with the upper face exposed to the air. Other pieces were placed in a mine gallery. After 5 years the fir, pine, oak, and even the beech and poplar, which rot so easily when exposed, were perfectly sound when treated with *Carbolineum* or Microsol. The untreated pieces of beech and poplar were completely done for before the third year. The untreated pieces of the other species were also in very bad condition—even the heart-wood of the oak and pine showing signs of decomposition. In the case of gas tar it was found that wherever there was the slightest crack decomposition had set in, although the surface of the treated pieces appeared to be in perfect condition. In the future a number of other preservatives are to be tried, and with them the Powell process, which claims to be white-ant proof.

3. It is said that the *Merulius lacrymans* (dry rot) is only to be found in damp, shaded, unventilated places. The mycelia of *Merulius* will die if exposed for some hours to the sun, but inside the attacked wood the fungus still lives. The spore, moreover, will withstand the action of prolonged sunlight, and has great vitality. But it cannot germinate except in a damp place, "and," adds M. Ména, "under the action of an alkali." He quotes two very striking cases to prove this, and we may mention one. A building, fifty years old, situated in a foggy place near a stream, had previous to being rebuilt in 1888 never been touched by dry rot. The wood used for the renewal was perfectly dry, and of first quality. The floor was well ventilated below, but in order to give a sort of drainage, and to keep things dry, a *layer of cinders* was spread below. In three

years (in 1891) the wood had to be replaced because of dry rot. River sand was then spread and the wood coated with some form of *Carbolineum*, the walls also being treated. By 1895, the wood had again rotted. M. Ména was then asked to prescribe. The wood was removed; the soil which had previously supported the cinders was dug out, and replaced by river sand; over this a concrete containing an acid solution of sulphate of copper was spread; and the new wood was painted with a strong solution of the same kind with some sulphuric acid added. For fourteen years no *Merulius* has appeared. It was in the cinders that the alkali was present. The second example, with which M. Ména was also directly concerned, was similar.

4. The afforestation of high exposed land, and of peat bogs, are difficult matters, but both appear to have been successfully accomplished in Belgium. The "Fagnes," in the S.E of the country, are very high plateaux (up to 2200 feet above sea-level), completely bare and exposed to furious winds, chiefly from the S.W. The cold is long and intense, the snowfall heavy. The Scots pine will not grow properly on these heights, and the Belgian foresters have made a rule not to plant it above 1640 feet (500 metres). The subsoil is a white clay, perfectly impermeable to water or air. On the clay lies usually a layer of peat from 8 inches to $6\frac{1}{2}$ feet deep. In the best spots is vegetable soil of variable quality in place of the peat. The water does not flow off regularly from the unplanted Fagnes, but when the peat is saturated it runs down off the impermeable subsoil rapidly. In winter it oftens happens that the surface, gorged with water, becomes a sheet of ice. Then comes snow followed by a thaw, which results in a violent rush of water off the icy surface. In summer the evaporation is intense, everything dries up, and there is no water in the streams. When taking the problem in hand the foresters first make firelines and roads; then they drain, but in a cautious manner, according to certain rules. They do not drain the lakes and ponds, which form reservoirs. The depth of the drains depends on the slopes and the depth of the peat. The turf and earth taken from the drains are all used for making planting spots for spruce. Heaps about 20 ins. × 20 ins. are made about 5 feet apart, but before laying down a heap the grass has to be scraped off to allow of the heap adhering to the soil. The turf

is turned over to decompose it. The foresters then wait from one to three years before planting in the heaps, by which time the turf, peat, and organic matters have formed a kind of vegetable soil. The spruce, which is the species proved to be successful, is put in as 4-year plants. When the heaps consist almost entirely of peat they become dry, and the plant cannot root itself. To deal with such difficulties experiments have been carried out in a dozen areas by planting on heaps of different sorts, as follows:—No. 1. Ordinary heaps planted after two years. No. 2. Half decomposed peat and earth brought to the spot. No. 3. Decomposed peat mixed with the ashes of turf. No. 4. Decomposed peat mixed with basic phosphate and clinkers No. 5. Decomposed peat, earth, and basic phosphate. No. 6. Decomposed peat, turf, ashes, and basic phosphate. No. 7. No heaps, but planting direct on the peat after removing the turf. No. 8. The same, with basic phosphate added. No. 9. Heaps of earth brought to the spot. No. 10. Heaps of decomposed peat mixed with lime (about a cubic metre to the acre, costing 40 francs). No. 11. Decomposed peat, earth, and lime (about a cubic metre of lime to the acre, and twice as much earth). No. 12. The same, with half quantities of lime and earth. Nos. 1, 7 and 8 were complete failures; the others were successful—Nos. 11 and 12 especially so. The result of the use of lime or basic phosphate mixed with earth is surprising. M. Crahay, the author of the paper, considers that very few marshy and peaty soils need now defeat us. If the author has been correctly understood, there are even now quite old crops planted in such conditions, which would prove that success is not confined to the early years. It appears to be merely a question of expense.

5. It may be that an era of chemical manures for plantations, or of the addition to the soil of special substances, is before us. Anyhow, the results given by M. Mathey are remarkable. The experiments have been in force on a large scale for several years now, on the hills of Burgundy, at some 1000 to 1300 feet above sea-level. The soil appears to be about as "ungrateful" as possible, being rarely more than $5\frac{1}{2}$ inches deep, over massive, unfissured rock. The plantations are made on raised ridges with Austrian pine, spruce, and various broad-leaved trees. The substances employed consist of clinkers, either pure or with a mixture of kainit (two-third clinkers to one-third kainit). This

mixture is particularly suited to hot aspects, because kainit has the property of fixing the humidity of the air. The dose per plant is 1½ to 4 oz., and the maximum cost 1 centime. The action of these added substances is variable according to species. With the spruce, and most of the broad-leaved trees, it is immediate; with the pines it only takes effect after two years. This is due to the root-system. The advance made by the plants is enormous. Austrian pines of two years, thus treated, are taller than untreated plants of seven years age. There is no failure, even in the greatest droughts. The plants are fine. The only drawback is the tremendous growth of the grass, which has to be weeded out, but the extra cost is not great.

6. Inasmuch as the spruce is a feebly-rooted tree, and therefore easily thrown down by wind, it is useful to know that in Switzerland it has been found that trees grown from seed gathered at high altitudes are always better rooted than those grown from the seed of low altitudes. In regard to the larch the remark is repeated that the Japanese larch will only remain ahead of the common larch for some fifteen years. M. Huberty highly recommends a variety of larch from the Sudetic chain of mountains in Silesia. According to Professor Cieslar, the Sudetic larch (with upward-turning branches) is stronger than the Alpine larch (with drooping branches); it is faster growing, and can accommodate itself better to low altitudes.

7. In the June number of the *Bulletin de Franche-Comté et Belfort*, M. Barbey has a very full notice on the Douglas, and quotes very numerous and very striking figures in its favour. Everywhere coppice is being converted into high-forest, and since coniferous woods are the most demanded by the trade, the Douglas, with its wonderful rapidity of growth and great intrinsic value, is well suited for introduction among broad-leaved woods in course of transformation. In such a situation a fast-growing and valuable conifer, supporting a light cover, or at least lateral shade, is the tree to choose. The firs are able to stand the early conflict with the quickly growing new coppice-shoots of a recently felled broad-leaved wood, but the silver at least is very slow in early youth. Pines and larch are too light-demanding for such conditions. In every way the Douglas is superior to all these in the circumstances. One may agree in a general manner with the writer that the planting of conifers among broad-leaved trees is excellent, but

yet there are dangers. Thus the *Armillaria mellea*, which is so deadly to conifers, flourishes on old beech stumps. The colour being no certain guide by which to tell the Pacific from the Colorado Douglas the author cites the fact that, in their own country, the latter throws up its branches at an angle of 45°, while the branches of the former are horizontal. On Southern slopes the Douglas requires a little shade, whereas this is not necessary on Northern slopes. The author gives to the Scotsman, Mr John Booth, the chief credit for the introduction of this species. Booth energetically pushed it in the face of much opposition. No one now doubts its value; the German States have been very thoroughly converted, and are introducing it vigorously. Not Germany only, but many other countries also, have followed the example of Scotland. The author, while admitting the far greater growth of the Pacific variety, considers that the Colorado variety has not been so closely observed. He quotes Mayr as preferring the Colorado Douglas where the climate is not maritime, or, failing that, where light lateral shade is not available; this variety is less exacting as to the degree of air-humidity, and of cover. The Douglas will stand a great degree of cold well, and the Colorado variety appears to do so the better of the two, but this is really due to the fact that the Pacific variety has a habit of reshooting in August and September, so that these shoots are weak against cold. M. Barbey says that the Pacific variety has now been conclusively shown to grow well in all soils, except in too limy, wet, or meagre ones. It has even been known to thrive in the stiffest clay. The nearer it approaches to the sea the better its growth, for a high degree of air-humidity suits it.

M. Jolyet, a forest officer charged with experiments at Nancy, also writes of the Douglas. His main contention is that the Pacific Douglas requires considerably more humidity than the Colorado, and that this fact renders the latter variety more suitable for the greater part of the Continent. We, in the United Kingdom, may, fortunately, employ the faster-growing variety. The Douglas has a wonderful range without its fast-grown wood ceasing to be valuable, which is not the case with most conifers. M. Jolyet quotes Dr Mayr as saying that "from a forest point of view the Colorado Douglas is the tree of a Continental climate, and of the plain, with its extremes of temperature and humidity; while the Pacific Douglas is the tree

of an insular or coast climate, and of the mountains." As to its degree of resistance to cold, M. Jolyet quotes a M. Charles Baltet to the effect that in Central and Eastern France the plant froze at – 18° F., though in the Bois de Boulogne it was merely "fatigued" at – 15° F. Unfortunately it is not clear what age these plants were. What tries a tree is long-continued cold with days of bright sunshine. The habitat of the Douglas extends northwards to the Jan. isotherm of 14° F. (which passes through St Petersburg), and southwards to the July isotherm of 84° F. (which cuts Algiers). It is the Colorado Douglas which reaches this southern point. Whereas on the Pacific coast the annual rainfall is 31·5 inches, and may rise to nearly 80 inches, the Colorado Douglas is found in regions where the mean rainfall is small—perhaps 20 inches. As to tenderness to spring frosts the Douglas and spruce are about on a level. M. Pardé states that natural seedlings of Douglas are to be seen at Les Barres (in the Department of the Eure) and in many other places—a most encouraging sign.

Finally M. Cannon, who has interested himself in the Pacific Douglas for thirty-five years and grown it for twenty-six, gives us his experiences. He has not found the tree to be exacting from the point of view of humidity. His land is meagre and arid, and the summers are very dry and hot. The mean rainfall is 23 inches and it is irregular, so that the droughts are long, while the evaporation from the light sand of the place is enormous. M. Cannon has a 40-year-old Pacific Douglas, placed, isolated, in a very dry and sterile corner, where even grass will not grow. This tree stood through tremendous droughts in 1876, 1893, 1900, and 1906, which were enough to kill off a great part of his Scots pine plantations. In 1879-1880, while still young, this tree withstood a frost of probably some 50°. It is now 52 feet high and $6\frac{1}{2}$ feet girth at $4\frac{1}{2}$ feet from the ground, and is in perfect vigour. M. Cannon has cultivated this species in a nursery since 1883, and, after the first year, always in the open; and it is no doubt the case that the winters of his country are vastly colder than with us. Occasionally an unseasonable frost will nip a shoot, but it is quickly re-formed, and, we may note, the capacity to re-form its leader easily is a great point with the Douglas. At the same time, none of these gentlemen seem to notice the risk from exposure that Douglas suffers,

and lightly propose to plant it among broad-leaved trees in coppice far above which the Douglas will quickly push as isolated stems. We think it would be an excellent tree to put, in bouquets say, in gaps in a high-forest beech wood; but coppice is another thing. M. Cannon has planted many Douglas, and he finds that it grows superbly in moist sand. Trees of 25 or 26 years old, planted among other conifers, have a height of from 53 feet to 59 feet, with a diameter of 3 feet to $3\frac{1}{2}$ feet. M. Cannon says it is certain that very calcareous soils are unsuitable to Douglas. Roebuck are particularly fond of the tree—possibly because of its aromatic needles.

8. Mention was made last year (*cf.* vol. xxii. p. 47) of the "June oak" (*Quercus pedunculata tardissima*, Simonkai). M. Bauchéry writes enthusiastically of this tree, which is to be found in the centre of France, in Hungary, Bohemia, the Crimea, and the Caucasus. In 1870 a certain young French forest officer, M. Cuénot, was struck with the lateness in coming into leaf of certain oaks, and since that time the variety has been studied. It appears, then, that this June oak is superior to the common pedunculate oak in that by coming into leaf four to six weeks later it escapes spring frosts and insects (*e.g.*, *Tortrix viridana*, it may be assumed); its growth is more rapid, and its shape is straighter. The density of its wood is 1·029; that of pedunculate oak ·911. Being somewhat pyramidal it no doubt occupies less room, and can be more easily freed from surrounding crowns. At the age of 60 years the growth of the June oak is 3·5 per cent. faster that that of *pedunculata*, and at 90 years 8 per cent. faster. M. Bauchéry has noticed that in a thicket of 18 years old the stems of the June oak were consistently a metre taller than those of the common oak; and wherever it is met with it is ahead of the common oak of similar age. Nor is this superiority due to growing in better soil. The June oak may be found in all soils, and as often in dry or very dry soils as in fresh and deep ones. In either case it keeps the same lead. And whereas certain of the common oaks will be mossy and stunted, the June oak will be free from moss and doing well. The constancy of lateness in this variety has been well established, even with trees 130 years old. It should be added that the June oak has no resemblance to the pyramidal oak (*Q. pedunculata fastigiata*).

9. During the year Professor E. Henry has brought out his book *Les Sols Forestiers*, which brings up to date the information so far obtained on this subject, including much done by himself. The subject is a most abstruse one, and it may well be that there are more secrets to be elucidated in this than in any other branch of forestry.

10. Since these notes last appeared a notable figure in French forest circles has died. M. Fliche, Professor of Natural Science at Nancy, was very highly thought of in his own particular line.

11. The Forest Nursery Station, Indian Head, Saskatchewan.

By Mr Kay, Assistant Nurseryman.

This Forest Nursery Station was established in order to raise and distribute young trees suitable for planting as wind-breaks, shelter-belts, snow-breaks, and woods' lots around the home and farm buildings, on the open prairies in the three provinces of Manitoba, Saskatchewan, and Alberta.

The Station is under the able management of Mr Ross, "chief of the tree-planting division," who is the very embodiment of energy, and has also a thorough grasp of all branches of the work which he directs. The Nursery is situated about two miles south of the town of Indian Head, and comprises a half-section of land—that is, 320 acres—with an elevation of about 2000 feet above sea-level. The aspect inclines to the south-east. The soil varies a little but is chiefly a good black medium loam with a clayey subsoil.

The grounds around Mr Ross's home and both sides of the main avenues are tastefully laid out and planted with trees and flowering shrubs. Quite a large variety of flowers grow in profusion, adding colour, and helping to beautify the grounds during the season. Nearly all kinds of vegetables and small fruits are grown in abundance, and this demonstrates what can be done with shelter at a high elevation in a short time. When one stops to consider the severe winters, and the hot summers, often with hot drying winds of high velocity, and the limited rainfall which we have here, it is really wonderful what can be done when the work is gone about in the right manner.

Tree planting on the prairies is justly considered a very important work, and is being recognised as such by an increasing number of farmers and others, who are taking full advantage of the helping hand the Government is extending to them in the way of supplying them with trees free of cost.

Trees grown on the prairies have to be given special attention as regards cultivation and tending. To be successful it is necessary to prepare the ground the year previous to planting. May and June are considered the best months to start breaking up the sod. The virgin prairie is covered by a hard tough compact sod, impermeable to plant roots (and also to moisture to a certain extent). It is first ploughed about 2 inches deep and allowed to lie from six to eight weeks so that the sod may rot. It is then ploughed back about 4 inches deep and well disced and harrowed as often as practicable during the season. Finally in the fall it is ploughed 8 to 9 inches deep and then disced and harrowed, which leaves it ready for planting operations in spring. This method of breaking is termed "backsetting." The best preparation however is summer-fallow or land from which a root-crop has been taken. These methods bring the soil into a much finer state of division for the plant-roots.

Fall or spring-ploughed land is not a good preparation. Trees are not supplied for such land, as to attempt to stock it is simply throwing away time, labour, and plants. The soil dries out to the depth of the tillage, and therefore the plants dry up and die from lack of moisture. The trees distributed have all been selected for their hardiness and to a certain extent their rapid growth, and include the following varieties:—

Manitoba Maple (*Acer negundo*).
Green Ash (*Fraxinus viridis*).
American Elm (*Ulmus Americana*).
Cottonwood (*Populus deltoides*).
Russian Poplar, several kinds, such as—*Populus petrovski, Populus certinensis, and Populus wobstiriga.*
Willows, several kinds, such as—
White willow (*Salix alba*).
Russian laurel leaf willow (*Salix laurifolia*).
Russian golden willow (*Salix aurea*).
Acute leaf willow (*Salix Acutifolia*).

The ash, elm, and maple are raised from seed gathered in Saskatchewan if possible to ensure the plants being thoroughly hardy.

The seed of the ash and maple is gathered in the fall. When brought home it is rubbed through a wire screen to separate it from the seed stalks. It is then spread on a table and hand-picked, all foreign substances being removed by this operation. It is then sacked and stored away till ready for use. The seed is sown with an ordinary Massey Harris drill grain-sowing machine, altered to suit for the time being. The seed is sown in lines 30 inches apart; this allows of horse cultivation during the season.

The elm seed is gathered in June and sown at once in the same way as the two former kinds.

The seedlings are divided into strips of about a chain wide by Caragana hedges, which act as a snow-trap (for reasons see conifers). The hedges also break the force of the wind, thereby diminishing excessive evaporation.

Most of the cottonwoods are shipped from the Western States, being pulled up from the sand-bars of certain rivers, where they grow in abundance. Procured thus they are cheaper and better than cuttings. The plants are from two to three years old and average 2 feet high. Willows are grown from cuttings made in the ordinary way in spring.

In the fall the young plants are lifted by another machine drawn by two horses, tied up in bundles of twenty-five, heeled in, covered up by the plough, and are then ready for spring distribution; by this method there is no delay when shipping time comes round in spring.

The best parts of the Nursery are being used for raising the young plants for distribution. Other parts not so suitable are being laid out in experimental plots to demonstrate the best species to plant, the best mixtures, the cost, etc.

The young plants are planted 4 feet by 4 feet to allow of horse cultivation during the season. This cultivation is necessary to keep down weeds, and is kept up till the trees are able to shade the ground, which, if properly looked after, they do in from three to four years. This constant stirring of the soil also prevents loss of soil moisture. After the trees shade the ground this cultivation is no longer necessary, as the shade keeps down weeds. The lower branches die and

drop off (thus saving pruning and giving clean stems) and with the leaves form a mulch, thereby establishing forest conditions. We have only from 15 to 19 inches of rainfall, snow included. It is thus easily seen that the conservation of moisture is an important matter with us.

Planting is often done with the plough. A furrow is ploughed out; the plough comes back in the same furrow making it deeper. The planters are all ranged along the line, each having his bit to do. The plants are carried in buckets half-filled with muddy water to keep the roots moist. The plant is placed in the furrow, and the soil drawn on to the roots from each side with the feet, and well tramped down. The rest of the soil is thrown back with the plough or harrow.

Cuttings, and plants with a tap-root, are planted with a dibbling iron. Conifers are planted with the spade.

Conifers are being propagated here, but are not yet being distributed to planters. They are propagated in the same manner as at home. They are grown in seed-beds about 4 feet wide, the sides of the beds being boarded; the beds are shaded with light flakes made from lathing. The Scots pine is kept for two years in the seed-bed and then lined out. The plants are dibbled in the lines instead of being lined out with the spade as we did at home. This of course is to ensure as little stirring of the soil as possible, as it dries out to the depth of the spading and the little plants would suffer accordingly. Other species are also grown, *e.g.*—

Jack Pine (*Pinus divaricata*).
Blue Spruce (*Picea pungens*).
White Spruce (*Picea alba*).
Tamarack (*Larix Americana*).
European Larch (*Larix europæa*), etc.

They are all handled in much the same way as the Scots pine. I may say that very successful results have been obtained in the growing of conifers from seed here.

On lining out the plants they are placed about 12 inches apart in the row with 3 inches between the plants. About every 12 yards a space is left in which sun-flowers are sown to form a snow-trap in winter. By this method the snow is caught and covers up the young plants, for if not covered up the parts exposed are browned and die off. The snow adds

considerably to the moisture available for the young plants during the season.

The ground is frozen to such a depth in winter, and till late in spring, that the young plants' roots are unable to absorb moisture, consequently the parts exposed die from drought, through being unable to replace the moisture given off in transpiration. This effect is augmented by the strong bright sun with its consequent radiation and isolation—made still worse by the snow. It is most essential for the well-being of the young plants that they be entirely covered by snow or other covering.

The conifers thrive best here when given some shelter for the first few years after being planted out, as the trees are apt to suffer in the same manner as the young seedlings till they are established. Once established they get along all right.

The European larch grows well here, but the Jack rabbits will not leave it alone.

The American larch (Tamarack) also does well. I would say if Tamarack seed could be procured cheaply and easily, it would prove a useful tree for planting on high exposed wet boggy places in the Highlands at home. It grows in the swamps here and seems to do fairly well. In fact a great many of the Tamarack we plant out are procured from the swamps. The seedlings are pulled up when about a foot high. It is much too early yet to say much in regard to the extent to which conifers will be utilised in prairie planting. Evergreens are in the experimental stage with us yet, but from the results seen in a few isolated instances throughout the provinces it would seem that they have a great future before them.

12. Visit to the Forests of Bavaria, 1909.

By Sir ANDREW N. AGNEW, Bart.

The Annual Excursion of the Royal Scottish Arboricultural Society for 1909 was made to Bavaria, with a view of visiting some of the forests of Southern Germany. Sixty members of the Society took part in the excursion, starting from Edinburgh on Thursday, 29th July, and reaching Munich at midnight on Friday, 30th. Here we were met by Professor Mayr, Professor of Forestry in the University of Munich, who had been appointed by the Bavarian government to accompany us during our tour and give us the benefit of his assistance. No appointment could have been more fortunate, so far as we were concerned, both on account of the Professor's intimate knowledge of the Bavarian forests, and of his lucid and happy way of imparting information and answering the many questions addressed to him. After a day's rest in Munich, we took train to Partenkirchen, a picturesque village in the Bavarian Highlands, about 2200 feet above the level of the sea, where we were to make our first acquaintance with the forests of the country. The following is an attempt to record in diary form the main features of each day's excursion.

Aug. 2. We started at six in the morning for a long day's expedition, which included a walk of 18 miles and a climb of 4000 feet. Our destination was a point named Shachen, where the late King of Bavaria had built himself a hunting lodge. It is 6300 feet above the sea, and close to the wall of limestone precipices which divide Bavaria from the Austrian Tyrol. The walk to Shachen occupied six hours, and led all the way (after the first mile or two) through Government forests. Before entering these, however, we had to thread our way through a singular gorge, only a few yards wide and about one-third of a mile in length, with perpendicular walls of rock several hundred feet in height on either side, and a rushing stream beneath our feet. The term "beneath our feet" is literally true, for the path through the gorge is made of wooden planks resting on iron stanchions driven into the face of the rock.

The lower slopes of the hills were covered with well-grown mixed woods of spruce, silver fir, beech, and sycamore, 115 years old—the spruce having tall straight stems of 100 feet or more. At an elevation of about 3000 feet, we passed

through an area which had been devastated by wind and snow. The ground had been cleared of fallen and broken timber, and the greater part of it replanted with young spruce trees, now from 4 to 6 feet high. The rest of the area had been left to natural regeneration, and the seedling spruces were coming up in all sorts of corners and crannies where they had been able to escape the attentions of browsing deer. From 3500 feet upwards, the forest grew steadily thinner, the trees often standing singly or in groups amid mountain meadows grazed by cattle. The difference in rapidity of growth became very marked. The trees were vigorous enough, but, though 150 years of age, they were only half the height of the younger trees in the valley below, and showed many signs of struggle with gales and snowstorms. As we ascended, the spruces became more and more mixed with the Alpine Stone Pine (*P. Cembra*), a tree that flourishes in these mountains at a higher elevation than any other forest tree, though its growth is very slow. And at the highest point of our walk, the Stone Pine grew almost alone amid patches of the dwarf Mountain Pine (*P. montana*).

The view from Shachen of jagged mountain peaks, white precipices, winding valleys, and forest-clad slopes, is a beautiful and striking one. In a situation overlooking this fine scene is an unexpected and well-arranged Botanic garden, in which we were able to find out the names of many of the plants which had attracted our attention on the way up. The garden contains specimens of all the native mountain plants, as well as specimens of foreign varieties which will thrive at that high elevation. A violent and prolonged thunderstorm, which happily only came on after our day's inspection was concluded, sent us hurrying back to Partenkirchen, which was reached at 6.30 P.M.

Aug. 3. Rain fell heavily till near midday, when we started on our return journey to Munich, most of the party stopping on the way to have a sail round Starnberg lake.

Aug. 4. This was a specially instructive day for us. At Partenkirchen we had seen forests in which the trees were for the most part matured or maturing. On this day we were able to follow the process of regenerating a forest, from the seed-bed to the tree of 20 years' growth.

The Ebersberger forest is situated about 30 miles south of Munich, on fairly level ground, and covers an area of 20,000

acres. Some 20 years ago, it began to suffer a series of calamities. In 1889 the Nun moth (*Liparis monacha*) appeared in extraordinary numbers, its caterpillars devastating 7000 acres of trees. Various artificial means were tried, but without effect, to get rid of the plague; but, happily, after two years, the caterpillars were smitten with a mysterious disease which killed them all off within a few days. In 1894 and 1895 a succession of gales destroyed another 2500 acres. All this area of nearly 10,000 acres was cleared of timber as fast as possible; since which, the process of re-afforestation has been steady carried on. Where re-afforesting was begun while the ground was still clear of vegetation, and manured by the carcases of myriads of caterpillars, the result was very successful. But as the years went on, the ground deteriorated, and it became more and more difficult to give the young plants a start. An interesting process of combined forestry and agriculture was then tried, which proved very effective. It is thus described by Prof. Mayr in a little guide-book prepared for our help. The old spruce roots having first been grubbed up, "the ground is sown with a crop of oats which is harvested in summer. This, after a light dressing of manure, is followed in the second spring by a potato crop. After the potatoes are lifted, a dressing of lime is given, and in the third spring some more artificial manure is applied, after which oat and spruce seed are sown. The ripe oats are cut fairly high," and the spruce seedlings come up among the stubble. "By this method, not only are the plants obtained free of cost, but a considerable net income is gained." The superfluous trees are lifted with a ball and planted in other parts of the forest; the instrument used being a spade with a blade bent into the shape of a half cone. We saw trees about 6 inches high raised by this instrument with a neat ball, and planted elsewhere, the work being performed by men and women—the men digging the pits, and the women putting in the trees and pressing them down.

When re-afforestation was begun, the system adopted was to plant birches a few yards apart to serve as nurses for the permanent crop. After giving the birches 8 years' start, the whole ground was sown with spruce and larch, which are now coming up well. But experience has proved that this system of nurses is not an economical one, and it has now been discarded. We walked down a straight green ride, on one side

of which was a wood formed in the above manner 15 years ago, and on the other side a wood of pure spruce planted out in the same year. The planted spruce were twice, and frequently three times, the height of the trees on the opposite side of the way. Hitherto, when planting spruce, the young trees have been put in at a uniform distance of one metre apart, but this is now considered too little, and in future the trees will be planted at distances varying from 1·3 m. to 1·5 m. according to circumstances. Once planted, the trees are left to themselves till they have reached a considerable height. It is only under exceptional circumstances that they are thinned before they attain 30 years of age.

The spruce is by far the commonest tree in the Bavarian forests, and is called by German foresters "the bread winner," being grown more easily than any other tree, and serving a greater variety of purposes. The Germans use spruce timber for many purposes for which larch and other tougher timber is considered necessary in our country.

Aug. 5. Our morning was spent at the Royal Experimental Forest-garden of Grafrath, 20 miles west of Munich. The garden was laid out in 1884, and covers about 140 acres of ground; its object is to study the characteristics of indigenous trees, and to discover which exotic trees might usefully be added to the Bavarian forests. A network of footpaths traverses the garden, giving ample opportunity for studying the silvicultural experiments.

One thing strikingly illustrated in the garden is the different rate of growth of the two varieties of Douglas fir. Groups of these two varieties standing side by side in the same soil show that the Oregon (light green) variety grows twice as fast as that from Colorado.

Another interesting fact is the failure of the Japanese larch to maintain its lead over the native species. Japanese and native larch were planted close together in the garden 21 years ago. At first the Japanese larch shot far ahead of the other; but after a while the native larch caught up the Japanese, and now exceeds it in height.

Returning to Munich, we took train to Kelheim, an old-world village on the bank of the Danube, entered by arched gateways surmounted by tile-roofed towers. As the two inns of the place could only provide room for a portion of our large party, most of

us were billeted among the inhabitants, and were comfortably accommodated.

Aug. 6. We had a long and interesting day's walk in the Neuessinger forest to the north of Kelheim. The woods consist mainly of spruce and silver fir, with a sprinkling here and there of beech and oak. The spruces and silvers in the early part of our walk had received their last thinning, and were maturing for the final felling. The average age was 96 years, and we could hardly have seen a better example of the final product of the German group-system. The trees were splendidly grown, over 100 feet in height, with perfectly straight stems. The effect of growing in close canopy was seen, not merely in the absence of branches below the crown, but in the uniform growth of the poles, with a minimum of taper, the girth seeming scarcely to diminish between 5 and 50 feet. Some of the outer trees of the forest had very fine boles,—one spruce measured being $6\frac{1}{2}$ feet, and a silver fir $9\frac{1}{2}$ feet, in girth. The distance between the trees of the final crop is from 4 to 5 yards.

We also had an opportunity of seeing a good example of the "group-system of natural regeneration," which is now very generally adopted. By this system a forest can be regenerated at very small expense, and sometimes without any expense at all. The old trees are cut out in circles at intervals through the wood, the diameter of each circle being about half the height of the surrounding trees, so as to admit just the amount of light required for the seedlings, while preventing the growth of weeds. These cleared circles get filled with seedling plants, and as the plants grow the circles are gradually enlarged, the outer rings getting filled in the same way, until, in the course of 20 years, all the circles meet, and the whole area is re-afforested.

Our morning's walk ended at a magnificent oak, under whose shelter we stopped for luncheon. It is the sole survivor of an ancient oak wood, and is 70 feet in height, with a girth of over 18 feet for a considerable distance from the ground.

On our way back to the village, we were shown over a large pulp mill employing 600 hands. This is one of the industries that spring up in a district as soon as a sufficient and regular supply of timber is assured. We followed the various stages of manufacture from the clearing of the tree stems to the production of smooth sheets of thick paper-pulp ready for the paper-maker.

The amount of fir wood annually consumed by the Kelheim mill is from 70,000 to 80,000 cubic metres.

Aug. 7. After visiting the imposing National Memorial, erected on a height above the village, to commemorate the battles fought by the Germans against Napoleon, we proceeded to inspect the forest lying to the west of Kelheim, between the rivers Altmuhl and Danube. The woods we were in this day were chiefly composed of broad-leaved trees, and we saw the group-system of natural regeneration being carried out with oak and beech, as we had seen it the previous day carried out with spruce and silver firs. The older beech wood contained a sprinkling of silver firs, some of which were of great size. The finest specimen, 180 years of age, measured 9½ feet in circumference, and 147 feet in height.

The interest of the walk culminated in a mature wood of oak and beech. The older beeches had already been cut out, but the array of four-hundred-year-old oaks was most striking. Many of them had stems over 12 feet in girth, which rose 100 feet without a branch. The largest, known as "King's Oak," is 118 feet high, with a girth of 14 feet and a clean stem of 65 feet, and is valued at 3000 marks, or £150.

Descending a long slope to the Danube, which we crossed by a ferry, we lunched in an imposing old building, partly monastery, partly restaurant; and we returned to Kelheim by river in time to catch the afternoon train to Nuremberg. The Danube here has a swift current, and is hemmed in between lofty precipices of limestone rock; and our fleet of little boats was carried down the stream very rapidly and pleasantly.

Aug. 8. Sunday was spent quietly at Nuremberg, and we were all glad of the rest, as well as of the opportunity of seeing one of the most interesting and picturesque cities of Europe.

Aug. 9. At Nuremberg we saw for the first time continuous forests of Scots fir. Hitherto, spruce had been the prevailing tree, but at Nuremberg we had reached the limit of its natural habitat. East of this point, the spruce sheds its seed, and the forests are usually maintained by natural regeneration. West of this, every spruce has to be planted. The Scots pine grows well in some parts of Bavaria, but it is not seen at its best here. This is due partly to the extreme poverty and dryness of the soil (the rainfall is the smallest in Bavaria, averaging only

18 inches in the year), and partly to certain rights possessed by the public. The most injurious of these is the right to take up and remove the fallen pine needles for litter, thus depriving the trees of their natural manure. The result is that these woods produce only 250 cubic metres of timber to the hectare, instead of 500 cubic metres as woods on better soil do. But if the forest at Nuremberg is not remarkable for productiveness, it is a good example of what may be achieved under the most adverse circumstances, and it made us feel that there is no soil in our country in which we need despair of making trees grow.

About 15 years ago, a large part of the area we visited was devastated by a plague of caterpillars, to the extent of 2500 acres, and re-afforestation has been going on ever since. We therefore saw mostly young Scots pine plantations at various stages of growth. But we also saw some which had reached 80 years, and were therefore considered mature and ripe for cutting. As just stated, these were poor trees for their age; but in spite of drawbacks, they will make good trees, if only allowed time enough. A certain number are allowed to remain for a second rotation of 80 years, and some even for a third. Of the last class, we noticed a very good specimen with a tall straight stem and a girth of 8 feet 9 inches.

In the evening we came on to Aschaffenburg to be ready for our final excursion.

Aug. 10. The concluding day of our Bavarian forest inspection was also the longest. We left Aschaffenburg at six in the morning in a procession of fifteen carriages, and did not get back again till half-past eight at night. During the interval we were able to see a great extent of the Spessart, one of the most famous forests of Germany. The trees are chiefly of the broad-leaved and deciduous kinds, more than 50 per cent. consisting of beech and 15 per cent. of oak. The beech is now used almost entirely for underplanting the oak. Though it fetches a fair price for fuel, for furniture, and for railway sleepers, it is chiefly valued and grown as a fertiliser of the soil. Without the humus formed by the decaying leaves of the beech, the oak would never grow in the poor sandy soil of the district. As it is, the oaks of the Spessart are the finest in Germany, and probably in Europe. The only species grown here is the Sessile oak (*Quercus sessiliflora*), which the Germans consider to be much the best variety for three reasons:—the grain of the wood is closer than

that of *Q. pedunculata*; the tree will thrive in poorer soil; and it has less tendency to fork.

The ordinary rotation for beech is 120 years, but in the Spessart a number of picked trees are allowed to stand through more than one rotation, so that boles are frequently met with which it would be hard to match anywhere else. The two largest which were measured were respectively 11 feet and 13 feet in girth.

Oak trees, which are the final crop and the chief glory of the Spessart, we were able to see in almost every stage, from the young sapling, protected by a strong paling from the deer and wild boars that frequent the forest, to the oak of 60 years, when the underplanting with beech commences; and so on to the mature crop, the growth of several centuries. In more than one compartment of the forest through which we passed, the oaks were 300 and 400 years old, and had an average girth of 9 feet at a height of 5 feet from the ground. The monarch of this forest is reported to be 1000 years old, and is still a thriving tree measuring 18½ feet in circumference.

It is hardly possible to find words to describe the striking effect of the woods in which we spent a large part of the afternoon. The huge oaks are known to have been planted while Germany was in the throes of the Thirty Years War; while the beeches, sometimes scarcely inferior to the oaks in size, have an average age of 200 years. Owing to the system of close canopy under which the trees have always been grown, there is no undergrowth of vegetation to obstruct the view. The eye wanders unchecked through an endless vista of stately columns rising straight out of the ground, the shafts being 60 to 80 feet high before the lowest branches form their arches overhead, while the summits of the trees often tower to a height of 150 feet and more. It is safe to say that no forest like this, or approaching to it, had ever been seen before by any of the members of our expedition.

13. The Thirty-second Annual Excursion, August 1909.

(*With Plates.*)

The following is a detailed account of the Annual Excursion, of which a summary report is given in the previous paper.

Monday, 2nd August.

ASCENT OF SCHACHEN IN THE STATE FOREST OF PARTENKIRCHEN.

On leaving Partenkirchen, the party followed along the Partnach and arrived at Partnachklamm (2427 feet above the sea), on passing through which Ferchenbachtal was entered (2628 feet above sea-level).

DISTRICT IX. STEILEN (Rotation 114 years).

Compartment 6. *Stegreif Westlich* (2628 to 2828 feet).

90,363 acres, 6^1, c^a. 115-year-old wood of spruce, silver fir, beech, and sycamore, very well grown. In places heavy selection cuttings have been made. Final yield per acre 4089 cubic feet.

Compartment 1. *Stegreif Östlich* (2828 to 3753 feet).

23,103 acres, f. 115-year-old wood of spruce, silver fir, with a few beech, sycamore, and white-beam trees of good development and thickly grown. Final yield per acre 3384 cubic feet.

42,248 acres, e. 100-year-old wood of spruce, silver fir, and beech, with a few sycamores, rowan trees, and white beams, mostly of inferior growth and density. Final yield 1410 cubic feet per acre.

Compartment 2. *Grasecker Wetterstein* (3753 to 4263 feet).

72,763 acres, g. 85-year-old wood of spruce and silver fir with a few beech and sycamore, of good growth generally, and with fair density. In places damaged by wind.

g^2 ·593 acres, e^1 ·247 „ } Lagerplatze (3771 feet).

35,142 acres, e. 65-year-old spruce wood with a few silver fir, sycamore, and beech of fair growth and density.

8,787 acres, c. Newly-planted trees on clearing caused by wind, partly under the shelter of a few remaining trees.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY EXCURSION PARTY IN THE SPESSART.
AUGUST 1909.

[*To face page* 8.

17,225 acres, d. 12-year-old spruce wood. Protected on north and east by neighbouring woods.

137,974 acres, c. 130-year-old spruce and silver fir wood with a few sycamore, beech, and white beam of medium growth. In the eastern portion severe selection cuttings have already been made. In the northern portion wind has done considerable damage. Final yield per acre 2820 cubic feet.

Compartment 3. *Oberer Bauholzweg* (4263 to 4785 feet).

12,925 acres, c. 130-year-old wood spruce, silver fir, beech, and sycamore of medium density and growth. Final yield per acre 2115 cubic feet.

117,139 acres, a d c. Alpine forest, very steep, with spruce, silver fir, *Pinus cembra*, beech, sycamore, and mountain pine, all of poor growth.

DISTRICT X. WETTERSTEIN.

Compartment 1. *Wetterstein* (4785 to 7797 feet).

347,869 acres, b. Alpine forest. High lying, light woods of poor growth, consisting of spruce, silver fir, *Pinus cembra*, larch, and yew, about 156 years old.

1,517,384 acres, a. Bare rocky face with mountain pine (Latschen), Alpine roses, and Alpine meadows with a few weather-beaten spruce, Cembran pines, and silver fir. Königshaus, 6125 feet.

Wednesday, 4th August.

NOTES ON THE EBERSBERGER FOREST.

GENERAL.

The Ebersberger Forest is situated to the south of Munich on the upper Bavarian plateau, at an elevation of 1700 to 2021 feet above sea-level. The soil belongs to the more recent diluvium, through which the arms of a recent moraine stretch. The boulder debris is covered with a layer of fine-grained, loamy-soil, to a depth of 14 inches. The entire forest belongs to the Bavarian State and extends to 19,219 acres, of which 18,591 acres are under forest. The management is under the control of the Forest Office of Anzing and Ebersberg. Most of the forest has since 1823 been surrounded by an oak paling. Until 1854 it was a royal hunting park. The chase is now under the manage-

ment of the State and contains an enormous head of game, consisting of wild boars, red and roe-deer.

Cause of the Deforestation of certain Areas.

In the year 1889 the nun-moth (*Liparis monacha*) appeared in destructive numbers, by 1890 4942 acres of trees had been defoliated, and in spite of all endeavours the destruction continued till the month of June 1891, when a disease which stopped their progress appeared among the caterpillars. The result of this attack was that—principally in the interior of the forest—6901 acres came under the axe. This was made up of—58 per cent. mature timber, 27 per cent. of timber approaching maturity, 13 per cent. half-grown timber, and 2 per cent. of young wood. Subsequent experience showed that totally defoliated spruce trees of all ages were killed, while those which were only partially defoliated, in most cases became green again and recovered completely. In the case of the Scots pine the leaves of the current year were left, and these sufficed to maintain the transpiration current, and to thus preserve the life of the tree. The larch and the broad-leaved trees on the whole withstood the attack. The wood cut within three years amounted to 50,682,773 cubic feet, whereof 74 per cent. was of timber dimensions. The gross income yielded was £437,309. The work involved in cutting this timber gave employment to 4000 men. All the trees were barked. The bark and branches were burned. In order to facilitate the transport a normal gauge railway, 5 miles in length, was laid down in 1890 by the Royal Bavarian Railway Battalion. This was brought into connection with the felling-areas by narrow-gauge light railways with movable rails. The timber was transported over these light railways in trucks drawn by horses. On the forest railway a rolling stock of 45,000 waggons was kept employed for 585 working days (12th December 1890 to 28th November 1892), and removed 59 per cent. of the total fall. The remainder was transported by road. In the years 1894 and 1895, the forest was struck by a whirlwind and was also visited by severe winter storms. In the partially opened-up forest these storms caused a wind-throw of 9,545,320 cubic feet and increased the area to be re-afforested by 9390 acres. The total fall of timber now amounted to over 600,000,000 cubic feet. There was no subsequent damage done to the remainder of the forest by insects.

Re-Afforestation.

The principal function of the forest management was at that time the re-stocking of the forest, half of which had been cut.

In 1892 and 1893 an area of 827 acres was sown with spruce seed, mixed with pine, birch, and larch, while small openings and holes were planted up with spruce. Subsequently sowing had to be abandoned on account of the increasing herbaceous growth. Owing to the nature of the soil, the object was to cultivate the spruce, not pure, but as the predominant species, in suitable localities, mixed with beech and silver fir.

On these extensive bare areas it was feared that these species, including the spruce, might be damaged by frost, hence it was planned to first cover the ground with a protective fore-growth (nurses) in order that the later-planted, more delicate but principal species, spruce, beech, silver fir, might be sheltered. The protective species chosen were birch together with black alder (*Alnus glutinosa*), and larch (*Larix europæa*) in suitable places. These were planted as 2-year-old seedlings at $6\frac{1}{2}$ feet apart. They succeeded satisfactorily on good soils but failed on shallow soils which here coincided with frost hollows. With the increasing spread of grass and herbaceous growth the development of the larch first fell off, then that of the beech even on medium good soil, and the plants either died or became unhealthy. As both species grew well on good soil, this failure must be attributed to soil conditions and not entirely to damage by deer. On the whole the fore-growth of nurses was not a success, hence from 1901 the cultivation of nurses was gradually abandoned, especially as they were not able to suppress the growth of grass. The grass offered a favourite resort for mice, which destroyed many developing, and even established, groups of beech. The present scarcity of beech groups is principally due to damage by mice, against which no effective measures were available. On this account a strenuous endeavour was made, with success, to cultivate the beech, not on bare areas, but in sheltered and otherwise suitable situations, partly under the selection system, with introduced groups of ash, oak, and also silver fir.

As regards the deforested areas, these had to be, as formerly, reserved for the spruce, which grows well in such places and gives a good return A certain number of exotics were experimentally cultivated. At the present time 3- to 4-year-old spruce raised in the large forest nurseries are used. To a less extent 4- to 6-year

old plants are taken with the ball from neighbouring forest-fields. The planting distance was formerly 3 ft. 3 ins., but was subsequently raised to 3 ft. 10 ins. and 4 ft. 2 ins. The holes are dug by men and the planting is done by women. Some prepared soil is put into the holes along with the trees. Broad-leaved and exotic trees must be thoroughly protected against deer when young. This can only be done by appropriate fencing. The spruce in exposed places is now protected against browsing by deer principally by putting tar on the leading shoot.

The afforestation of the whole area will be completed in 1909.

EXCURSION THROUGH THE SOUTHERN PART OF THE EBERSBERGER PARK.

1. After entering the park the way led through strip-sowings made between 1893 and 1894, with 5·3 lbs. spruce, 2·6 lbs. larch, and 2·6 lbs. birch-seed per acre. To the north lay an opened-up (thinned-out) pine wood 98 years old, which was undergoing regeneration. In the autumn the surplus larch and birch was to be cleaned out of the young growth. On the left of the road lay an 8-year-old spruce plantation, under a partly natural and partly planted fore-growth of 16-year-old nurses.

2. Next came a culture-brake enclosed by a primitive fence against deer. The stock consisted of spruce (seedlings and transplants under protective fore-growth of natural birch and aspen), larch, pine, beech, ash, alder, and lime on the average six years old.

3. View of the western part of the Ebersberger Park. To the south were seen young spruce woods already closed, also spruce plantations under a protective growth of birch. These young spruce plantations are interspersed with old pine woods, but on the south and west they are surrounded by them. The northern part of the deforested area is already almost completely re-afforested.

4. The way then led through a clearing between a 13- to 15-year-old spruce plantation to a noteworthy object-lesson in comparisons.

To the east (Compartment XI., 10) lies a strip-sowing made in 1895 (like Example 1). This consists of spruce, larch, and birch, and was "beat up" in the years 1902-1903. To the west (Compartment XI., 11) occurs a spruce plantation made in 1893 and 1894 without the previous cultivation of nurses, and without any admixture of birch. The planting distance was $3\frac{1}{2}$ feet

by $3\frac{1}{2}$ feet. The cost was about the same in each case, but the advantage of planting over sowing was very striking.

5. A culture enclosed by wire-netting completely protected against all kinds of game. The deep soil (4ft. 3 ins. to subsoil) is also here used in the formation of group mixtures in spruce matrix. The under-mentioned species occupy the following percentages of the area—spruce 71, beech 11, larch 8, Douglas fir 5, *Pinus strobus* 24, ash 0·7, oak 0·3 per cent.

6. Enclosure for the raising of spruce ball-plants and nursery plants. A large part of the area is utilised agriculturally, and also for the raising of spruce. (This is an example of Forestry combined with Agriculture.) The spruce roots are grubbed out in the first spring, and the ground is sown with a crop of oats which is harvested in summer. This, after a light dressing of manure, is followed in the second spring by a potato crop. After the potatoes are lifted a dressing of lime is given, and in the third spring some more artificial manure is applied, when oat and spruce seed are sown. The ripe oats are cut fairly high, and after a few years the spruce plants are lifted with the ball.

By this method not only are the plants obtained free of cost but a considerable net income is gained. The eastern part of the garden is used for the production of seedlings and transplants; these were formerly utilised in the re-afforestation of the devastated areas, but now they are sold to forest-owners or handed over free of cost to other State forests.

A demonstration was given of sowing with Essingler's sowing lathe, transplanting with Haker's transplanting machine and rake, the lifting of plants with Landenberger's apparatus, and the weeding and the hoeing of plants.

7. A 21-year-old spruce thicket grown on a former forest field, which was not sufficiently opened up and which is consequently much too thick. The wood is deficient in height-growth, and a thorough cleaning out is now necessary and will be commenced by the cutting out of broad lanes.

8. Forest House, Diana, occupied by a State forester. Here a pause was made for lunch.

9. To the east a strip of birch alternating with black alder which was formed in 1899 is intended to act as a fire-screen, and in later years it will be made a separation cutting. To the west is a well-grown 17-year-old fore-growth of birch. Larch which was planted at the same time has almost entirely disappeared.

In the year 1901 it was underplanted with spruce, and has since been thinned to prevent excessive shading.

10. A spruce wood mixed with pine and birch and which has also developed from a forest field, the south part is twenty-two and the north part thirty years old. The continued utilisation of the field for agriculture was prevented by the nun-moth calamity. A severe cutting out of the suppressed spruce and pine trees, also the cutting out of birch to prevent whipping is contemplated this year.

11. A thin 75-year-old pine wood with 3525 cubic feet per acre. This pine wood was formed seventy-five to eighty years ago after a hailstorm had completely destroyed a young spruce wood on the same area. Formerly it contained a good many spruce, but these were defoliated in the year 1890 and had to be cut out; since then the pines have shown a strong light-increment. Cutting out of the less vigorous material yields 423 to 564 cubic feet per acre.

Thursday, 5th August 1909.

GRAFRATH.

The Royal Experimental Forest-Garden of Grafrath lies about 20 miles to the west of Munich, 1870 to 1968 feet above sea-level. It is situated on a terminal moraine. There is considerable diversity in soil and aspect.

The climate may be described as that of the cooler Fagetum, with an average annual temperature of from 44·6 to 59° F. during the four principal vegetation months (May to August inclusive). The average humidity of the air during that period is 75 per cent. The annual rainfall is about 27·5 inches.

First frost in October (seldom in September). October 1908, 14° F. Last frost in May, though sometimes in June. On 6th June 1868, 21·2° F. Lowest temperature in winter, −13° F. In the lowest lying part of the garden, −36·4° F.

The Soil.—This varies within short distances from heavy clay to inferior sandy, and gravelly soil. On the higher ground both good and bad soils occur; this is very well shown in the growth of the larch. On the whole the soil is neither very good nor very bad. The southern slopes after clear felling tend to become heathy.

Size of the Garden.—The experimental plots situated to the south of the railway, from Munich to Lindau, cover 98 acres. The

part lying to the north of the line covers 37 acres. Over 61 acres are fenced against deer.

The aim of the Experimental Garden is to study the botanical and silvicultural characteristics of the indigenous trees, and the cultivation of exotics among indigenous species. With this object in view the whole garden is traversed by a network of footpaths, along which all species from other parts of the world, capable of growing in this climate, have been planted. Further back from the walks occur the silvicultural experiments, arranged in such a way that small plots of some exotic species are grown pure. The more tender ones have to be grown under the shelter of indigenous species. The garden was laid out in 1884, and the oldest specimen in it is now twenty-five to thirty years of age. Many of the experiments are entering the stage from which definite conclusions can be drawn. Many are still too recent to yield any definite conclusions. The greatest dangers are early and late frosts and also winter frost, root canker caused by *Agaricus melleus*, *Pestalozzia* along with frost, and mouse epidemics. The various experimental plots had numbers and English descriptions attached.

Friday, 6th August 1909.

KELHEIM. (North).

EXCURSION TO THE NEUESSINGER FOREST.

The party left Kelheim by the Redenburg road which runs through the valley of the Altmuhl River. Shortly after passing the village of Gronsdorf the Compartment Schanze was reached. This occupies rather steep ground rising from the Altmuhl. The soil of this slope consists, like that of all the other valley sides there, of Kelheim chalk. The stand of timber is on an average 96 years old, and consists of Norway spruce, silver fir, Scots pine, larch, and beech in single stem and group mixture. The area is 90 acres.

The Ziegal-thal opens up to the right of the road, and on entering it one finds on the right the Compartment Kager, which contains 86 acres of spruce wood with silver fir, larch, and Scots pine in single stem and group mixture, and average 96 years. On the left occurs the Compartment Kalkofen.

The Compartment Kager on the right abuts on the Compartment Kuhtranke. It contains 111 acres. On its steep, rocky

slope the stand of timber is on the average 20 years old, and consists of spruce, silver fir, beech, and larch mostly from natural seeding, and is irregularly mixed.

The road here was left and the Compartment Kalkofen was entered. It extends to 108 acres. The stand of old timber consists of spruce, silver fir, larch, Scots pine, and beech, all about a hundred years old, in stem and group mixture. The larch which occurs in this Compartment is characterised by its fine, straight growth. The natural regeneration of the beech is now ended, and the future management will be directed towards the natural regeneration of the spruce. Spruce seedlings were seen springing up everywhere as the result of seeding which occurred in 1907.

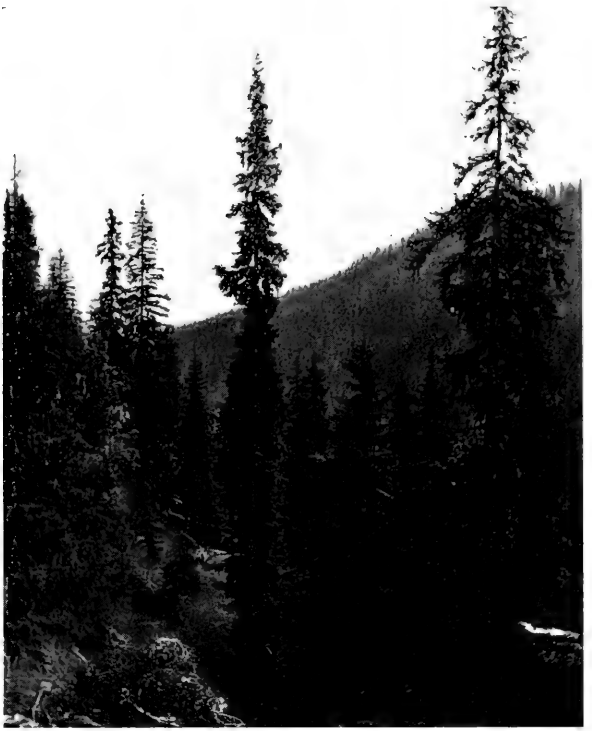
The Compartment Schulerloch with 78 acres abuts on Kalkofen, and is under natural regeneration which is nearly complete. It consists of 20-year-old spruce mixed with beech, silver fir, and larch, but a few of the old trees have been left to give shelter to the Compartment Kalkofen.

After crossing the road the party arrived in the Compartment Plattenberg. The trees on this plateau are spruce, silver fir, pine, and beech about a hundred years old. The Compartment has been regenerated, partly naturally and partly artificially, with beech, spruce, and larch.

After leaving this Compartment and passing along the margin of a meadow, surrounded on all sides by the State Forest, and in the middle of which lies a small steading, the Compartment Dachsbau is reached. This contains 56 acres, with a stand of timber (about a hundred years old) of spruce, silver fir, and beech, together with a few well-grown larch in single stem and group mixture. The natural regeneration of the beech has been very successful on the shallow, rocky ground. The spruce seedlings which were everywhere abundant were produced in the year 1907.

After returning to the road the party passed through the Compartment Langerbogen, which extends to 46 acres with 100-year-old spruce, silver fir, beech, Scots pine, and excellent larch in single stem and group mixture. In this Compartment the regeneration of the beech is on the whole completed. The future management will be directed towards the regeneration of the silver fir and the spruce.

On descending into the Hammertale the party passed through



PARTENKIRCHEN. Columnar Spruce observed on the ascent of the Schachen.

PARTENKIRCHEN. View from the Schachen. Alpine forest of *Pinus Cembra* and *Picea excelsa*. The distant peaks are the Hoch Blassen on the left and the Alp Spitze on the right.

[*To face page* 88.

EBERSBERGER PARK. Planting with ball plants.

EBERSBERGER PARK. Example of planting *versus* sowing in reafforestation. The spruce wood on the left was planted 12 years ago, that on the right was sown 8 years ago, under birch as nurses.

EBERSBERGER PARK. Demonstration of Sowing with Essingler's Sowing Lathe.

KELHEIM. Silver Fir and Beech undergoing natural regeneration on group-system. In foreground, commencement of a group; in middle distance, older group, indicated by clear patch of sky. These groups will become confluent by peripheral extension.

KELHEIM. Neuessinger Forst. Spruce growing well on very dry situation, south aspect. Calcareous rock.

KELHEIM. Silver Fir. View of mature trees and new crop produced by natural regeneration on the group-system.

a 55-year-old spruce wood mixed with silver fir and Scots pine and arrived at a giant oak, the age of which, from its dimensions and form, is reckoned at many hundred years. (Near this oak a short halt was made for lunch.) From here the Excursion was continued between the Compartments Riederbuchel and Dachsbau with 40- to 60-year-old spruce, silver fir, and Scots pine. On following a path which branched off to the right of the valley a 15-year-old wood of spruce and silver fir which had been reproduced by natural regeneration was inspected.

The road leading to the plateau passes the Compartments Weiden on the left-hand and Riederbuchel on the right-hand. These Compartments contain beech, silver fir, and spruce, which have been naturally regenerated under the group-system. Only a few of the old trees remain. These consist of 120-year-old spruce and silver fir with a few beech and Scots pine. On reaching the plateau, the party had a good view of the Compartment Randeckerirlach which had been regenerated on the so-called Neuessing system. This consists of 19-year-old spruce and silver fir in group mixture with a few beech and larch.

On crossing the plateau, through open fields, the party arrived at the ruined Burg of Randeck, from the tower of which the beautiful and extensive view of the Altmuhl valley and especially of the forests of North and South Kelheim was much admired. From here a descent was made to the valley, and after crossing the Altmuhl at the village of Altessing, the party returned to Kelheim along the right bank of the river.

Saturday, 7th August 1909.

KELHEIM. (South.)

EXCURSION TO HIENHEIMER FOREST.

The party set out by the road leading to the Befreiungshalle—built in 1842-63 by King Ludwig I.—and arrived at the Crown lands of Michelsberg which have an area of 114 acres. This part of the forest is maintained for æsthetic or landscape effect. The yew tree is fairly abundant.

At the second Roman Wall (more probably however a defensive wall built by the Celts) the State Forest begins, and covers an area of 7413 acres. The lowest elevation is 1148 feet and the highest 1607 feet above the level of the North Sea. The timber-yield from this forest, complex at present, amounts to 565,056

cubic feet of spruce, silver fir, and beech, 52,974 cubic feet of oak, with 229,554 cubic feet as thinnings. The total yield is therefore 114 cubic feet per acre.

On the Right—

Compartment II. 2. Sattlerholz.

Right and Left—

I. 13. Coniferous forest, which was formerly in private ownership but was bought in the years 1889, 1892, and 1894. It is 114 acres in extent.

I. 1. Vorderer Römerbogen. 74 acres. The regeneration of spruce, beech, and silver fir was well advanced. It contains also a few flourishing group of oak.

I. 3. Kanzel. 24½ acres. 40-year-old oak from seed with beech for protection.

I. 4. Herrenholz. 20 acres. About 12-year-old oak from seed.

I. 5. Hintere Römerbogen. 131 acres. 180 years. Beech, spruce, and silver fir, a great part of which has been naturally regenerated. The proportion of spruce is 0·7 per cent., beech 0·2 per cent., and silver fir 0·1 per cent.

I. 6. Langwiese. 24½ acres. The regeneration was begun on the selection system and was nearing completion. Large nursery to raise plants for private forest-owners.

On the Right of the Road—

II. 7. Buchgrund. 100 years. Spruce wood with beech and larch.

II. 8. Alte Sulz. 90 years. Beech wood with spruce occurring in groups. Final yield, 78,960 cubic feet per acre.

On the Left of the Road—

I. 9. Heugrund. 22 acres. 60 years. Oak wood (partly sown, partly naturally regenerated). Thinning and cleaning in process.

On the Right of the Road—

II. 9. Grunmarter. 15 acres. 60 years. Oak wood with beech (the beech partly co-dominating and partly dominated); then 114 acres 90-year-old beech wood with a few, very flourishing, oaks.

II. 10. Suhlbogen. 109 acres. Oak wood, 410 to 500 years old, mixed with 200-year-old beech and spruce. The cubic contents in old oak is about 105,968 cubic feet. The whole Compartment will be regenerated with oak. The method will be to cut the oak in strips (proceeding from east to west, or north-east to south-west). The strips will be sown with 14 bushels of acorns per acre, after the soil has been artificially prepared.

I. 11. Grubet. 46 acres. 33 years. Oak wood (sown), King's oak; height 118 feet with a clean stem of 65 feet, valued at about £150.

I. 10. Rotmarter. 66½ acres. 53 years. Oak wood (sown and natural regeneration) with beech. Thinning in process.

I. 12. Buchenholz. Formerly private forest, but purchased by the State within the last few years; of varying age.

I. 9. Heugrund. 24½ acres. 70-year-old beech with a few spruce and oak thinned 1908.

I. 8. Platte. 20 acres. 73 years' beech with advanced growth of oak, birch, and spruce.

I. 7. Fleckl. 110 years. Spruce wood with a few beech and larch. Felling in combined systems (strip and selection cutting). A ride had been cut through to facilitate transport.

Here the Danube was crossed by the ferry to Weltenburg, whence the return journey to Kelheim was made by boat. During the journey a wood of oak and ash 55 years old was seen at Wipfelsfurt. Height of ash and oak, 112 to 115 feet; free from branches to a height of 82 feet. (Compartments Kanzel and Hohlstein.)

Monday, 9th August 1909.

SKETCH OF THE FOREST CONDITIONS IN THE NUREMBERGER REICHSWALDENUNGEN.

I.—Position.

The extensive State Forest area known as the Reichswald stretches along both banks of the Pegnitz River, upon which is situated the town of Nuremberg. It is divided into two main parts, which are called after the two principal churches of the town—

Laurenzer Wald and Sebalder Wald—the former lies to the south, the latter lies to the north of Nuremberg. At the present time the total area of the two forests is 75,316 acres. A quantity of the land near the outskirts of the town has within the last century gradually passed into private ownership.

II.—Soil and Climate.

The soil is derived from the Upper New Red Sandstone and diluvium. The Jura formation is represented on small areas only. Wide stretches of the area however are covered by quaternary deposits of diluvial sand, which in many places forms a thick bed above the underlying strata, and which presents to the eye extensive level plains, only here and there traversed by dune-like undulations. The average altitude of the area above the level of the North Sea is 984 to 1009 feet. In places ranges of hills trending from east to west, composed of Upper New Red Sandstone, rise from the bed of the former diluvial sea to a height of 1443 feet. The climate is a moderate one. The average barometric pressure is 28·94 inches. The average temperature is 47° F. Frost and snow appear in winter about December and disappear about the month of April. The chemical and physical qualities of the soil vary in an extraordinarily abrupt manner over small areas of the apparently homogeneous landscape. It changes from good, deep, sandy-loam to dry, fine-grained sand. Sandy soil containing only a little humus with a great tendency to drought and tolerably fresh sandy-humus soils predominate. Frequently in hollows or low-lying situations there is a tendency to bogginess. In such places there is frequently a good supply of water.

III.—Forest Conditions and Object of Management.

In accordance with the condition of the soil already described, the predominant species belong to the indigenous conifers, the principal tree being the common Scots pine (*Pinus sylvestris*), which composes 70 per cent. of the forest. It occurs pure and without any admixture of other species in the dominant classes. Next in importance comes the spruce, which also forms fairly extensive pure woods. The silver fir (*Abies pectinata*) and the larch (*Larix europæa*) occur seldom. Among the broad-leaved, species occurs the oak (principally *Quercus pedunculata*), which was undoubtedly much more abundant in the previous century, the alder (*Alnus glutinosa*), and the beech (*Fagus sylvatica*),

but these are poorly represented. In localities where the soil is not too poor in mineral food-constituents the growth of the Scots pine may be described as good to very good, and in many cases excellent. The same applies to the other species when they occur in suitable localities, that is, their strong, normal growth and development leaves nothing to be desired. On the other hand, on very poor, sandy soil which gets no water from the subsoil, the growth frequently deteriorates into scrub. On the whole, with a rotation of a hundred years the annual average increment in timber (down to 2·75 inches at thinner end) is estimated at 45·120 to 49·350 cubic feet per acre, of which the maximum may be 84·6 cubic feet and the minimum may be 9·87 cubic feet.

High-forest is the principal form, with the exception of a few small areas. Until the year 1889 there were two working-sections of 80 and 96 years, the woods however in which cuttings took place were as a matter of fact usually much older. Strip-cutting is everywhere, with few exceptions, the rule on account of the nature of the soil, and also on account of certain exceptional conditions of management. The Reichs Forest has from time immemorial been subject to numerous rights claimed by the inhabitants within its area, such as the right to structural timber and fire-wood, forest litter and grazing. The object of management is therefore still the production of timber-producing coniferous woods capable of supplying the demands imposed by those burdens, and at the same time yielding an ever-increasing rental to the State.

IV.—Dangers to which the Forest is Exposed.

A most far-reaching natural calamity occurred in this forest during the last decade of the previous century, when the caterpillar of the Kiefernspanner (*Fidonia piniarea*) increased to an unprecedented extent (this moth was not previously considered a dangerous pest of the Scots pine). In a few years 15,394 acres of the Laurenzer forest and 7561 acres of the Sebalder forest were destroyed. This entailed the cutting, between 1895 and 1897, of 7,392,373 cubic feet of timber; that is, twenty times the then existing annual yield of these forests.

V.—Method of Re-Afforestation.

After this extraordinary felling was completed, the State Forest Department set about the re-afforestation of these 22,955 acres in

the Nuremberger Reichswald, as well as of an additional 3953 acres in neighbouring forests in the middle Franken pine territory. At the present time (1909) the re-afforestation is practically ended. These operations have been carried through on an area of about 27,000 acres, and have involved an expenditure of about £108,000, so that the cost per acre has been £4.

As regards the method of re-afforestation, the cleared areas were partly sown and partly planted in the proportion of thirty to seventy. Sowing could not be carried out over extensive areas, since it was only possible to sow during the year following the cutting. After that the ground became too strongly covered with herbaceous and other growth for the seed to find a suitable bed for germination. The method of broadcast sowing was practised on small areas after the soil had been broken up. On the other hand, natural seeding was more extensively tried. The soil was prepared in strips. The covering was first removed, and then the soil was broken up with special iron instruments or the mattock. The natural seeding was not, however, so successful as was expected. Hence planting played the most important part in the re-afforestation.

The method applied on the largest scale was the planting of 1-year-old pines in strips 12 to 16 inches broad in which the soil had been previously prepared. The distance between the strips was 2 ft. 3 ins. to 3 ft. 3 ins., so that 25 per cent. to 30 per cent. of the area was worked to a depth of 10 to 14 inches. The plants in the strips were in rows 20 inches apart, with double rows here and there. They were planted with the triangular planting-iron or with the wooden dibble. The number of plants per acre was as a rule 9000, but varied between 5500 and 10,000.

By this method by far the greatest portion of the devastated area was replanted. It was practised with success on the light sandy-soils as well as on the loamy-sand soils, and even on peaty ground when it was possible to bring the mineral soil to the surface by artificial working. Part of the material used for planting was raised in the State Forest Nursery, the rest was obtained from commercial nurseries at a distance. The supply of plants from local forest nurseries was rendered very precarious by the pine leaf-cast fungus. The latter method, therefore, of bringing plants from a distance was cheaper and also better. In addition to 1-year pine seedlings, 2-year-old plants were used. Two-year 1-year plants gave very satisfactory results.

Sometimes also 3- to 5-year-old pines were transplanted with the ball from neighbouring broadcast or strip sowings.

In order to establish the spruce in suitable places 3- to 4-year-old transplants were used, and occasionally 2- to 3-year-old seed-bed (untransplanted) plants were substituted. This method was adopted where it was desired to mix the spruce in single stem mixture with the pine either as an undergrowth or soil-protector.

Planting the spruce was necessary since the experiment of sowing the spruce seed among the 1-year-old pine seedlings proved a failure, as the young spruce seedlings in the loose-worked soil of the strips were very liable to be thrown out by frost; nevertheless, in some cases, it was possible to obtain the desired mixture by this method.

In very wet soil or in soil with a deep layer of moss the planting was done in upturned sods. A hole was made with the planting-iron in the sod, which was placed face downwards. This hole was filled up with mineral soil, in which the 1-year pine seedlings or the 2-year 1-year pine plants were placed. This method of planting gave very satisfactory results, but was found to be expensive. Exotics were used only to a very small extent on the re-afforestation area. Here and there small experimental plantings were made with *Pinus Banksiana* and *Pinus Murrayana* (which proved not to be frost-hardy); *Pinus strobus* and *Pseudotsuga Douglasi* were also planted.

Tuesday, 10*th August* 1909.

SPESSART.

Royal Forest of Rothenbuch.

The forest of Rothenbuch lies in the interior of the southern part of the forest region of the Spessart (in the High Spessart). It covers an area of 8634 acres; of this 118 acres are not used for timber production. The highest point of the forest is 1700 feet (Compartment Hengst Kopf), the lowest 823 feet (at Lichtenan and at the north limit of the Compartment Rauhoh) above the level of the North Sea. The soil is sandy with more or less loam. It is poor in mineral-constituents, and is rendered fertile only on account of its humus content. The climate is fairly severe, with late and early frosts. Full mast years for beech and oak are expected every ten to twelve years. The stand of timber is formed principally of broad-leaved trees, such as beech.

About 1235 acres are stocked with oak principally, but the conifers, sometimes pure and sometimes mixed with beech, cover large areas. Those belong principally to the younger age-classes.

The proportion of species in mixture in the forest is :—

Oak	15·5 per cent.
Beech and oak . .	9·5 per cent.
Beech	53·0 per cent.
Beech and conifers .	7 per cent.
Pine	11 per cent.
Spruce	4 per cent.

The following kinds of woods are represented :—

1. Oak woods, pure or mixed with beech.
   (*a*) Mixed woods of 400-year-old oak and 200-year-old beech about 370 acres.
   (*b*) Oak woods of 100 to 120 years, with beech partly as underwood and partly as co-dominating wood, about 74 acres.
   (*c*) Oak woods, young and in the pole stage, up to 85 years, covering extensive areas, part pure and part mixed with beech as under and co-dominating wood. There are no oak woods between 120 and 400 years.
2. Beech woods.
   (*a*) Mostly pure or under old oak, or sometimes mixed in groups with oak of the same age.
3. Pine woods, part pure and part mixed with larch, beech, and spruce.
4. Spruce woods, mostly pure.

According to soil and position, the above-mentioned species thrive well, and under favourable conditions reach a considerable height with full cylindrical stems. Conifers clean themselves with difficulty of lower branches.

The system is entirely high-forest, with 300 years' rotation for the oak, and 120 years for the beech and other species.

The annual fall (yield) gives :—

1. Principal yield :

300 years' rotation .	98,886·420 cub. ft.	353,165·805 cub. ft.
120 ,, ,, .	254,279·385 ,,	
2. Intermediate yield	125,373·852 ,,	
Total	478,539·657 ,,	

Professor HEINRICH MAYR.

KELHEIM. Neuessing group-system always completed within 20 years as regards regeneration. Shown here in finished state. The centres or commencement of two groups indicated by taller trees. The trees become smaller towards the place where the groups converge.

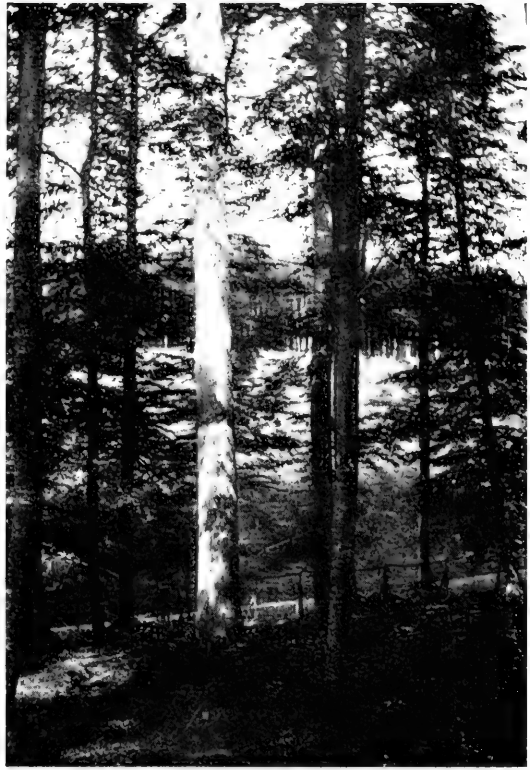
[*To face page* 96.

NURNBERG. Preparation of the soil in strips for planting.

NURNBERG. Strip planting of Scots Pine on prepared lines.

NURNBERG. Mature wood of Scots Pine (90 years of age). Leaf litter had been removed, and soil was therefore impoverished.

NURNBERG. Scots Pine.



SPESSART. Oak, 200 years old, with Beech, 120 years old. Natural regeneration of Oak in rising ground behind the large trees.

SPESSART. Giant Oak, 400 years old.

Actually cut during the nine years 1901 to 1909, annual average:—

Principal yield, 300 years' rotation (oak)	110,364·309	cubic feet.
,, ,, 120 ,, ,,	293,480·793	,, ,,
Intermediate yield	179,055·036	,, ,,
Total	582,900·138	,, ,,

The high value of the old oak may be specially mentioned (sessile oak about 400 years old). On account of its fine quality and golden-yellow colour, it is very well adapted for furniture making. It is easily sold at prices well above 10 shillings per cubic foot.

Forest Conditions.

The forest is under the following obligations (burdens):—

1. To supply the necessary structural timber at normal price.
2. The right to remove dry and decayed wood or that lying on the ground, in so far as it is not more than $3\frac{1}{2}$ inches diameter at 17 inches above the soil.
3. The right to remove branch wood and twigs after felling, provided these are not more than 2 inches in diameter.
4. The right to remove blown timber or wood broken by snow and ice, provided there is not more in one place than 15 cubic feet. None of this must exceed 2 inches in diameter.
5. The free right to remove the stumps in certain cases.
6. The grazing of cattle and feeding of swine under the supervision of a herd. The swine are excluded in a mast year.
7. The right to remove litter according to certain restrictions. The litter may be removed during eight years, after which a ten years' rest is given.

The regulation in regard to the removal of litter is of great importance in this forest, as the poor sandy-soil is of very little use without the admixture of humus. At the present time little damage is done as there is sufficient litter to meet the demand. The right to remove litter has a considerable influence upon the management, since thinnings cannot be made in the

broad-leaved woods before the sixtieth year, nor in the coniferous woods before the thirtieth year. (Late thinning and increased expense.)

Principal Objects of Management.

The beech is desired as the matrix of the forest as far as possible. The maintenance of beech woods on large areas is however avoided. Suitable but not too small areas in the beech woods are to be filled up with oak, or in other cases with larch in groups or single, likewise with spruce and pine in larger or smaller groups. The oak groups are raised from seed in small woods.

The beech is naturally regenerated under a shelter-wood (Group-system).

The conifers are established by planting 1-year pine, and 2-year spruce and larch. In certain exceptional cases 3-year-old spruce and larch are pit-planted.

The oak (Durmast) is only planted in suitable localities in large groups or in whole woods pure or under-planted with beech.

In raising the plants only local Spessart seed is used. Therefore, regeneration can only be carried on during mast years. When seed trees are present the natural regeneration is assisted by breaking up the soil and covering the fallen acorns. When no mother trees are present artificial sowing is carried out, either broadcast or by dibbling-in irregularly $16\frac{1}{2}$ to 20 bushels per acre, or in rows with $6\frac{1}{2}$ to 10 bushels per acre. The prepared strips are 12 to 16 inches broad, and $23\frac{1}{2}$ to $27\frac{1}{2}$ inches apart. The young oak is protected against over-shading and suppression by beech. In oak woods, where an undergrowth of beach is absent, this is introduced by planting when the oak is in the pole stage. Good oak groups and woods may be retained for more than one beech rotation. They give extremely valuable material when about three hundred years old.

The pine is used—especially in southern and western aspects for afforestation where the soil has deteriorated and in the regeneration of badly-grown beech—as far as possible with beech (sometimes spruce) as underwood.

Pine woods are being at the present time and will be in future underplanted with beech. The spruce is used abundantly in the afforestation of bare, moist, low-lying localities and for mixing with beech on east and north aspects.

The larch is planted wide apart in suitable localities and soil in beech woods. The other conifers and broad-leaved trees, as well as exotics, are not abundantly represented.

Notes on the Excursion.

The Excursionists arrived, first of all, at the primeval woods,—dense beech woods of all ages up to two hundred years interspersed with single stems and groups of oak about four hundred years old. These oaks are of great height (about 140 feet in height) and in many cases have fine stems. On the high ground the regeneration had commenced. The existing young growth of beech is useless and must be removed before regeneration commences. After leaving the primeval forest, and proceeding on the journey through Lindenbuch, many fine oak groups and young beech woods with a few oak standards were seen. Compartment Potasche. Oak groups about one hundred years old, under-planted with beech. Woods of mixed oak and beech. Weissenstein is the oldest wood under-planted with beech, and gave an idea of the way in which the oak is now grown. The Excursion was continued along the Eselshohstrasse (old Roman road and boundary between Rotenbuch and Waldaschaff) to Schilder. Young woods were passed, among which the fine oaks in Schneuse were specially admired. From Schilder the drive was continued downhill to Waldaschaff, and from there to Hosbach and Aschaffenburg.

The following is an Alphabetical List of the Excursionists:—Sir Andrew N. Agnew, Bart. of Locknaw; Robert Allan, Polkemmet, Whitburn; John F. Annand, Newcastle-on-Tyne; Dr A. W. Borthwick, Edinburgh, *Hon. Cryptogamist;* John Boyd, Crown Forester's House, Inverliever; J. B. Braid, Great Witley, Worcester; Charles Buchanan, Penicuik, *Convener of Excursion Committee;* H. M. Cadell of Grange; R. C. Cowan, Eskhill, Inveresk; R. W. Cowper, Gortanore, Sittingbourne; John D. Crozier, Durris, Drumoak; John G. Cunningham, of Letham, Fife; William Dawson, Marischal College, Aberdeen; James Falconer, Hill, Errol; A. C. Forbes, Department of Agriculture, Dublin; James Forbes, Overtoun, Dumbarton; Robert Forbes, Kennet, Alloa; Arch. K. Foulis, Edinburgh; Robert A. Fraser, Edinburgh; Robert Galloway, Edinburgh, *Secretary and Treasurer;* Sydney J. Gammell, of Drumtochty;

A. T. Gillanders, Alnwick; Donald Grant, Ferrit, Tulloch; James L. Gray, Elginhaugh, Dalkeith; David Hardie, Errol Park, Errol; J. Smith Hill, Agricultural College, Aspatria; Henry Jonas, London; Robert C. Jonas, London; David Keir, Ladywell, Dunkeld; William King, Elgin; C. E. Legat, Pretoria, Transvaal; George Leven, St Quivox, Ayr; Sir Leonard Lyell, Bart. of Kinnordy; John M'Bain, Aberdeen; George U. Macdonald, Peebles; Wm. Mackenzie, Novar, Evanton; John M'Kerchar, London; R. E. Marsden, London; Fred Milne, Fothringham, Forfar; David Mitchell, Drumtochty; Cyril Moiser, Heworth Grange, York; Alex. Morgan, Crieff; Alex. J. Munro, Edinburgh; George A. Munro, Edinburgh; A. Murray, Kingswood, Murthly; Edward B. Nicolson, Edinburgh; George H. Ogilvie, Edinburgh; W. Ralph, Corstorphine; C. Ronald Ritchie, Edinburgh; J. D. Rutherford, Edinburgh; Frank Scott, Comlongon, Ruthwell; Thomas Sharpe, Monreith, Portwilliam; James Shiel, Abbey St Bathans, Grantshouse; Robert Skimming, Kirkinner; Fraser Story, University College, Bangor; D. P. Thompson, Inverkeithing; Andrew Wardlaw, Bridge of Allan; John Watson, Edinburgh; James Whitton, Public Parks Department, Glasgow.

Dr Heinrich Mayr, Professor of Forestry, Munich, accompanied the party throughout the tour as Official Guide, appointed by the Bavarian Government.

[The foregoing report was prepared by Dr Borthwick, at the request of the Excursion Committee, from information obtained from official sources and from his personal knowledge of the forests visited. The members of the Excursion, on the last day of the tour, formally thanked Dr Borthwick for preparing the very useful guide which had been put into their hands, but the Committee now think it right to record their thanks for the great assistance rendered by him to them both before and during the tour.]

14. The Forestry Exhibition held in the Highland and Agricultural Society's Showyard at Stirling.

The Royal Scottish Arboricultural Society held their ninth Annual Exhibition of Forestry in the Showyard at Stirling from 20th to 23rd July 1909. Stirling being situated in a central district, it was expected that there would be a large collection of exhibits and keen competition for the various prizes offered, but though this anticipation was not altogether realised, the entries comprised a fair collection of interesting objects. The timber competitions were again divided into open and local sections, the prizes in the former being as in previous years offered by the Highland and Agricultural Society. The principal exhibitors in the timber sections were Captain Stirling of Keir, Mr J. A. Stirling of Kippendavie, the Duke of Montrose, and Mr J. Ernest Kerr, Harviestoun Castle, Dollar, and the quality of their exhibits compared favourably with similar exhibits in previous years.

In the competition for farm gates made of home-grown timber there were five exhibitors—namely, Captain Stirling, Mr J. A. Stirling, Mr Wm. Low, of Balmakewen, the Duke of Roxburghe, and Mr James Younger of Mount Melville. Mr J. A. Stirling and the Duke of Roxburghe were also exhibitors of self-closing wicket-gates. The only exhibitors in the competition for a full-sized section of rustic fence made from thinnings were Captain Stirling and Mr J. A. Stirling.

Mr Alan Burns, of Cumbernauld, forwarded a very interesting exhibit of specimens showing the good and bad effects of pruning, and an extensive collection of fungi injurious to forest trees and shrubs. Another collection of fungi was exhibited by Mr Hugh R. Munro, assistant forester at Murthly.

The Duke of Roxburghe sent a large collection of examples of damage caused by squirrels, voles, rabbits, hares, and blackgame; with specimens of *Peziza willkommii* on Japanese larch, and other diseases. He also sent a working model of a portable boiling creosoting plant, and photographs of a portable sawing and creosoting outfit, showing the plant in transit, a general view of the plant working, tackle for lifting and setting tank, and portable saw benches.

The Competitors showing miscellaneous articles wholly

or mainly made of wood, were the following:—Mr Thomas Strachan, Keir, card table top made from twenty-four varieties of home-grown hardwood timber, and a model wicket-gate; Mr Alexander Pollock, Tarbolton, rustic oak seat made of oak grown on the banks of the river Ayr; Captain Stirling of Keir, model of a field-gate made of walnut 200 years old, and a similar model made of oak 90 years old; Mr John A. Howe, forester, Kippendavie, also exhibited a model field and wicket-gate, made of larch 120 years old, grown at the gathering stone where the battle of Sherriffmuir was fought.

Articles for exhibition only included the Society's own slides showing sections of timber of British-grown trees and shrubs and plant tissues. The Duke of Roxburghe showed a collection of coniferous seeds as sown in the home nursery, and photographs showing forest railway, sawmill, and plant of the woodyard. The Duke of Montrose sent three specimens of home-grown timber, namely, Douglas fir cut out of a standing crop of 213 trees per acre and of 50 years' growth, silver birch, and bird cherry. Mr John D. Sutherland, Ardconnel Lodge, Oban, exhibited blocks of different kinds of timber grown on the Ardanaiseig Estate, on Loch Awe-side (belonging to Mr Ainsworth, M.P.), for the purpose of suggesting their use for technical instruction in country schools. Specimens of abnormal growth, and specimens showing frost crack and damage from other causes were sent by Mr Burns of Cumbernauld; while Mr Alexander Gow, assistant forester, Murthly, forwarded a fine collection of cones and foliage of different kinds of conifers. Mr John D. Crozier, forester, Durris, exhibited a valuable collection of hand specimens of exotic timbers; and Mr F. R. S. Balfour sent a section of larch planted at Dawyck, Peeblesshire, previous to 1737, by Sir James Naesmith of Posso.

A collection of decorative plants sent by Mr M. Chapman, Tarbrex Nurseries, St Ninians, Stirling, and a collection of decorative shrubs sent by Messrs W. Drummond & Sons, nurserymen, Stirling, were utilised to advantage in the scheme of arrangement.

The judges were Mr W. Dawson, Marischal College, Aberdeen; Mr George Leven, Auchincruive, Ayr; and Mr John Broom, Bathgate. The Report and Prize List will be found in the Proceedings of the General Meeting held at Stirling in 1909.

NOTES AND QUERIES.

The Beech Tree in Scotland.

Information is invited as to the latitude and the altitude up to which the beech tree flourishes in Scotland ; and, where it shows signs of being out of its element, as to the probable causes of such indications.

Effects of Frost on Plants of *Larix europæa* and *L. leptolepis* Compared.

In the home nursery of an estate in the West Highlands where the writer was employed, a plot of seedlings of *Larix europæa* were, during the spring of 1907, put in side by side with one of *Larix leptolepis*. Both plots were in full growth when the severe frost about the end of April 1908 occurred, and both suffered severely. They were allowed to remain in the nursery till the spring of 1909 when they were to be planted out.

Of the European larch, more than 60 per cent. were worthless, not having been able to recover from the damage caused by the frost. But nearly all the Japanese larch were good plants, having suffered but little permanent damage. If, as this seems to indicate, the Japanese larch can thus throw off the effect of late spring frosts, it should be the better able to withstand the attack of the larch canker (*Peziza willkommii*).

David Stewart.

Suggested use of *Abies nobilis* for Planting up Blanks in Old and in Young Woods.

Though this tree cannot be recommended for general planting, I think it is one of the most suitable for filling up blanks that may occur in plantations, whether old or young. It is a good shade bearer, and, once established, it is a very rapid grower. I have often seen annual growths from 2 to 3 feet long on trees of about 10 years old, and after this age the rapid growth is maintained. It is liable to suffer from frost in the earlier stages

of growth; but if used for the purpose suggested, it would be protected by the surrounding crop. It is not very particular as to soil, but does best on a strong, fresh loam. One advantage gained by using *Abies nobilis* is that it does not need protection against rabbits. I have seen hundreds grown where rabbits were plentiful, and have never yet seen more than one or two small twigs damaged. As a timber-tree I should class it as equal to the silver fir. As an ornamental tree there are few that surpass it for beauty and grandeur.

DAVID STEWART.

PLANTING WITH THE MATTOCK.

This method may be practised on rocky, rough, heath-clad mountain sides, and is the best method of planting on exposed situations, owing to the benefit which the plant derives from the shelter which the pit (made under this method of planting) affords it until it becomes firmly established. The handle of the mattock is $3\frac{1}{2}$ feet long, the broad end, which is shaped much like an adze, being 16 inches long, and the pointed or pick end 17 inches long. The adze end is used to pare off the sward, heath, or other obstructions which may be in the way of clearing a seat for the plant; the pick end is then used to open up the soil to the required depth. When working on a steep hillside, the soil should be drawn towards the operator, who stands with his face to the hill, and the planting operation is then performed with an ordinary garden trowel. The trowel is inserted into the soil in the centre of the pit, and is drawn towards the planter with the right hand. The roots of the plant are then placed, with the left hand, in the hole thus made, and the soil is allowed to fall back by withdrawing the trowel; the plant is then given a slight upward shake so as to bring the roots into their natural position. The rest of the soil is then filled in, and the whole is firmed with the foot, care being taken to leave the front of the pit higher than the back, so as to catch and retain the moisture, which would otherwise, as in notch-planting, run off over the surface. Stones which may have been taken from the soil during the first operation, should be placed round the edges of the pit so as to afford as much shelter as possible to the young plant.

THOMAS HALL.

Forest Fires in Canada.

During the month of August last terrible conflagrations occurred in the forests of British Columbia. In the Kootenay district the fire, a mile wide, swept over the country consuming all before it. Timber to the value of many millions of dollars was destroyed, with many sawmills, while valuable timber limits along Arrow Lake and near Creston were burnt.

Japanese Oak.

During the course of a case recently tried in the City of London court, it was stated that Japanese oak, which has been imported during the last three or four years, is not increasing in favour, being less serviceable than European oak owing to excessive shrinkage.

Sir William Schlich, K.C.I.E., F.R.S.

All foresters, British and Indian, will join in hearty congratulations to Sir William Schlich on his elevation to a Knight Commandership of the Indian Empire. He is personally connected with Scotland, having been an Honorary Member of our Society since 1889, and he is now Additional Examiner in Forestry at the University of Edinburgh.

The Japanese Larch *versus* the European Larch.

On this estate (Gregynog) about 2 acres were planted with a mixture of Common larch, Scots fir, and Douglas fir, and about 2 acres with Japanese larch, Scots fir, and Douglas fir. Rabbits did enormous damage in the first four or five years, and the plantation has been filled up many times. As the rabbits are not so numerous now as formerly, it is hoped that the crop will soon be properly established. The Japanese larches have quite justified their introduction, for those that the rabbits left (and they have been less touched by the rabbits than any other species) are well grown, and at present are entirely free from disease, while the European larches in the other half of the plantation are badly attacked. The only other Japanese larches on the estate are also free from disease. Judging from

this experience, the writer is of the opinion that the Japanese larch should be planted here in preference to the European variety, but, of course, only on soil and in situations suited to it.

W. H. WHELLENS.

AFFORESTATION OF THE INVERLIEVER ESTATE.

Progress of the Work.

The *Journal* of the Board of Agriculture for June 1909 states that the Board has been furnished by the Commissioners of Woods with the following statement of the progress which had been made up to April 1909 in the afforestation of the Inverliever Estate:—

"Work to the end of April has been entirely of a preparatory nature. It has been impracticable to proceed with planting in the area selected, as local labour was unobtainable, and for outside workmen dwelling accommodation was not procurable. A corrugated iron bothy has accordingly been erected at Cruachan, the most convenient spot, to accommodate twelve men, and a similar but smaller structure has been put up for the nurserymen at Ford. Shelter sheds in the nursery and upon the site to be planted next season have also been built.

"The area to be planted during the next two seasons has yet to be fenced against sheep and cattle, but the erection of the fences will be commenced almost immediately. A site for a nursery, which will eventually be about seven acres in extent, has been selected at Ford, and this has been fenced. A part of it has been ploughed, manured, and trenched, and by the end of this season about 400,000 conifer seedlings will have been planted in it and several seed-beds sown.

"A plan of planting operations for the next twelve years has been drawn up, under which not less than 150 acres per annum will be planted. The site for next season's planting has been examined with regard to the species of conifer most suited to the varying conditions of soil, moisture, exposure, etc. The clearing of valueless scrub, necessary on parts of this area, is almost completed. Drains have been cut through the swamps, and the drainage of part of the adjoining 150 acres is in progress."

In answer to a question asked on the same subject in the House of Commons on 2nd December, the Secretary to the Treasury gave the following additional information:—"The fencing of

the area to be planted during the next two years has been put up. Planting, which will extend this season to about 150 acres, has been begun upon the ground which was prepared last year, but for the present is stopped by the frost. The area of the nursery at Ford has been extended, and at the present time occupies about 5 acres. The following seedlings for the nursery were purchased in the United Kingdom in February last:—45,000 Scots pine, 40,000 larch, 180,000 spruce, 15,000 Douglas spruce, and 5000 Sitka spruce; and at the same time 100,000 spruce were purchased in Germany at a cost of £6, 17s. 4d. The following plants have been ordered in the United Kingdom for direct planting on the hillside (no plants having been ordered abroad for this purpose):—150,000 larch, 80,000 Scots pine, 35,000 Douglas spruce, 45,000 silver fir, 240,000 spruce, and 40,000 Sitka spruce."

Value of Work done by the "Unemployed."

At a recent meeting of the London County Council, says the *Spectator*, some very striking figures were given as to the value of work done by the unemployed,—figures which amply prove the truth of a remark which has been made again and again. Pauper labour, like slave labour, is almost worthless. Work was done during the winter 1908-9 in the London parks to the value of £7800. It cost the Central Unemployed Body to accomplish this no less than £59,220. In other words, work which labourers, hired in the open market and paid high wages, could have done for £7800 cost £51,420 more when done by the unemployed, —that is, by men who knew that they would not be discharged if they idled, and who had no interest in their work, but only in their wages. That, we venture to say, is the type of work which will be universal when the State is the sole employer, and when men do not choose their own form of work, but have it found for them by that beneficent despot. It would, of course, have been far cheaper to have given an allowance to the unemployed, and not gone through the pretence of work. To assert that the dignity of labour is maintained by such a transaction as that which we are recording is ridiculous. There is, indeed, nothing new in all this. The Commissioners of 1834, and all experienced Poor Law authorities since, have always insisted on the demoralisation and extravagance of relief works.

The Pulp Industry of Canada.

A writer in the *Bulletin* de la Société de Géographie de Quebec gives an interesting account of this subject. A remarkable feature of the industry has been its rapid rise, especially in the New World. Its origin is somewhat uncertain, but the discoveries on which it is based are not anterior to the second half of the nineteenth century. In the Old World, the Scandinavian countries have carried the industry to the highest pitch of perfection, and supply not only the greater part of the markets of Europe, but send also some of their product to America. Germany comes next and supplies part of the markets of Central Europe, while Russia has quite recently started pulp factories.

In America the industry only dates back about twenty-five years, and is confined to the States and to Canada. In the States the decade 1870-80 saw a great development of pulp factories, while it was ten years later before Canada followed. Since 1890 the development of the industry in Canada, both as to the number of factories and as to the output, has been enormous. It is in the province of Quebec especially that the greatest progress has been made, and the industry bids fair to become the predominant one in the province. Before 1897 there were only three pulp factories in this province, now there are thirty-seven. The product differs from Scandinavian pulp in some respects, and at first difficulty was experienced in finding a market for it in England, where the paper-makers preferred the more familiar kind. Now, however, it is extensively used to mix with Scandinavian pulp. But the difficulty with the English market is that it is only available for seven months of the year, and the accumulation of the product during the period when navigation is closed is a serious difficulty. The United States is a better customer even than Great Britain, and there is no winter stoppage in connection with this market. France takes about 5000 tons of pulp, as against the 163,000 tons of the United States, and the 100,000 of Great Britain.

Three conditions are absolutely indispensable for the successful starting of a pulp industry:—water power, an extensive area of forests to draw upon, and large capital. As minor conditions, the purity of the water and the proximity of the market are important. As to the necessary forest area, the

author calculates that for a factory producing 40 to 50 tons of pulp a day, the available forest should measure 337,500 acres.

In Canada there are always three separate departments in the factory, each of which requires to be under the control of an experienced manager. These are, the purchase of the wood, its transport to the factory, and the process of manufacture. In the first place the wood must be bought, and as the chances against all the wood purchased reaching the factory are considerable, the contracts have to allow a relatively large margin. Thus in the case of the large factory of Chicutimi, which makes 120 tons a day, a daily supply of 4600 logs is required. The logs measure $13\frac{1}{2}$ feet in length, and vary in diameter from 6 to 15 inches. Now to supply the annual 1,500,000 logs required, at least 2,000,000 must be cut, to allow of loss in transit. In order that 2,000,000 logs may be cut, at least 2,500,000 must be contracted for, as the cutting depends so much upon the weather. Thus the contracts given must allow of a possible loss of about 33 per cent. The greatest loss is in transit. The logs are floated down stream with the spring floods, but these last only a few weeks at most, sometimes only a few days. It is thus a delicate and difficult matter to seize the right moment, and if it is allowed to slip past, the logs may remain in the streams till the following spring.

The particular factory named has a large forest reserve, but the contained wood is so carefully husbanded that it is reckoned that it should not be called upon to supply more than one-third of the necessary supply. The remaining two-thirds are obtained from the farmers and settlers engaged in clearing new land. The advantage of this to all parties is seen when it is recollected that formerly the standing wood was simply burnt. Now it supplies some of the capital necessary for turning the land to agricultural uses.

The author believes that with careful management the woods of Canada are practically inexhaustible, though in the interests of the Dominion it is desirable to discourage, as far as possible, the export of wood to be pulped in the United States, instead of in factories on the spot. This export of wood is rising steadily, and was 850,000 cords in 1907.

The Timber Trade of Eastern Siberia.

A "Report on the Lumber Industry in the Russian Far East," by Mr Vice-Consul Hodgson, has been issued as a Parliamentary White Paper [Cd. 3728-6]. The account which Mr Hodgson gives of the forests of the Amur region and the prospects of their commercial development is of substantial interest, as the world is now beginning to realise the threatened inadequacy of its timber supply, and to take careful stock of the chief productive areas remaining. Comparatively little attention has, so far, been paid to the utilisation of the forests in the Russian Far East, though concessions have been sporadically worked, and an Australian and a British company have lately been included among those which have acquired concessions from the Russian Government. According to the estimate of the Forest Department, the Amur and Maritime provinces contain 509,000,000 acres of forest land. It is by no means so densely timbered, however, as the forests of North America. Both hard and soft woods are found in considerable variety; the latter include white cedar, pine, larch, fir, and spruce, and the former walnut, ash, and oak.

The right to cut timber on a large scale may be obtained either by way of concession for a term of years or by contract. Recent concessions have been granted for four years only (this being the *maximum* that the Governor-General can accord), with an extra year for taking away the timber felled. Though this period can be extended on application, yet it is generally recognised that it is too short, and efforts, which appear likely to prove successful, are now being made to have the regulations on the subject altered and a longer term allowed. Areas which the Government desires to sell are from time to time put up to auction either at Vladivostok or at Khabarovsk, the terms and conditions being published beforehand. They are adjudged to the highest bidder, who is required to pay down the equivalent of the royalty for one year on the number of trees put up to auction, a certain portion of the forest being allotted for each year of the currency of the agreement. Moreover, in the case of felling rights obtained by auction, as well as those obtained in the form of a concession, some money deposit is generally insisted upon. Felling tickets may also be obtained from the local forest officials, giving the right to cut small quantities of timber on payment of the Government royalty.

SPRUCE, ALTERNATELY PITTED AND NOTCHED.

The plants marked **A** were pitted, those marked **B** were notched.

[*To face page* 110.

Plate XII.

THE ROOTS OF TWO OF THE PLANTS SHOWN IN PLATE XI.
The upper root is that of a notched plant, the lower of a pitted one.

To face page 111]

At present the Russian authorities insert a clause in all contracts stipulating that Russian labour shall alone be employed. As they are actively encouraging immigration, however, the resultant hindrance to industry may be expected to diminish. The report includes full schedules of the royalty levied on timber of different classes and in the different areas. It also describes the existing facilities for transport and shipping, which are still in a predominantly undeveloped state. Other miscellaneous information includes the terms of the forest regulations and the scale of export duty. There is also an outline map.

Pitting *versus* Notching.

(*With Plates.*)

On page 45, Mr Ribbentrop deals with this subject, and in connection with it Sir Kenneth Mackenzie writes:—"When, in 1904-5, I was planting various kinds of trees to form a shelter-belt, I put in two rows of spruce, the plants being alternately pitted and notched. By means of the accompanying photograph (Plate XI.), the results of the two methods after an interval of four years may be compared; and the advantage, during youth at anyrate, of pitting is clearly indicated."

Plate XII. shows the root development of one of the above-mentioned "notched" plants as compared with that of one of those which had been pitted.

The main objections to the practice of notching may be thus stated:—The young plants are placed in an unnatural position, and this alone must be detrimental to them; it is difficult to insert them with the "collar" at the surface of the soil, many being buried so deeply as to leave a considerable portion of the stem covered. Plate XIII. shows how difficult it is to avoid this, especially with plants trained in the nursery for notching; the root is restricted to a very small bulk of soil from which to draw its moisture with food in solution—from $\frac{1}{10}$ to $\frac{1}{20}$ only of the normal bulk of soil may be drawn upon; the root, being disposed near the surface, is exposed to disadvantageous variations of temperature, with risk of damage by frost, and to variations of moisture, which may involve drought; the young plants, not being securely anchored all round, are specially liable to disturbance by wind immediately they have been planted, and

for some time afterwards; they take long to establish themselves in their new situation, and their prolonged period of feebleness, together with its degree, renders them particularly liable to severe damage by weevils and other pests.

From the above causes numerous death-vacancies occur, especially if the planting season be followed by a dry summer; and the rate of development of the survivors is greatly reduced. Plants with very much deformed roots may easily be detected in a plantation by their smaller size or unhealthy appearance.

Then again, the deformity is frequently a permanent one, and, later in life, the trees are thus rendered liable to be thrown by wind or by over-lying snow. Plate XIV. shows the roots of some trees notched. Those in the lower figure are from the Crawfordton Estate, Dumfriesshire, where Captain Walker, the proprietor, says such defects are by no means exceptional.

The initial cost of planting in this way is certainly low, but the advantage is heavily outweighed by subsequent loss.

It may be added that the above objections do not apply with equal force to "vertical" notching, as described by Sir Wm. Schlich at p. 217, vol. ii., of his *Manual of Forestry*.

Lecturers at Murthly.

In our July issue (vol. xxii. p. 237) we gave an account of the Estate Museum established at Murthly, and said that it was Mr Steuart Fothringham's intention to arrange, from time to time, for the delivery there of lectures on forestry and kindred subjects. We are glad to state that, in pursuance of this intention, a course of ten weekly lectures was commenced by Dr Borthwick on the 27th November. The opening lecture was attended by about forty persons.

Death of a Nancy Professor.

Indian foresters who received their training in France will learn with regret that M. Nicolas Emile Petitcollot, Sous-Directeur of the Forest School at Nancy, died, after a long and painful illness, on 9th November 1909.

Plate XIII.

SCOTS PINE PLANTS TRAINED FOR NOTCHING.

[*To face page* 112.

SCOTS PINE, NOTCHED, WITH DEFORMED ROOTS. About 12 years old.

SCOTS PINE, NOTCHED, WITH DEFORMED ROOTS.
15 and 20 years old. From Crawfordton Estate.

To face page 113.]

The Forests of the British East Africa Protectorate.

A Blue-book of 143 pages, with map and 25 photographs, contains a report on the forests of the Protectorate, by Mr D. E. Hutchins, who had been deputed to visit them. The Government timber-forests comprise an area of 2,040,269 acres, and there are in addition 105,406 acres of private forest which "is being rapidly destroyed and need not be considered unless early measures are taken to redeem it." The author deals at length with the yield of the forests; with fires which have done enormous damage and against which effective measures must be taken; with the alienation of forest land which should be kept permanently as part of the State domain; with the destruction of forests by temporary cultivation; with the resources in rubber; with game in the forests; and with the organisation of the Forest Department, which last may be studied with advantage by candidates for employment in it. There are full and very interesting chapters dealing with the Uganda Railway forests. In appendices, the author gives a dissertation on trees suitable for cultivation in equatorial Highlands, with special reference to the conifers indigenous to Mexico and Central America, and with a descriptive list of foreign trees suitable for the Highland forests of British East Africa.

The report, which has involved very arduous work, both in the field and at the table, reflects much credit on its author.

The Forests of the Central Vosges Mountains.

In a recent issue of Engler's *Botanische Jahrbücher*, Dr E. Issler gives some account of the plant formations of the Central Vosges. In the montane region he distinguishes the following formations:—spruce, beech, mixed fir woods, and the vegetation of forest streams. The upper tree limit occurs at the low altitude of 4000 feet, as compared with above 7000 feet in Switzerland. This limit is determined by the wind, and it is a remarkable fact that in many places the beech woods ascend higher than the coniferous woods, the reason being that the beech is better able to withstand the action of the wind.

REVIEWS AND NOTICES OF BOOKS.

Our Forests and Woodlands. By JOHN NISBET. London, J. M. DENT & Co. New and revised Edition. xx + 348 pp., including Index, and five Illustrations. Price 3s. 6d. net.

The new edition is longer by eight pages than the former one of 1900, but the number of illustrations has been reduced from twelve to five, and the cost has been reduced from 7s. 6d. to 3s. 6d. There is a new preface which is eighteen pages longer than that of the original edition. It is dated 20th August 1908. In it the author reviews the principal events that have occurred since the issue of the first edition, and gives his views on the present aspect of the "timber and wood question," as it is indicated by increasing imports from abroad. He shows how the national requirement in such produce might be satisfied from forests to be raised within our own coasts, and urges that all political parties should unite in securing for an adequate national scheme of afforestation and timber-planting the full consideration which it undoubtedly deserves. The Report of the Erosion and Afforestation Commission had not been issued when this was written.

Trees: A Handbook of Forest Botany for the Woodlands and the Laboratory. By the late Professor MARSHALL WARD. Vol. v., "Form and Habit." Cambridge Biological Series. Cambridge University Press, 1909. Price 4s. 6d. net.

The fifth and final volume of *Trees* has now been issued. It deals with "Form," and under this title are considered the following:—the habit of woody plants; the shoot-system including the stem, branches, twigs and branch-systems; the appearance of the bark, and the form of the tree. Much interesting and useful information has been brought together under these various headings. The present volume, like its predecessors, is divided into two parts,—Part i., General, and Part ii., Special. The special part contains a classification of trees and shrubs according to their shapes, while a most interesting appendix to

the volume gives a classification of trees and shrubs according to their seedlings. In conformity with the scheme of the entire work, excellent drawings to scale of the various seedlings dealt with accompany this classification.

It was the author's intention to have completed the entire work in six volumes, but unfortunately he was not spared to see his scheme accomplished. However, before his death, three volumes, dealing with buds, leaves and flowers, had been published, and sufficient manuscript remained for two additional volumes. The task of seeing this manuscript through the press was undertaken by Professor Percy Groom. The material could not have fallen into more competent hands, and the last two volumes maintain the high level of those previously published. This work will rank as one of our standard books of reference.

The general part of each volume is written in a very lucid and interesting manner, and unnecessary technical terms are rigidly excluded, so that the beginner need have no difficulty in following the text, while the special part of each volume makes *Trees* a most valuable work for reference. Too much praise cannot be bestowed upon the accurate and excellently reproduced illustrations with which the whole work is replete. No library of forest literature should be without *Trees* by Professor Marshall Ward.

Working-Plan Report on the Keir Woods, with some Notes on Quoigs and Ardchullary. By W. R. Fisher. Printed by Jas. Hogg & Co., *Journal* Office, Stirling.

The number of proprietors who have come to realise the importance of working their woods on business principles is steadily on the increase, and if reasonable concessions in the incidence of taxation could only be made by successive Governments, it cannot be doubted that private landowners would take a large share in the desirable and necessary work of extending the forest area of this country. A fresh instance of this quickened practical interest is furnished by the Working-Plan Report, which has been prepared by Professor Fisher, for an area of about 600 acres of woodland on the Keir Estate in the county of Stirling.

Parts I. and II. of the report deal with the present condition of the woods, and the general character of the locality as a

silvicultural area; Part III. gives proposals for future management; Part IV. describes the various compartments; and Parts V. and VI. contain notes on the adjoining woods of Quoigs and Ardchullary.

The soils, which rest on the Old Red Sandstone formation, are stated to be generally suitable for the growth of the more valuable broad-leaved trees, and it is proposed, ultimately, to have crops mainly of those species, worked on a rotation of 100 years. Douglas fir, larch, and other conifers are also to be used in certain cases.

The decision to have hardwood crops appears to be a wise one. The extent of suitable land available for the growth of hardwoods is certainly limited, and for this reason a good market in the future, for this class of timber, is well assured.

It is worthy of note that the proprietor has transferred practically all the woods in his policy grounds to the economic woods. This step seems dictated by sound common sense. To have a proportion of the woods, even in the home park, occupied by a close crop of fine, shapely stems, such as one sees, for example, in the Spessart, can only tend to enrich and enhance, by contrast, the effects of the more open parts, and this arrangement has the advantage of ensuring that the land is being utilised to its fullest capacity.

This is a carefully prepared working-plan, and it is accompanied by an excellent map, prepared by the estate architect, showing the various woods and compartments throughout the estate. The whole is printed and bound in pamphlet form. J. F. A.

The Practice of Forestry, concerning also the Financial Aspect of Afforestation. By PERCIVAL TRENTHAM MAW, late Professor of Forestry at the Royal Agricultural College, Cirencester, etc., etc. Walter & Walter, Heatherside, Brockenhurst, Hants, 1909. Price 17s. 6d. net.

The author of this book devotes the first chapter chiefly to a consideration of the financial aspects of afforestation. He sets forth his reasons for and against general schemes of afforestation, and the conclusions he arrives at are so unfavourable to all such schemes, and his views generally are so pessimistic, that one is almost tempted to ask why he took the trouble to write a book

on forestry at all. Many of the reasons he advances against afforestation will not stand examination. For example, he says that whereas in foreign countries there are no rabbits, here it is nearly always necessary to fence against them, and that 30s. an acre spent on this fencing, will, at the rate of 4 per cent. interest, represent a debt of £50 an acre at the end of a 90 years' rotation. This, no doubt, is quite true, but economic forestry has nothing to do with game preserving, and where rabbits become a nuisance, the obvious remedy is to exterminate them. Notwithstanding the possibility of a timber famine, he is opposed to extensive schemes of afforestation in Great Britain. His alternative proposal is that the British Government should buy up extensive timber "limits" near the coast in Canada, from which to draw future supplies. Many objections might be raised to this proposal, and such an investment would not be entirely without its risks. Large tracts of forest are often destroyed by fire. The Canadians are already restricting the output of pulp timber to the United States, and it seems fairly certain that the amount which will be available for export to this country will steadily become smaller. Their own needs are increasing, and they may in the course of time come to require much of the best forest land for agriculture. Further, one of the chief reasons usually urged in favour of the extensive afforestation of poor land at home, is that new industries would be created just as they have been on the Continent, with the result that more people would be kept on the land, and the formation and cultivation of small holdings would often be rendered possible. It is difficult to see how the acquisition of forest land in other countries, such as Canada, would help forward such objects, and the Canadian product would, of course, compete in the market with that grown by private owners quite as much as any State-owned forest material would do at home, with the additional disadvantage that there would be less probability of new industries being started—paper-pulp factories for example.

The other chapters in the book contain a large amount of useful information of both a scientific and a practical nature, on such matters as nursery management, planting, tending of woods, different silvicultural systems, average yields to be expected from forest land, timber measuring, marketing, etc. There is a good chapter on the silvicultural characteristics of

native and of introduced trees; and the appendices contain a number of useful tables.

In the preface, the author expresses the opinion that British foresters can be taught their forestry at home only. "I scout any idea," he says, "that a complete training in any Continental school can act other than prejudicially upon those who take such a course," etc. Surely few will concur in this extreme view. "Home-keeping youths have ever homely wits," and British foresters cannot afford to ignore Continental methods. It is quite true that details of practice must differ widely, but all our modern ideas of forest organisation are derived from Continental sources, and until we can build up organised forests of our own, we must continue to look to the Continent for example and guidance.

But although all may not agree with some of the author's views on general forestry questions, the volume makes a useful addition to English forestry literature. J. F. A.

British Woods and their Owners. By JOHN SIMPSON. 8+116 pp., with 14 full-page plates. Price 12s. 6d. net. Pawson and Brailsford, 1909.

This book may be described as a somewhat rambling statement of facts and references to topics more or less connected with British forestry of the past, with the addition of a criticism of the Afforestation Report of the Coast Erosion Commission. The principal chapters in the book are devoted to remarks on German and British forestry, and the commoner forest trees of the country, with short discussions on Planting, Waste and By-products in Woods, Planting of Catchment Areas, etc.; but none of these subjects are very fully dealt with from a practical forester's point of view.

The author makes a somewhat vague reference to a new kind of wire-netting, and to a newly discovered willow which has apparently not been honoured with a botanical name; but it cannot be said that there is much in the book which has not been fully discussed in various publications during the last twenty years. The author appears to assume throughout that both British estate owners and their foresters are more or less ignorant of rational wood-management, otherwise he would

hardly have inserted so many elementary facts which are now common knowledge to most people. The book contains a number of extracts from the works of other authors, articles, Government returns, etc., and fourteen illustrations, amongst which are several German landscapes, towns, and villages, with more or less wooded backgrounds, but otherwise of a kind more likely to interest the continental tourist than the forester.

Part II. of the book criticises the Afforestation Report.

A. C. F.

Trees and Shrubs of the British Isles, Native and Acclimatised. By C. S. Cooper and W. Percival Westell. Sixteen full-page coloured plates, and 70 full-page black and white plates, drawn from nature by C. F. Newall. 16 parts at 1s. each. Two bound volumes 21s. London: J. M. Dent and Co.

This book is very well got up, and the price appears marvellously low.

The Food of Some British Birds. A Report by Robert Newstead, M.Sc., A.L.S., etc., School of Tropical Medicine, Liverpool.

This report, price fourpence, appears as a supplement to the *Journal* of the Board of Agriculture for December 1908. In publishing it, the Board say that numerous representations having been made, during recent years, respecting the losses caused by birds to farmers and fruit-growers, and the necessity for measures to reduce the nuisance having been urged, while there is very little accurate knowledge about the food and habits of birds, they have come to the conclusion that a full and scientific inquiry into the matter should be carried out. The present report forms a preliminary contribution to such an inquiry. "Mr Newstead, whose name is well known in connection with Entomological research, has conducted the investigations here reported on through a period of twenty years, and has materially contributed to the sum of knowledge on the subject. But valuable as the work is, it is clear that a great deal more requires to be done, especially as regards the food of nestlings and of adult birds in the summer."

The present report is principally directed to the examination and tabulation of the contents of the crops of certain birds in each month of the year, so that an opinion may be formed of the benefits or injuries caused by these birds at all seasons. It will be found of interest to foresters as well as to farmers and fruit-growers.

Forestry in New Zealand. Report by WILLIAM C. KENSINGTON, Under-Secretary of Lands.

The Colonial Government having called for a report dealing not only with the state of the indigenous forests and the timber industry (which had previously been reported on), but also with the whole question of demand and supply, the utilisation of the produce, the need for conservation, the steps that have been taken to augment the local supply by raising trees on State nurseries and plantations, and the likelihood of additional supplies being obtained from abroad—such a report has been prepared and submitted by Mr William C. Kensington, Under-Secretary of Lands.

The report, which covers 118 foolscap pages and is illustrated by 29 full-page plates and 2 maps, gives full particulars on the above points. It shows the areas of land still covered with forest, the quantities and descriptions of milling-timber remaining in each district, the estimated duration for commercial requirements of the local timber supply, the sources and amounts of the supplies that may be expected from abroad; and it gives also detailed results of the operations of the Afforestation Branch of the Department of Lands. It is therefore valuable, not only as a record of present conditions, but also as a guide to what may be expected in the future.

The Colonial Government is to be congratulated on the important step it has taken in preparing this valuable report.

Webster's Foresters' Pocket Diary. Seventh Edition, for 1909. Completely revised. Eighth Edition, for 1910. Revised. London: William Rider & Son. Price 2s. 6d. each.

This well known and compact little diary contains many useful tables and notes relating to the duties of a forester, and is brought up to date annually.

TRANSACTIONS

OF THE

ROYAL
SCOTTISH ARBORICULTURAL SOCIETY.

VOL. XXIII.—PART II.

July 1910.

LIEUT.-COLONEL F. BAILEY, F.R.S.E.,
HONORARY EDITOR.

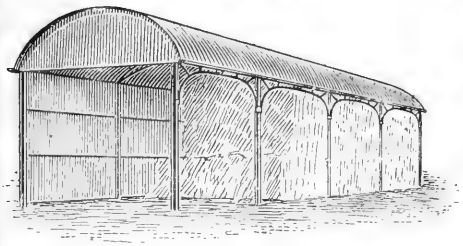
ROBERT GALLOWAY, S.S.C.,
SECRETARY AND TREASURER.

EDINBURGH:
PRINTED FOR THE SOCIETY.
SOLD BY DOUGLAS & FOULIS, CASTLE STREET.

Price to Non-Members, 3/-

A. & J. MAIN & Co., LTD.,

MANUFACTURERS OF
HAY & GRAIN SHEDS.

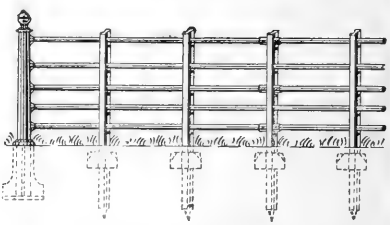


Design No. 661.

In this SHED the HAY or GRAIN can be stored to within a few inches of ROOF.

FOLD YARD COVERINGS, STEEL AND IRON BUILDINGS, of every description.

CONTINUOUS BAR FENCING, IRON & WIRE FENCING, WROUGHT IRON RAILINGS, GATES, HURDLES, PALE FENCING, TREE GUARDS, Etc., Etc.



Roofing and Fencing Catalogues on Application.

GALVANIZED WIRE NETTING & FENCING WIRE
at Lowest Prices.

SPECIAL QUOTATIONS ON APPLICATION.

CLYDESDALE IRON WORKS,
POSSILPARK, GLASGOW.

49 CANNON STREET, LONDON, E.C.

CORN EXCHANGE BUILDINGS, EDINBURGH.

BY SPECIAL APPOINTMENT TO HIS MAJESTY THE KING.

Telegrams—
"Hothouse, Edinburgh."
"Iron, Edinburgh."
"Treibhaus, London."

Telephone Nos.—
Edinburgh—Central, 2674, 2675, and 4665.
Glasgow—Argyle, 2336, National.
London—2117 P.O., Hampstead.

MACKENZIE & MONCUR,

HOTHOUSE BUILDERS, LTD.

Heating, Ventilating, and Electrical Engineers, and Iron Founders.

Plant Houses erected at Royal Botanic Gardens, Edinburgh.

HOTHOUSE BUILDING.—Hothouses of every description designed and erected in any part of the country, with improved Ventilation, Gearing, Staging, and Heating Apparatus complete.

HEATING.—Churches, Public Buildings of all kinds, Schools, Mansions, Villas, &c., heated efficiently by Low Pressure, Hot Water, or by Steam. Also by "Barker's" Cable System of Hot Water Low Pressure Heating, with small bore pipes and no sunk stoke-holes.

LIGHTING.—Complete Installations by Electricity or Petrol Vapour Gas.

FOUNDRY.—Architectural Ironwork of all kinds, Stable Fittings, Sanitary Castings, Manhole Covers, Ventilators, Gratings, &c.

PLANS AND ESTIMATES ON APPLICATION.

EDINBURGH — Registered Office — Balcarres Street.
WORKS—Balcarres Street. **FOUNDRY**—Slateford Road.
GLASGOW—121 St Vincent Street. **LONDON**—8 Camden Road, N.W.

Membership.

THE Roll contains the names of over 1300 Members, comprising Landowners, Factors, Foresters, Nurserymen, Gardeners, Land Stewards, Wood Merchants, and others interested in Forestry, many of whom reside in England, Ireland, the British Colonies, and India.

Members are elected by the Council. The Terms of Subscription will be found on the back of the Form of Proposal for Membership which accompanies this Memorandum.

The Principal Objects of the Society,

and the nature of its work, will be gathered from the following paragraphs:—

Meetings.

The Society holds periodical Meetings for the transaction of business, the reading and discussion of Papers, the exhibition of new Inventions, specimens of Forest Products and other articles of special interest to the Members, and for the advancement of Forestry in all its branches. Meetings of the Council are held every alternate month, and at other times when business requires attention; and Committees of the Council meet frequently to arrange and carry out the work of the Society.

Prizes and Medals.

With the view of encouraging young Foresters to study, and to train themselves in habits of careful and accurate observation, the Society offers Annual Prizes and Medals for essays on practical subjects, and for inventions connected with appliances used in Forestry. Such awards have been granted continuously since 1855 up to the present time, and have yielded satisfactory results. Medals and Prizes are also awarded in connection with the Exhibitions aftermentioned.

School of Forestry, Afforestation, Etc.

Being convinced of the necessity for bringing within the reach of young Foresters, and others interested in the Profession, a regular systematic course of Instruction, such as is provided in Germany, France, and other European countries, the Society, in 1882, strongly urged the creation of a British School of Forestry; and with a view of stimulating public interest in the matter, a Forestry Exhibition, chiefly organised by the Council, was held in Edinburgh in 1884.

As a further step towards the end in view, the Society, in 1890, instituted a Fund for the purpose of establishing a Chair of Forestry at the University of Edinburgh, and a sum of £584, 3s. 10d. has since been raised by the Society and handed over to the University. Aided by an annual subsidy from the Board of Agriculture, which the Society was mainly instrumental in obtaining, a Course of Lectures at the University has been delivered without interruption since 1889. It is recognised, however, that a School of Forestry is incomplete without a practical training-ground attached to it, which would be available, not only

for purposes of instruction but also as a Station for Research and Experiment, and as a Model Forest, by which Landowners and Foresters throughout the country might benefit. The Society has accordingly drawn up a Scheme for the Establishment of a State Model or Demonstration Forest for Scotland which might serve the above-named objects. Copies of this Scheme were laid before the Departmental Committee on British Forestry, and in their Report the Committee have recommended the establishment of a Demonstration Area and the provision of other educational facilities in Scotland.

The Government has recently acquired the Estate of Inverliever in Argyllshire; and while this cannot be looked on as a Demonstration Forest, it is hoped that it may prove to be the first step in a scheme of afforestation by the State of unwooded lands in Scotland. Meantime Mr Munro Ferguson, M.P., for a part of whose woods at Raith a Working-Plan has been prepared, and is now in operation, has very kindly agreed to allow Students to visit them.

In view of the passing of the Development Acts of 1909 and 1910, the Council has now passed a Resolution urging that the Government should, as soon as possible, create a Board of Forestry, with an adequate representation of Scottish Forestry upon it, and an Office in Scotland, where the largest areas of land suitable for Afforestation are situated, which would provide Demonstration Forests and Forest Gardens, and otherwise assist the development of University and other Educational enterprise, and would carry out, as an essential preliminary to any great scheme of National Afforestation, a Survey of all areas throughout the country suitable for commercial planting.

Excursions.

Since 1878 well-organised Excursions, numerously attended by Members of the Society, have been made annually to various parts of Scotland, England, Ireland, and the Continent. In 1895 a Tour extending over twelve days was made through the Forests of Northern Germany, in 1902 a Tour extending over seventeen days was made in Sweden, during the summer of 1904 the Forest School at Nancy and Forests in the north of France were visited, and during the past summer a visit was undertaken to the Bavarian Forests. These Excursions enable Members whose occupations necessarily confine them chiefly to a single locality to study the conditions and methods prevailing elsewhere; and the Council propose to extend the Tours during the next few years to other parts of the Continent. They venture to express the hope that Landowners may be induced to afford facilities to their Foresters for participation in these Tours, the instructive nature of which renders them well worth the moderate expenditure of time and money that they involve.

Exhibitions.

A Forestry Exhibition is annually organised in connection with the Highland and Agricultural Society's Show, in which are exhibited

specimens illustrating the rate of growth of trees, different kinds of wood, pit-wood and railway timber, insect pests and samples of the damage done by them, tools and implements, manufactured articles peculiar to the district where the Exhibition is held, and other objects of interest relating to Forestry. Prizes and Medals are also offered for Special Exhibits. In addition to the Annual Exhibition before referred to, a large and important Forestry Section organised by this Society was included in the Scottish National Exhibition which was held in Edinburgh in 1908.

The Society's *Transactions*.

The *Transactions* of the Society, which extend to twenty-three volumes, are now published half-yearly in January and July, and are issued *gratis* to Members. A large number of the Prize Essays and other valuable Papers, and reports of the Annual Excursions, have appeared in them, and have thus become available to Students as well as to those actively engaged in the Profession of Forestry.

Honorary Consulting Officials.

Members have the privilege of obtaining information gratuitously upon subjects connected with Forestry from the following Honorary Officials appointed by the Society.

Consulting Botanist.—ISAAC BAYLEY BALFOUR, LL.D., M.D., Sc.D., Professor of Botany, Royal Botanic Garden, Edinburgh.

Consulting Chemist.—ALEXANDER LAUDER, D.Sc., 13 George Square, Edinburgh.

Consulting Cryptogamist.—A. W. BORTHWICK, D.Sc., Royal Botanic Garden, Edinburgh.

Consulting Entomologist.—ROBERT STEWART MACDOUGALL, M.A., D.Sc., Professor of Entomology, etc., 9 Dryden Place, Edinburgh.

Consulting Geologist.—R. CAMPBELL, M.A., B.Sc., Geological Laboratory, University of Edinburgh.

Consulting Meteorologist.—ANDREW WATT, M.A., F.R.S.E., Secretary Scottish Meteorological Society, 122 George Street, Edinburgh.

Local Branches.

Local Branches have been established in Aberdeen and Inverness for the convenience of Members who reside in the districts surrounding these centres.

Local Secretaries.

The Society is represented throughout Scotland, England, and Ireland by the Local Secretaries whose names are given below. They are ready to afford any additional information that may be desired regarding the Conditions of Membership and the work of the Society.

Register of Estate Men.

A Register of men qualified in Forestry and in Forest and Estate Management is kept by the Society. Schedules of application and other particulars may be obtained from the Local Secretaries in the various districts, or direct from the Secretary. It is hoped that Proprietors and others requiring Estate men will avail themselves of the Society's Register.

Consulting Foresters.

The Council has authorised the Secretary to keep a list of Consulting Foresters whose services will be available to Members of the Society and others.

Correspondents.

The following have agreed to act as Correspondents residing abroad:—

Canada, .	Robert Bell, I.S.O., M.D., LL.D., D.Sc.(Cantab.), F.R.S. of Ottawa. Chief Geologist to Government of Canada, Ottawa.
India, . .	F. L. C. Cowley Brown, Deputy Conservator of Forests, c/o Inspector-General of Forests, Simla.
British East Africa, .	Edward Battiscombe, Assistant Conservator of Forests, Nigeri, *via* Naivasha, East Africa Protectorate.
United States of America,	Hugh P. Baker, Forester, State College, Pennsylvania.
Cape Colony, .	W. Nimmo Brown, M'Kenzie's Farm, Mowbray, P.O.

LOCAL SECRETARIES.

Scotland.

Counties.	
Aberdeen, .	John Clark, Forester, Haddo House, Aberdeen.
	John Michie, M.V.O., Factor, Balmoral, Ballater.
Argyle, . .	John D. Sutherland, Estate Agent, Oban.
Ayr, . .	Andrew D. Page, Overseer, Culzean Home Farm, Ayr.
	A. B. Robertson, Forester, The Dean, Kilmarnock.
Berwick, .	Wm. Milne, Foulden Newton, Berwick-on-Tweed.
Bute, . .	Wm. Inglis, Forester, Cladoch, Brodick.
	James Kay, Forester, Bute Estate, Rothesay.
Clackmannan,.	Robert Forbes, Estate Office, Kennet, Alloa.
Dumfries, .	D. Crabbe, Forester, Byreburnfoot, Canonbie.
East Lothian, .	W. S. Curr, Factor, Ninewar, Prestonkirk.
Fife, . .	Wm. Gilchrist, Forester, Nursery Cottage, Mount Melville, St Andrews.
	Edmund Sang, Nurseryman, Kirkcaldy.
Forfar, . .	James Crabbe, Forester, Glamis.
	James Robertson, Forester, Barnhill, Broughty Ferry.
Inverness, .	James A. Gossip, Nurseryman, Inverness.
Kincardine, .	John Hart, Estates Office, Cowie, Stonehaven.
Kinross, .	James Terris, Factor, Dullomuir, Blairadam.
Lanark, . .	John Davidson, Forester, Dalzell, Motherwell.
	James Whitton, Superintendent of Parks, City Chambers, Glasgow.
Moray, . .	D. Scott, Forester, Darnaway Castle, Forres.
Perth, . .	John Scrimgeour, Doune Lodge, Doune.
Renfrew, .	S. MacBean, Overseer, Erskine, Glasgow.

Scotland.

Counties.	
Ross, . .	JOHN J. R. MEIKLEJOHN, Factor, Novar, Evanton.
	Miss AMY FRANCES YULE, Tarradale House, Muir of Ord.
Roxburgh, .	JOHN LEISHMAN, Manager, Cavers Estate, Hawick.
	R. V. MATHER, Nurseryman, Kelso.
Sutherland, .	DONALD ROBERTSON, Forester, Dunrobin, Golspie.
Wigtown, .	JAMES HOGARTH, Forester, Culhorn, Stranraer.
	H. H. WALKER, Monreith Estate Office, Whauphill.

England.

Beds, . .	FRANCIS MITCHELL, Forester, Woburn.
Berks, . .	W. STORIE, Whitway House, Newbury.
Cheshire, .	WM. A. FORSTER, Belgrave Lodge, Pulford, Wrexham.
Devon, . .	JAMES BARRIE, Forester, Stevenstone Estate, Torrington.
Durham, .	JOHN F. ANNAND, Lecturer on Forestry, Armstrong College, Newcastle-upon-Tyne.
Hants, . .	W. R. BROWN, Forester, Park Cottage, Heckfield, Winchfield.
Herts, . .	JAMES BARTON, Forester, Hatfield.
	THOMAS SMITH, Overseer, Tring Park, Wigginton, Tring.
Kent, . .	R. W. COWPER, Gortanore, Sittingbourne.
Lancashire, .	D. C. HAMILTON, Forester, Knowsley, Prescot.
Leicester, .	JAMES MARTIN, The Reservoir, Knipton, Grantham.
Lincoln, .	W. B. HAVELOCK, The Nurseries, Brocklesby Park.
Middlesex, .	Professor BOULGER, 11 Onslow Road, Richmond Hill, London, S.W.
Notts, . .	WM. ELDER, Thoresby, Ollerton, Newark.
	W. MICHIE, Forester, Welbeck, Worksop.
	WILSON TOMLINSON, Forester, Clumber Park, Worksop.
Suffolk, . .	GEORGE HANNAH, The Folly, Ampton Park, Bury St Edmunds.
Surrey, . .	JOHN ALEXANDER, 24 Lawn Crescent, Kew Gardens.
Warwick, .	A. D. CHRISTIE, 16 Oak Tree Lane, Selly Oak, Birmingham.
Wilts, . .	ANDREW BOA, Land Agent, Glenmore, The Avenue, Trowbridge.
York, . .	D. TAIT, Estate Bailiff, Owston Park, Doncaster.

Ireland.

Dublin, . .	A. C. FORBES, Department of Forestry, Board of Agriculture.
	JAMES WILSON, B.Sc., Royal College of Science, Dublin.
	ARCH. E. MOERAN, Lessadell, Thelorgan Park.
Galway, . .	THOMAS ROBERTSON, Forester and Bailiff, Woodlawn.
King's County,	WM. HENDERSON, Forester, Clonad Cottage, Tullamore.
Tipperary, .	DAVID G. CROSS, Forester, Kylisk, Nenagh.
	ALEX. M'RAE, Forester, Dundrum.

Royal Scottish Arboricultural Society

FORM OF PROPOSAL FOR MEMBERSHIP.

To be signed by the Candidate, his Proposer and Seconder, and returned to ROBERT GALLOWAY, S.S.C., *SECRETARY*, Royal Scottish Arboricultural Society, 19 Castle Street, Edinburgh.

Candidate's

Full Name, ...

Designation, Degrees, etc., ...

Address, ...

Life, or Ordinary Member, ...

Signature, ...

Proposer's

Signature, ...

Address, ...

Seconder's

Signature, ...

Address, ...

[CONDITIONS OF MEMBERSHIP, see Over.

CONDITIONS OF MEMBERSHIP (excerpted from the Laws).

III. Any person interested in Forestry, and desirous of promoting the objects of the Society, is eligible for election as an *Ordinary* Member in one of the following Classes:—

1. Proprietors the valuation of whose land *exceeds* £500 per annum, and others, subscribing annually . . One Guinea.
2. Proprietors the valuation of whose land *does not exceed* £500 per annum, Factors, Nurserymen, Timber Merchants, and others, subscribing annually . . Half-a-Guinea.
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, subscribing annually . . . Six Shillings.
4. Assistant-Foresters, Assistant-Gardeners, and others, subscribing annually . . . . . Four Shillings.

IV. **Subscriptions are due on the 1st of January in each year, and shall be payable in advance. A new Member's Subscription is due on the day of election unless otherwise provided, and he shall not be enrolled until he has paid his first Subscription.**

V. Members in arrear shall not receive the *Transactions*, and shall not be entitled to vote at any of the meetings of the Society. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.

VI. Any eligible person may become a *Life* Member of the Society, on payment, according to class, of the following sums:—

1. Large Proprietors of land, and others, . . . £10 10 0
2. Small Proprietors, Factors, Nurserymen, Timber Merchants, and others, ... 5 5 0
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, ... 3 3 0

VII. Any *Ordinary* Member of Classes 1, 2, and 3, who has paid *Five* Annual Subscriptions, may become a *Life* Member on payment of *Two-thirds* of the sum payable by a *new* Life Member.

XII. Every Proposal for Membership shall be made in writing, and shall be signed by two Members of the Society as Proposer and Seconder, and delivered to the Secretary to be laid before the Council, which shall accept or otherwise deal with each Proposal as it may deem best in the interest of the Society. The Proposer and Seconder shall be responsible for payment of the new Member's first Subscription. The Council shall have power to decide the Class under which any Candidate for Membership shall be placed.

CONTENTS.

The Society does not hold itself responsible for the statements or views expressed by the authors of papers.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY

15. The Immediate Needs of Forestry in Scotland.[1]

By Sir JOHN STIRLING-MAXWELL, Bart.

The present is a critical moment for forestry in this country. For the first time within the recollection of any one living, a large body of public opinion is interested in the subject. Public opinion in a matter of science can never be fully instructed, but we have reached a stage when a great many people have grasped the fact that we are behind other countries in the matter of silviculture: that the steady rise in the price of timber justifies some action on the part of the Government to increase our home supplies: that if we are to increase our rural population, forestry and its attendant industries are the means to which we must look for the realisation of that hope. We are now face to face with a new Parliament, and there is usually a vigour about a new Parliament of which we must try to make the best use. We have an advantage in the fact that the Chancellor of the Exchequer is friendly to our ideas. He has shown his friendliness by relieving silviculture of some of the burdens which have pressed upon it most seriously, and he has also, in his scheme for the utilisation of the Development Grant, outlined a policy which exactly commends itself to the wishes of this Society. It is, therefore, with great hope that we look forward to the immediate future. In these circumstances, I think we ought to have clearly in our minds what we want to see done.

In the first place, we desire to have a survey of the ground which is adapted for planting in Scotland. Perhaps everyone here has not realised the difficulties of such a survey. No one imagines that the whole of the waste land in this country

[1] Presidential address delivered to the Society at the General Meeting on the 11th February 1910.

can be planted. Deductions have to be made on the score of elevation and bad soil, and further deductions have to be made for land which can be more profitably devoted to other purposes, or which is required for the wintering, indispensable to areas which cannot be planted. My predecessor in this chair has called attention, in an article printed in the last number of the *Transactions*, to the serious effect which wholesale planting would have on the local finance of some Highland counties. That is another consideration which will have to be borne in mind. But it must be remembered that the whole essence of any scheme of silviculture lies in a proper rotation under which the crops will become ripe year by year in order. Therefore to arrive at the area to be planted in any single year, after making the deductions mentioned above, the whole area intended for forest must be divided, generally speaking, by the number of years fixed for the rotation, which will, I suppose, be something between 80 and 120. It will thus be seen that the area to be planted in a single year in any district cannot be very large, and by the time the forest is complete, the area first planted will be more profitable and better able to make a contribution to local finance than the grazings which the forest has replaced. We consider this survey an essential preliminary to anything else. It is not possible for our Society, which is expected to lead opinion in these matters, to form a plan, or tender advice to the Government, until we really know what the extent of the problem is which we have to tackle. Should any reason intervene to prevent the Government from undertaking this survey at once, I think it will be the duty of the Society to undertake at least a sample of such a survey on its own account, in order that we may form an opinion of the manner in which this difficult undertaking should be conducted.

Another preliminary for which we have to press, is the provision of what is called a Demonstration Forest. Such an area would not only afford a field for scientific experiments, but would also provide a school for Forestry apprentices. Mr Nisbet has done well in calling attention to this subject. Nothing can be more unsatisfactory, or to my mind more pathetic, than the fact that the excellent teaching which is now given by most competent experts in Edinburgh, Glasgow, and Aberdeen, is inevitably so much divorced from practical work.

Scientific training in forestry is of very little use without practical experience. I hope no one will say that Inverliever will do for a Demonstration Forest. It will not do because it has no plantations more than three years old. It is not necessary that the demonstration area should be very large, but it must have timber upon it, and land suitable for the extension of the existing plantations. It is not necessary that the existing plantations should be perfect. One of the most valuable experiments it can provide will be that of turning bad woodlands into good. That problem has to be faced in every county in Scotland. There is reason to hope that such a Demonstration Forest would pay its way.

To turn now for a moment to minor matters. I think there is a need of some scheme for training the foresters who are at this moment responsible for our woods. Many of them have had little or no scientific training, and though they desire to have it, they are unable to attend the existing classes, which are held during the winter months when they cannot be spared from their duties. I hope that it may be possible to arrange summer classes for the benefit of such students.

Mr Haldane has called attention to a movement among Scots proprietors for co-operation for various purposes connected with silviculture. That movement has originated among members of this Society who feel that the Society as a whole cannot be asked to devote its influence and the time of its officials to work which concerns only one branch of its members. I hope that this co-operative movement may, among other good results, bring about a better understanding between proprietors and nurserymen, two classes of people who seem to have drifted too widely apart. If there is to be the extension of planting which we desire, a very large supply of plants will be required, and I have no doubt that it will be possible to obtain these from British nurserymen at reasonable prices if fair notice is given of the number required. At present, too often plants are ordered in January which are to be planted out the same spring. Under any reasonable system of co-operation, they would be ordered at least two years ahead, so that the nurserymen might know how much to sow of each species. The present system of ordering plants at the last moment is neither fair to the purchaser nor to the nurseryman, and it is no doubt the principal cause of the high prices which have usually obtained hitherto in this country.

16. When Afforestation Comes.[1]

By Sir JOHN FLEMING, LL.D.

The title of my paper indicates that I have a belief that afforestation, by which I mean afforestation aided by the State, is bound to come. In that opinion I think all are now agreed, no matter what political complexion the Government of the day may assume. I think we may safely reckon that the movement to afforest a large portion of the surface of these islands is sure to receive the hearty support of the general body of the people. Various considerations have brought public opinion up to this point, and these may be summarised as follows:—First, the high price to which timber has risen; second, the extraordinary demand for timber for paper-making (a comparatively new industry); and third, the laudable desire to create some new industry to keep more people on or about the land of the country. These reasons are each of them powerful, and have been brought nearer to practical results by the evidence collected by the Coast Erosion Committee, and by the passing of the Development Bill of the present Government, which ordains the setting aside of a large sum of money annually for the express purpose, amongst others, of afforestation. In the full expectation that State-aided afforestation will take a beginning in the near future, all minds with a bent for arboriculture are giving much thought to this subject, a subject fraught with large issues, climatic, social, and financial. The matter, I observe, is being discussed by arboricultural and agricultural societies all over the country, and it is but right that Aberdeen, near to which, without a doubt, there will be wrought out many large, and it is to be hoped successful experiments, should take the matter into consideration, and make up its mind as to the best manner in which these experiments should be gone about. Undue haste to-day might mean disaster forty or fifty years hence. It is easy to spend money, still easier to waste it. To make a few suggestions as to what kinds of timber we should grow, to hint at a few necessary arrangements without which profitable marketing of the forest product will be impossible, and to utter a word of caution against too

[1] Read on 11th December 1909 at the Annual Meeting of the Aberdeen Branch. From the report in the *Aberdeen Free Press*.

great expectations from the financial side of this movement will be the objects of my short paper.

I do not mean to waste time discussing the social aspects of afforestation. There can be no finer peasantry than is made up by those who work amongst the woods, and carefully planned woodlands should be an aid rather than a hindrance to both farming and sport. Neither will I stay to discuss the climatic influences of a well-wooded country where moisture is more regular and winds are stayed in their intensity. Rather would I discuss the probable financial profit of growing timber for our own uses, and a life-time spent in the timber trade ought to fit me to some extent to undertake this task. Here I may say that I have no intention of weaving a web of airy statistics to prove that timber growing upon the shoulders of certain hills or up the sides of certain glens, or even upon some low haughlands, will pay better than grouse or sheep or oats or potatoes. Were I a promoter of a timber lands company, I could easily, by hunting up statistics gleaned from available sources, prove all that, at least to my own satisfaction. But for wood grown on the grand scale that it is soon likely to be; with, say sixty years hence, a supply ready for the markets, and which must be marketed, possibly ten times larger than that available at present, a totally new state of matters will have arisen. Suffice it to say, there will always be a market in this country for all the timber that can possibly be grown, and provided the felling and marketing charges can be kept within reasonable limits, and a class of timber suitable for the local demands produced, then with or without a tax on imported produce the crop of timber will be a paying one, but we must never expect our trees when grown to have "trunks of gold and limbs of silver."

I have mentioned, as the first of the considerations that have brought to the front the subject of State afforestation, the high price to which wood has now risen in this country. That wood of all kinds is higher at the present moment than it has been for some years is undoubtedly true, that even to-day it is showing a tendency to rise still higher is also true, but that there is cause to fear anything approaching to a timber famine, I for one do not for one moment believe. The late Mr Lewis Miller was, in our locality, the great prophet of a famine in timber. I was never a believer in

the doctrine. I have in my lifetime seen the introduction of too many new woods, and the opening up of too many new sources of supply, ever to be led away by such a belief.

Let us take a few instances:—The famous yellow pine of Canada, grown on the banks of the Ottawa River, without which, fifty years ago, it was thought impossible properly to finish a good dwelling-house, has been cut out, or almost cut out, but to take its place we have got in rich abundance the poplar of the Southern States, known here as Canary pine, the Kauri pine from New Zealand, and the Douglas fir from British Columbia, and now there is being placed on the market beautiful yellow pine from Vladivostock. The strong red fir for joisting timber which at one time came from Dantzic or Memel or Stettin, although still obtainable, has been ousted by the handsome long-leafed pitch pine from Florida or Louisiana or Texas, of greater length, better dimensions, and much freer from sapwood.

But perhaps there is no better example than mahogany. That wood in varying quality, until about thirty years ago, came entirely from the West Indies, from Cuba, San Domingo, Honduras, and Mexico. Prophets were not awanting then as now who predicted the early extinction of this beautiful timber, which, as a tree, is to the forest what the rose is to the garden. The world was then ignorant that in tropical West Africa there were vast forests of mahogany of nobler dimensions and of as fine quality as any that ever grew in the Indies—forests that even yet, after thirty years of exploitation, have only been nibbled at. The figure is so rich in some of these African logs, and their value for veneer cutting so great, that only last month, at a Liverpool auction, three logs were sold that realised in all £2400; the largest log of the parcel, 28 feet 6 inches by 37 inches, selling at 9s. 10d. per superficial foot 1 inch thick and fetching £1013. There is already a Forest Department organised at Lagos, Southern Nigeria, where the forests are being conserved and new plantations opened at the rate of about 250,000 plants per annum, and this is only one little spot in the tropical district of that vast continent. Even in British East Africa, at one time thought to be comparatively sterile, there have been surveyed over 2,000,000 acres of saleable forest.

Sixty years ago Norway supplied almost all the roofing

and flooring timbers required in Great Britain; Sweden and Finland little or nothing; Russia not a great deal. Norway still supplies a considerable quantity; Sweden, right up to the Arctic circle, sends us large supplies; Finland, which as a country has its surface almost entirely covered either with woods or water, is coming more and more into the field; whilst Russia, that country that is almost a continent, and only now waking up to its own possibilities, is already taking the lead, and is now formulating development schemes that will, if carried out, in course of time enable her to swamp all the other Baltic countries by her enormous exports. A commission of engineers in St Petersburg has been appointed to design and carry out new canals to open up virgin forests; many new railway lines are also under consideration; and a service of commercial agents is being arranged for, whose duty it will be to visit all timber-importing countries to ascertain their wants and to make suggestions to the Government for their fulfilment. That there is a vast field for development will be apparent when it is stated that besides 201,400,000 acres of privately-owned forests, there are 228,973,000 acres of State-owned forests in European Russia, and in addition there are 192,660,000 acres surveyed in Asiatic Russia, besides 465,000,000 acres unsurveyed, also in the Asiatic provinces. Professor Somerville, the professor of rural economy at Oxford, an expert in forestry, at the meeting of the British Association in Winnipeg this year, said, in regard to the future supply of wood, that Russia was reducing her exports; but the most recent Consular reports do not bear this out, the annual export of timber since 1903 having increased in value from four to six million pounds sterling. In the same report we are informed that the re-afforestation of the State lands more than compensated for the quantity annually cut down. We are also told that the wooded provinces in the Consular district of St Petersburg alone cover an area equal to three times the area of great Britain. The exports from St Petersburg are this year higher than those of 1908 by 13,000 standards of 165 cubic feet each. Freights are cheap from Russia, and there is no lower paid labourer in the civilised world than the Russian. With these facts before us, I think you will agree with me that if there is to be a timber famine Russia will not be to blame.

But there will never be a timber famine, for new substitutes are being constantly found for timber. Many here must remember when beds, which are now chiefly made of iron, were made of wood, and when wooden ships were the rule as they are now the exception, when corrugated iron was little known for roofing, nor reinforced concrete for harbour piles. We who have to live by the sale of the article sometimes endeavour to take a little comfort from the contemplation of the incoming of wooden mantelpieces and wall-linings, or even, afar off, of wooden pavements; but these changes in the direction of the further use of timber form a poor compensation for uses that have been dispensed with, and, along with these changes, new sources of supply are constantly being brought nearer, while State conservation and compulsory replenishing are being insisted upon in Burmah, in the United States and Canada, in Sweden, in Germany, in fact, practically everywhere. Indeed, I think it is only a question of time when the whole world, with its steadily growing population, will be as assured of its supply of timber and at a moderate price, as it is at present of its supply of wheat.

Taking it for granted, then, that common-class timber will reach no abnormal figure in the times to come, and that we have no intention of cultivating the finer varieties for house finishing purposes either in pines or hardwoods, let us consider what we should grow, what market demands we should endeavour to meet, and how we should put our products on the market when ripe. In considering these matters, I hope it will not be supposed that I shall look upon them from the standpoint of one who deals chiefly in foreign timber. I may frankly say that I should much prefer to deal in timber grown in my own country to timber grown anywhere else, but it cannot be got, at least not good enough to satisfy the specification of the ordinary Scotch architect, who calls for timber free from shakes, sapwood, knots, and, as is sometimes added, "all other imperfections"; neither can it be got in sufficient quantity, nor in anything like great enough dimensions. I well remember when there was as much home timber sold by some merchants as there was foreign, and the signboards usually read, "home and foreign timber merchant." These days have now passed, but some day may see them return again, at least, let us hope so.

In taking a perfectly detached view of the case, and making a large and generous allowance for improvement in quality

consequent upon a better selection of suitable seeds and greater attention to massed growths with proper shelter, I can come to no other conclusion than that for Scotland the trees to grow are the larch and the Scots fir; and the products will be as at present—staves, sleepers, pitwood and boxwood, with the addition as time goes on of roofing and light joisting in dimensions from 4 inches by 2 inches up to 7 inches by $2\frac{1}{2}$ inches. I have not mentioned spruce, useful only for scenic effect or protection, for the Scottish whitewood, so far as my experience goes, is an inferior wood, only less inferior than its sister, the silver fir. An improvement may be effected in the manner of its growth, but at present it is much too knotty. I am afraid my strictures upon the spruce may cause some controversy, and were it possible to grow such wood as is grown in the Baltic, the case would be altered.[1]

The Government authorities quite evidently do not share my views, for I observed that the other night Sir Samuel Scott drew from Mr Hobhouse, in the House of Commons, the answer that there had been ordered for direct planting on the hillside at Loch Awe 80,000 Scots pine, 150,000 larch, 35,000 Douglas, 45,000 silver, 240,000 spruce, and 40,000 Sitka spruce. I only wish some of those who pin their faith to our Scotch spruce had been with me last June, as I glided on for half a day through the woods of the Hallingdal Valley in Norway, where the almost branchless spruces grew of all ages, and not densely planted either, straight as pencils, clean as stalks of wheat. I know it is expected that spruce will come into use for pulp-making, but for that purpose a wood much freer from knots is necessary. It is a well-known fact that the hard gummy-edged knots have all to be drilled out, and with spruce, as we find it in Scotland, this would be a laborious and unprofitable task; moreover, when the straw of the American prairies can be converted into paper, and this is quite on the cards, pulp from wood will be a thing of the past. The larch is a most admirable wood, and should be more abundantly planted. It has not its equal amongst soft woods for its lasting qualities, for railway and pit sleepers, for all manner of housebuilding timber, and for various other purposes. The Scots fir is a beautiful wood badly grown nowadays. Why, I am not

[1] See Vol. xxii., p. 106. Much of what is there said is applicable also to the spruce.—Hon. Ed.

technical enough to be able to say, but that it was not always so I have good proof. The old Mar wood, as it was called, grown in Ballochbuie or at Mar Lodge or in Rothiemurchus, was equal in mildness, and even in freedom from sapwood, to the best fir that comes into this country from abroad.

In hardwoods, I should recommend but three varieties: the oak, the ash, and the elm. All these three, as grown in this country, especially in England and central and southern Scotland, are far superior in quality to the same timber grown in any other part of the world; all that they have needed to attain perfection has been that they should have been grown *en masse* and not, as they as a rule are, in park or hedgerow. The plane was wont to be a most valuable tree, but many substitutes have been found for both it and the beech, although they are perhaps the most beautiful trees in the landscape. Beech is very plentiful in Virginia and adjacent states. It is very similar to our own wood, perhaps a little softer and redder in colour. Whilst on a prospecting visit there many years ago, I was offered whole tracts of very decent trees at one-eighth of a penny per cubic foot on the stump, as it is called.

The counsel to grow common varieties of firs and to look for what may be regarded as mean markets may seem unpatriotic, but there the most profitable markets will be found. There was a rude truth in the advice I once heard a veteran dealer in mahogany give to a beginner, "If you want to make money buy trash." What was meant was that you made about the same profit off the foot of a low-priced log as you did off a high-priced one, and only half, or perhaps less than half, the money was needed for the purchase. The reasons I put forward for this line of policy are these. You will always have an abundant demand; you will have easily handled dimensions; the foreigner will be less able to compete with you in cheap wood than in dear, as his freight and handling charges will be as high per cubic foot in the one case as in the other. I know strong arguments will be used to you that you should try Douglas fir, let us say, instead of the Scots pine. All honour to the Durris lairds for their heroic experiments, but as far as they have gone they have failed to establish that, whatever the tree may be in its native haunts in British Columbia, it has in this country proved a

commercial success. If it could ever be supposed to produce here in Scotland the same quality of wood that it does in the west coast of America, then it would be a brilliant success.

These remarks may suffice as to what to grow; as to distribution and mixture of varieties I can give no advice. I should think that altitudes up to 1500 feet might suit either the Scots fir or the larch. The only remark I would make before leaving this part of the subject would be, try and make your planting fairly continuous and not patchy.

I referred to the want of a cheap form of transit from the wood to the sawmill, and from the sawmill to the seats of commerce; in these facilities this old country is notoriously deficient. These, of course, will not be severely missed for many years to come, but still they ought to come up for early consideration. splendid waterways for the flotation of logs are an almost universal appanage of all the great wood-exporting countries, both of the old world and the new. The Tay, the Spey, and our own Dee have in olden days been so used, and it is hoped they may be so used again; I see nothing to prevent it if the fish do not prove more powerful than the tree. The Caledonian Canal and many of the western arms of the sea might also be requisitioned in the same way, but these would only tap a very small area of the lands which we hope may some day be covered with forest. Light railway lines up the side valleys, more suitable railway trucks, cheaper railway rates for what will be a welcome new traffic to all Scotch railways, these are all essential, but I doubt if they will ever be obtained without nationalisation of the railways. In all these arrangements the use of the handy man will come in; steel cableways, for instance, a specialty of a well-known Aberdeen firm of engineers, would in all probability be found indispensable.

At the present time timber can be brought from Russia, 1500 miles away, to Aberdeen, at 7s. to 7s. 6d. per ton; from Ballater to Aberdeen, 44 miles, the rate is practically the same. Sawmills on a good scale as to size, and not in the present retail style, must be erected at convenient converging sites close to water-power itself, or where water-power can be electrically transmitted. Better machinery must be brought into use, thinner saws used, and a neater finish given to the output, which is at present alas! too often, rough, wasteful, uncouth, in striking contrast to the make from over the seas.

All the wood when sawn should be sorted in well understood qualities, piled under cover, and offered out by accredited agents, acting, if possible, for groups of mills in co-operation, in printed specifications giving qualities and dimensions. Kiln drying should also be introduced to save railway carriage and interest on money. Kiln drying on a large scale is almost universal in America, and it is now being introduced into Sweden as well. I personally long for the day when it will be universal, as we can then depend upon receiving wood in good order.

In Sundswall, this summer, I came alongside the premises of a large exporter with a river front of about a quarter of a mile, where not a piece of sawn wood was to be seen. The logs were dragged up to the mill at one end, cut, kiln dried, manufactured, and then piled close and ready for shipment in another set of sheds at the other end. This without doubt is ideal, and with such large amounts of sawdust going to waste, more especially where water-driven mills are in use, it is very easy of accomplishment. If all these details be attended to, and if architects would only be less finical in their demands, there is every reason to expect a splendid future for the home-timber trade. The larch has qualities that are unsurpassed. There is no fir that can hold a nail like the Scots fir, and if it could only be grown a little cleaner and with less sapwood, it also would be a wood hard to beat. I have left to others the decision as to when and where to plant, and all matters of fencing and distribution, and have touched only on what I happen to know a little about. In conclusion, I have no hesitation in saying that with care and circumspection, aided by the country's common purse, a healthy peasantry will arise, the fair face of our beautiful country will become still fairer, new industries will be created, and all surely to the nation's profit "when afforestation comes."

17. Note on the Death Duties as affecting Woodlands.

By Robert Galloway, S.S.C.

The Death duties may be described as (1) Estate duty under the Act of 1894; (2) Succession duty under the Act of 1853; and (3) in certain cases, Settlement estate duty.

Estate Duty.

Section 7 (5) of the Finance Act, 1894, enacts that "the principal value of any property shall be estimated to be the price which, in the opinion of the Commissioners, such property would fetch if sold in the open market at the time of the death of the deceased," but there is a proviso that the principal value shall not exceed twenty-five times the annual value as assessed under Schedule A of the Income Tax Acts, after making various allowances in respect of outgoings and management.

This in practice has been interpreted to mean that where an estate, including the woodlands, is sufficiently valuable to yield 25 years' purchase of its rental or annual value, no higher value can be taken, even although a large quantity of mature timber should happen to be upon the ground.

By Section 60 of the Finance (1909-10) Act, 1910, the proviso mentioned above, limiting the valuation of an estate to 25 years' purchase of its rental, has been abolished in the case of persons dying after 30th April 1909, and it is enacted that in estimating the principal value of any property "the Commissioners shall fix the price of the property according to the market price at the time of the death of the deceased, and shall not make any reduction in the estimate on account of the estimate being made on the assumption that the whole property is to be placed on the market at one and the same time," but it is provided that where it is proved to the Commissioners that the value of the property has been depreciated by reason of the death of the deceased they shall, in fixing the price, take such depreciation into account. Provision is also made by the Act for appeals against the decision of the Commissioners, as to the value of property.

Special provisions as to the payment of duties have been made with respect to certain classes of property, including

woodlands. Subsection 5 of Section 61, which specially deals with woodlands, is in the following terms:—

> "Where an estate, in respect of which estate duty is payable on the death of a person dying after the passing of this Act, comprises land on which timber, trees, or wood are growing, the value of such timber, trees, or wood shall be aggregated with the other property passing on the death of the deceased for the purpose of determining the value of the estate and the rate of estate duty; but the estate duty which, but for this subsection, would be payable on the principal value of the timber, trees, or wood shall not be payable thereon, but shall at the rate so ascertained be payable on the net moneys (if any), after deducting all necessary outgoings since the death of the deceased, which may from time to time be received from the sale of the timber, trees, or wood, when felled, during the period which may elapse until the land on the death of some other person again becomes liable or would, but for this subsection, have become liable to estate duty, and the owners or trustees of such land shall account for and pay the same accordingly as and when such moneys are received, with interest at the rate of three per cent. per annum from the date when such moneys are received:
>
> "Provided that if at any time the timber, trees, or wood are sold, either with or apart from the land on which they are growing, the amount of estate duty on the principal value thereof, which, but for this subsection, would have been payable on the death of the deceased, after deducting the amount (if any) of estate duty paid in respect of the timber, trees, or wood under this subsection since that date, shall become payable."

A new scale of rates of estate duty has been instituted, and a comparison between it and the previous scale shows that on the larger estates the duty has been very much increased. For instance, an estate between £75,000 and £100,000 formerly paid $5\frac{1}{2}$ per cent., whereas estates between £70,000 and £100,000 now pay 8 per cent. The latter rate was only payable previously on estates between £250,000 and £500,000, whereas an estate of

£500,000 now pays at the rate of 12 per cent. An estate of £1,000,000 formerly paid 10 per cent., whereas it will now pay 14 per cent. An estate over £1,000,000 pays at the rate of 15 per cent. on the full amount. Such an estate formerly paid 10 per cent. up to £1,000,000 and 15 per cent. on the remainder.

Succession Duty.

As regards Succession duty (1853 Act), where the successor is competent to dispose of the heritable property comprised in his succession, the principal value is ascertained in the same way as for estate duty, with the further deduction of estate duty paid in respect of the property on the death of the predecessor and the expenses incurred in raising and paying the same.

Where the successor is not competent to dispose of the heritable property, his interest is considered to be the value of an annuity equal to the annual value of such property after making certain allowances. Every such annuity is, for the purposes of the Act, valued according to tables annexed to the Act. But before making any assessment of succession duty in respect of timber sales, he is given credit for any sum paid by him in name of succession duty on the woodland.

A person is deemed *competent to dispose* of property if he has such an estate or interest therein, or such general power, as would, if he were *sui juris*, enable him to dispose of the property, including a tenant in tail, whether in possession or not; and the expression "general power" includes every power or authority enabling the donee or other holder thereof to appoint or dispose of property as he thinks fit.

According to the new Finance Act (Subsection 5 of Section 61, partly quoted above), succession duty payable in respect of woodlands is to be paid in the same way as estate duty under that section.

Succession duty has also been materially increased. Successions that formerly paid 3 per cent. now pay 5 per cent., and those that paid 5 per cent. or 6 per cent. now pay 10 per cent. Formerly, where an estate had already paid estate duty, children and their descendants, or father or mother, or lineal ancestors, paid no succession duty, but where the value of the estate now amounts to £15,000, duty at the rate of 1 per cent. is chargeable against such successors, unless the succession, including any legacies from the same source, does not exceed £1000, or in the case of

a widow, or child under twenty-one, the succession and legacies from the same source do not exceed £2000.

Settlement Estate Duty.

As regards entailed property where the successor is not entitled to disentail without consents, or without having the consents valued and dispensed with, settlement estate duty as well as estate duty is payable; but neither of these duties shall be again payable until such estate is disentailed, or until the death of an heir of entail, to whom it passes on or subsequent to the death of the first heir of entail mentioned, and who is entitled to disentail without consents or without having the consents valued. This duty is also payable, in addition to estate duty, on the principal value of property settled by the will of a deceased, or which, having been settled by some other disposition, passes under that disposition on the death of the deceased to some person not competent to dispose of the property except where the only life interest in such property, after the deceased's death, is that of the husband or wife of the deceased, or where the disposition took effect before 2nd August 1894, or where the net value of the property liable to estate duty (exclusive of property settled otherwise than by the will of the deceased) does not exceed £1000.

Settlement estate duty was formerly chargeable at the rate of 1 per cent., but has now been increased to 2 per cent.

Power is given (Section 56) to the Commissioners if they think fit, on the application of any person liable to pay any of these duties in respect of any real (including leasehold) property, to accept in settlement of the whole or any part of such duty, such part of the property as may be agreed upon between the Commissioners and that person.

With regard to the alterations made by the recent Act, attention may be directed to one or two points.

(1) The full value of all the woods must now be included in the valuation of an estate, so as to ascertain the rate of duty payable.

(2) The duties in respect of the woods are not now payable until the woods are converted into cash.

(3) In the event of another death occurring before the woods are converted into cash, the first estate will be relieved

from further payment, and the liability of the next estate will be arrived at in the same way as in the case of the first estate.

(4) It will thus be seen that as regards these duties, woods are looked upon as a crop, requiring many years to mature, which shall pay the duties once only, that is, when converted into cash, whoever may be in possession at the time.

(5) Complaint can, therefore, no longer be made that the same woods are found liable several times in death duties, owing to successive deaths occurring during the time they were standing on the ground.

(6) On the other hand, the rates of duty, so far as now exigible, have been substantially increased.

In the foregoing note no attempt has been made to go into details. It will take some time to ascertain whether upon the whole the provisions of the new Act are likely to encourage forestry, but it would appear that in several respects very substantial concessions have been obtained.

18. The Rating Act, 1874.

The following circular, dated 18th April 1910, has been addressed to Union Assessment Committees by the Local Government Board, London :—

I am directed by the Local Government Board to inform you that it has been represented to the Board, by a Committee appointed at the British Timber Conference held in London last year, that the Union Assessment Committees throughout England have generally failed "to properly appreciate and act upon the provisions of the Rating Act, 1874," in regard to the assessment of woodlands.

The Committee urge the Board to communicate with Assessment Committees, and to point out that woodlands should be assessed at their "unimproved" value, which is practically "prairie" value. They state that though "prairie" value represents on the average about half-a-crown per annum per acre, yet many of the woodlands of England are rated at figures four and five times greater.

The Committee state further, that they are aware that an occupier of woodlands who is over-assessed can obtain redress

by an appeal to Special or Quarter Sessions, but that the costs of such an appeal are out of all proportion to the saving of rates effected by a successful appeal, and consequently the illegal over-assessments remain, and the benefits of the Rating Act of 1874, so necessary for the promotion and encouragement of afforestation, do not in fact reach the occupiers of woodlands.

The Board have no jurisdiction to lay down any rules for the guidance of Assessment Committees in the matter, but in view of the representations which have been made to them, they desire to call the attention of the Assessment Committee to the following observations upon the provisions of the Act of 1874, contained in the Circular addressed to Assessment Committees on the 24th November 1874.

The Act classifies woodland under three heads, viz. :—

1. Land used only as a plantation or a wood.
2. Land used for the growth of saleable underwood.
3. Land used both for a plantation or a wood, and also for the growth of saleable underwood.

1. In the first case, viz., where the land is used only for a plantation or a wood, and not for the growth of saleable underwood, the Act provides that the gross and rateable value (meaning by gross value the gross estimated rental, as defined by the Union Assessment Committee Act, 1862) shall be estimated as if the land, instead of being a plantation or a wood, were let and occupied in its natural and unimproved state.

It is the duty, therefore, of the Assessment Committee to deal with the land as if it were divested of timber or wood of any description, and to determine its value without taking into account any improvement which has been made, or of which the land might be capable.

It will be observed that the words used are "as if the land, instead of being a plantation or a wood, were let and *occupied* in its natural and unimproved state," and the word "occupied" was introduced in order to show clearly that the capabilities of the land for improvement were to be excluded from consideration in estimating the rent at which it might reasonably be expected to let from year to year, and that the land was to be valued as if it would continue to be occupied in its natural state, without any expenditure of capital in its improvement; or, in other words, as if it were waste land.

2. The second case is that of land used exclusively for the growth of saleable underwood; and the statute requires that in such case the value shall be estimated as if the land were let for that purpose.

3. With respect to the third case of composite woods, *i.e.*, where the land is used both for a plantation or a wood, and also for the growth of saleable underwood, the value is to be estimated either as if the land were used only for a plantation or a wood, or as if the land were used only for the growth of the saleable underwood growing thereon, as the Assessment Committee may determine.

In this case, therefore, it is entirely within the discretion of the Assessment Committee to adopt either alternative; but it must be borne in mind that if they assess the land as if it were used for the growth of saleable underwood, the land cannot be valued as if it were let for the growth of saleable underwood, and capable of improvement for that purpose, but only in respect of the saleable underwood actually growing thereon, irrespective of any capacity for improvement by the removal of trees or otherwise.

It should be added that woodlands which are subject to rights of common, are not rendered rateable by the Act.

In connection with the foregoing provisions of the Act, the Board may call attention to the decisions in two cases which have come before the Courts.

In the case of the *Earl of Westmorland* v. *Southwick and Oundle* (1877), 36 L.T. n.s. 108; 41 J.P. 231, it was decided that in ascertaining the rateable value of a plantation or wood as "land let and occupied in its natural and unimproved state," it was not admissible to base the estimate upon the rent which a hypothetical tenant would give if expenditure were incurred in draining, fencing, or other improvements. In the case of *Eyton* v. *Mold Churchwardens and Overseers* (1880) L.R., 6 Q.B.D. 13, 50 L.J.M.C. 39; 43 L.T. 472, it was held that the value of a right of sporting over land might properly be included in estimating the rateable value of a plantation or wood as land in its natural and unimproved state.

The Board request that the matter may have the consideration of the Assessment Committee, with a view to determining whether there are any cases in their district in which the assessment of woodlands calls for revision. (*Signed*) Hy. Monro, *Secretary*.

19. The Development Act and Forestry.

By R. C. Munro Ferguson, M.P.

Until the Commissioners appointed under the Development Act bring their Department into working order, it is difficult to estimate what will be the influence of this new body upon afforestation and silviculture. One of the Commissioners is a forest expert, and one or two others have some knowledge of plantations. The agricultural interest is exceedingly sensitive as regards the afforestation policy of the Commission, on the ground that it may absorb some undue proportion of the available resources. That is, however, a groundless fear, because it must be a matter of some years before any large scheme of afforestation can be undertaken, and an expenditure averaging £50,000 for the first six or eight years is probably as much as could be well laid out on the requisite preliminary steps.

To provide a central machinery, the best plan would probably be to reorganise the Office of Woods and Forests as a real National Board of Forestry, and in view of the fact that the main sphere for its operations must be in Scotland, it should have a Department in Edinburgh. In order to secure that the Board should be in a position to devote its attention exclusively to forestry, the farm lands now managed by the Woods and Forests Department ought to be transferred to the Board of Agriculture, and the ground rents to the Treasury or some other Department. If that should not be feasible then a Forestry Board for the United Kingdom should be created. This Board of Forestry would then proceed to organise the necessary surveys, report upon and "plan" the areas suitable for afforestation, purchase demonstration areas, and create centres of silvicultural training. It is high time that we should have our own system of forestry, for, much as we owe to Germany, it is idle to continue to hang upon her apron strings. As soon as these preliminaries are completed, the Board should direct its attention to the afforestation of waste lands, either as a State operation upon the great scale, or, in the case of smaller areas, by co-operation with private owners.

It is essential that there should be some reliable authority, of the nature of a Board of Forestry, to prepare the schemes for which the Development Commission would recommend the

necessary grants, and I can think of nothing better than to make the Office of Woods worthy of its name. A Board of three would suffice—a chairman of practical experience, recognised as an authority; an expert British forester, capable of founding a British School of Forestry; a first-rate factor or surveyor, able to carry through purchases of land, and to deal with problems of the incidence of local taxation, and of severance, questions which must inevitably be raised—especially in the Highlands—by afforestation on the large scale. The selection of both the forester and the land agent is of supreme importance: the initial cost and ultimate financial success of the undertaking must depend very much on the latter. It would be the function of the chairman to keep in touch with the Development Commission, and, perhaps, to some extent also with the civil servant and the politician. Given a right Board of Forestry, there need be no fear of the success of the forestry section of the "Development" enterprise.

20. Forestry Education in Great Britain.[1]

In November 1902, a Departmental Committee appointed by the Board of Agriculture and Fisheries to inquire into and report upon British forestry presented an unanimous Report (Cd. 1319) in which they urged, as the cardinal point of their recommendations, "the immediate and effective provision for bringing systematised instruction (in forestry) within the reach of owners, foresters and woodmen." An article appeared in the issue of the *Journal of the Board of Agriculture* for April 1904, in which was shown the effect which had been given to this recommendation up to that time. The purpose of the present article is to show what further progress has been made, and what facilities exist in Great Britain at the present time for instruction in forestry.

At the time the Departmental Committee were conducting their inquiry there were, broadly speaking, no organised courses of instruction in forestry in Great Britain other than those held at the Royal Indian Engineering College at Coopers Hill, and at the University of Edinburgh. At the present time there exist the following centres:—The University of Oxford, to which the Indian School of Forestry has been transferred; the Forest

[1] From the *Journal of the Board of Agriculture*. By permission of the Controller of H.M. Stationery Office.

of Dean, where a School of Forestry has been established by the Commissioners of His Majesty's Woods and Forests; and eight other institutions, at each of which systematic courses of study in forestry are provided, viz., the University College of North Wales, Bangor; the Armstrong College, Newcastle-upon-Tyne; the University of Cambridge; the Royal Agricultural College, Cirencester; the University of Edinburgh; the Glasgow and West of Scotland Agricultural College; the Edinburgh and East of Scotland College of Agriculture; and the Aberdeen and North of Scotland College of Agriculture. In addition, mention should be made of the Inverliever Estate in Argyllshire, which has been purchased by the Commissioners of His Majesty's Woods and Forests for the purpose of carrying out an experiment in afforestation on scientific and economic lines, and of the Alice Holt Woods, which are now being worked as a demonstration area for the practical study of forestry. In certain agricultural colleges, other than those mentioned, lectures on forestry are delivered, but instruction in this subject has not been developed sufficiently at these institutions to require specific mention here.

The increase in the facilities for instruction in forestry during the past seven years has been brought about, in the first place, by the attention drawn to the subject by the report of the Committee; secondly, by the action of the Commissioners of His Majesty's Woods and Forests in certain areas of land belonging to the Crown; and thirdly, by the financial assistance given by the Board of Agriculture and Fisheries to the University College at Bangor, to Armstrong College, and to the University of Cambridge to enable these institutions to appoint lecturers in forestry. The agricultural colleges in Scotland are in receipt of grants in respect of the whole of their work from the Scotch Education Department, while for the past two years the Royal Agricultural College has been similarly aided by the Board of Education.

The following particulars of the above-mentioned centres have been supplied by the institutions named, or are taken from published reports:—

University of Oxford.—In 1905 the training of Indian forestry students, which had previously been conducted at the Royal Indian Engineering College at Coopers Hill, was transferred to the University of Oxford. The School of Forestry which was

then established is attended principally by probationers for service in the Indian Forest Department, who have been nominated by the Secretary of State for India, but other members of the university may attend the instruction in forestry.

The Diploma in Forestry is granted to members of the university who have pursued a prescribed course of study extending over two years; undergone a course of practical work lasting nine months, of which about seven are spent with selected German forest officers in Germany; and satisfied the examiners in prescribed examinations.

The fees for instruction in forestry and subjects auxiliary to it amount to about £63 during the two years, or an average of £10, 10s. a term. In addition, students must meet the expenses (except railway fares) of the excursions in Great Britain which form part of the course. Students who are probationers for the Indian Forest Service are required to defray all their expenses at Oxford, but they receive, under certain conditions, a sum of £240 from the Secretary of State for India during the course of probation, which, in the case of those who have already passed with Honours in Natural Science, lasts for two years, and, in the case of the remainder, for three years.

School of Forestry, Forest of Dean.—This school was established in January 1904, with the object of carrying out in one of the Crown forests the recommendations made by the Departmental Committee. The course of instruction extends over two years. The number of young men entering each year is usually eight. Since the school was started twenty-seven students have received certificates. The minimum age of entry has recently been raised from sixteen years to twenty. The young men are paid 15s. a week for their work, they receive practical instruction in the woods and attend lectures in a class-room, the subjects of instruction being forest botany, silviculture, forest mensuration, and the protection of woods. A special building has been built for the purposes of the school, and contains a class-room, museum, and carpenter's shop.

Applications for admission to the school, and for further particulars, should be addressed to Sir E. Stafford Howard. K.C.B., Commissioner of His Majesty's Woods and Forests, Whitehall, London, S.W.

University College of North Wales, Bangor.—A lecturer in forestry at this college was appointed in the spring of 1904.

At first forestry was attached to the Department of Agriculture, but since July 1907, it has occupied an independent position as regards both the college and the university.

Two courses of study are offered by the college, one of these qualifying for the degree of B.Sc. in Forestry in the University of Wales, and the other for a College Certificate. A third course, leading up to a diploma, is at present under consideration. The Degree Course extends over three years subsequent to passing a Matriculation examination, while the course for the Forestry Certificate may be covered during a single session. Candidates taking the Degree Course devote their first qualifying year to general scientific study, attending classes in botany, chemistry, physics, and zoology. During their second year they pursue the study of these subjects to a more advanced stage, and enter upon forestry work. In the third year forestry is continued and final courses are taken in certain prescribed science subjects. In order to obtain the forestry certificate students need not matriculate, but have to satisfy the examiners in chemistry, botany, zoology, and agriculture, in addition to forestry.

The number of students attending forestry classes averages seven or eight each session. The fees are low, amounting only to £15, 15s. per annum.

Several large proprietors have kindly placed their woods at the disposal of the college for forestry instruction and practice, while an experimental area has been laid out by the Department at Chirk in Denbighshire. Lord Penrhyn allows the classes to visit his park, which immediately adjoins the college. In the park there is an excellent collection of conifers and broad-leaved trees, while there is also a large estate nursery which is useful for demonstration purposes. There are woods amounting to several hundred acres within a comparatively short distance of the college, and use is made of these for excursions.

The freehold of the land at Chirk was presented, in 1906, to the Denbighshire County Council by Mr John Mahler of Penissa Glyn, upon condition that it should be devoted to forestry investigations carried out by the Department at Bangor. The land is 50 acres in extent, and it has been divided into some thirty-two plots, each plot constituting a separate experiment. It is situated at a high elevation (850-1250 feet), and is of a character frequently found in Wales. The planting has now

been completed, and already some interesting results have been obtained. Through the generosity of the donor of the land, facilities have been given which enable students to visit the area several times each year.

The advice of the Department is sought by owners of woods in the neighbourhood, certain estates being visited periodically; and short courses of lectures in country districts have been given from time to time.

Armstrong College, Newcastle-upon-Tyne.—Lectures in forestry have been given to the agricultural students in this college since 1892, but it was not until 1904, when the Board of Agriculture and Fisheries made its first annual grant in respect of forestry, that a lecturer in forestry was appointed. Since this date special efforts have been made to develop the Forestry Department, and the success which has been achieved has been owing largely to the hearty co-operation of owners of woodlands in the neighbourhood. The chairman of the Agricultural Committee of the college, Lord Barnard, has taken a special interest in the work of this department.

Instruction in forestry forms a part of the regular courses of study for the B.Sc. degree in Agriculture (University of Durham) and for the College Diploma in Agriculture. In addition there is a special course in forestry, which includes practical work and demonstrations in the Chopwell Woods, and in other woods and nurseries during one or two days in each week, together with lectures additional to those given in the ordinary course. There is also a short course for young working foresters which lasts for four weeks. A further course for the same type of student is being organised at the present time, and is expected to include a course of lectures at the college lasting from four to six weeks, and about twelve months' practical work in the woods. The fees for instruction in forestry alone are £1, 11s. 6d. a term.

As the result of an agreement between His Majesty's Office of Woods and the College authorities, the latter have taken over the local management of Chopwell Woods. These are within a few miles of the college, extend over 900 acres, and carry crops of larch, spruce, Scots pine, oak, ash, and othe trees. The woods will be gradually brought under a proper rotation of cropping by the clearing and replanting of the more matured portions. This work will afford favourable opportunities for demonstrations in practical forestry, and for the holding of short

courses for practical foresters and others. It is anticipated that in a few years' time these woods will form an extensive and valuable demonstration area.

The experimental plantations and the tree nurseries at Cockle Park, the Northumberland County Agricultural Experimental Station, are available for demonstrations and practical instruction, and representative and appropriate private woodlands in the neighbourhood have been placed at the disposal of the college for the purpose of demonstrations to students. At Cockle Park ten plots of ground, comprising in all about eight acres, have been laid off and planted with forest trees for the purpose of illustrating certain principles of silviculture. A small arboretum has also been formed consisting of conifers and a few deciduous trees.

Since 1904 many extensive woodlands have been visited by the lecturer in forestry, and reports and working-plans prepared for most of them. In addition, the lecturer has given advice, by letter and otherwise, to landowners and others in the North of England, and has conducted several important investigations into matters connected with the management of woods.

Extension lectures in forestry are held at various centres in the contributing counties; occasionally single lectures only are given, but usually courses of three to six lectures are held.

University of Cambridge.—Instruction in forestry was instituted at Cambridge University in 1907, when a Forestry Committee of the Board of Agricultural Studies was formed, and a Reader in Forestry appointed.

The course of study for the Diploma in Forestry may be summarised as follows:—Candidates for admission to the examination for the diploma must have (1) obtained the degree of B.A.; (2) passed qualifying examinations in botany, geology, physics, and chemistry; and (3) attended for two years courses of instruction in forestry and cognate subjects.

The course for the first year includes lectures and practical work in forest botany, silviculture, and general forestry. During the long vacation the student spends ten weeks on a British woodland estate, in practical work, under the superintendence of an experienced forester.

The course for the second year includes similar instruction in forest management and forest utilisation, and in diseases of trees and timber, forest zoology, surveying, and engineering. During the long vacation of this year, the student has ten

weeks' practical work in a Continental forest, under the superintendence of a State forester.

The total fees for instruction in forestry for the Diploma Course at the university amount to £9, 19s. 6d. The fee for admission to the examination for the diploma is £2, 2s. The student in addition incurs the expenses, which are variable, of instruction during the two long vacations in a British and in a Continental forest.

An elementary course in forestry has been established for agricultural students, who are now encouraged to take forestry as an optional subject in the examination for the Diploma in Agriculture, and for the B.A. degree in Agricultural Science. This elementary course is identical with the first year's course for the Diploma in Forestry.

The average number of students who have attended courses of instruction in forestry during the last two years is twelve.

The woods used for the purpose of demonstration are all privately owned, and lie in the neighbourhood of Cambridge or in the adjoining counties. The Forestry Department is indebted to various landowners for the permission accorded to the Reader and his students to visit their woods and plantations. These visits, including those to the Botanic Gardens at Cambridge, are made weekly during term time, and afford an opportunity of seeing every type of woodland in the eastern counties, and of studying many forestry operations.

There is no land at present under the control of the Forestry Department, but certain experiments on timber have been carried out by the Reader and by the lecturer, with the assistance of private owners interested in forestry.

The Forestry Department is supported in part by annual subscriptions from the County Councils of Northamptonshire, Norfolk, Cambridgeshire, West Suffolk, and Huntingdonshire. Arrangements have been made with the Education Committees of these contributing counties by which owners of woodlands and persons who contemplate planting, may receive advice free from the Reader in Forestry; and from time to time his services have been solicited. In addition, the Reader has advised in regard to various woodlands belonging to the colleges of the university.

In the new building for the Agricultural Department, which is

now completed, provision is made for a room for the Reader and for some museum and lecture-room accommodation.

Royal Agricultural College, Cirencester.—The course of instruction in forestry was established in this college in 1903. There are two branches of the curriculum of the college, viz., the Estate Management and Forestry Branch, and the Farming and Colonial Branch. The majority, however, of the subjects are common to both branches; and the diploma may be taken in either branch of the college.

The full Diploma Course occupies three years of three terms each. In addition, there is a two-years' course. The fees are £45 a term for in-students and £25 a term (with an entrance fee of £5) for out-students. The average number of students in the Forestry Branch is about thirty. Instruction is given in the General Principles of Silviculture, Forest Management, Preparation of Working-Plans, Forest Protection, Forest Utilisation, and English Forest Law.

By the permission of Earl Bathurst, the Oakley Park and Woods, which cover an area of over 3000 acres, and have been for many years under systematic management, are used for instructional purposes. They comprise fine woods of oak, ash, Scots pine, beech and larch. About 90 acres of coppice are annually cut over. Lord Bathurst has also placed some acres of the park at the service of the college for an experimental area or forest garden. This is divided into ten half-acre plots, surrounded by screen belts. A useful Guide to the Forest Garden was printed in 1907 for the use of students. Visits for class instruction are also made to the estate nurseries and to trade nurseries in the immediate neighbourhood; periodical excursions are made to Gloucestershire forest areas, and in the summer vacation (if so desired) to Continental forests with the Professor of Forestry.

University of Edinburgh.—The course of lectures in forestry in this university was first delivered during the winter session of 1888-9, and the course has been conducted annually since that year. The degree of B.Sc. in Forestry has recently been instituted, with special courses in Advanced Forestry, Forest Botany, Forest Entomology, Chemistry of Forest Soils, and Forest Engineering with Drawing and Surveying. The Degree Course extends over three academic years, of which two and one-third are spent at the university. The First Course in

Forestry occupies a single winter session, and forms part of the course for the degree of B.Sc. in Agriculture.

The class-fee for the First Course of Forestry is £3, 3s., and that for the Advanced Course of Forestry is £2, 2s. The fees for the other Degree Courses amount to about £47. The Degree Examination fees are £6, 16s. 6d., and the total, including the annual Matriculation fee of £1, 1s., is thus about £60. The cost of board and lodging in one of the halls connected with the university, for each academic year of 30 weeks, ranges between about £40 and £50, which for two and one-third years of residence comes to from about £90 to about £120. The total estimated expenditure by a Degree student, for board and lodging, and university fees, with excursions and a practical course on the Continent, is about £300, or £100 a year.

During the 21 years of the existence of the Forestry Department, 201 students have passed through the First Course of Forestry; and during 14 years, from 1895-6 to 1908-9, 51 agricultural students have passed in Forestry for the Degree in Agriculture. The university has no woods under its control, but practical instruction is given by means of visits paid to privately-owned woods in the neighbourhood. Among these are the woods of the Raith estate, owned by Mr Munro Ferguson; and in order to enhance their value for instructional purposes, the lecturer has drawn up for them a working-plan or scheme of management. There are several trade nurseries in the suburbs of Edinburgh, and visits are paid to them and to the arboretum and galleries of the Royal Botanic Garden. In connection with the Advanced Course of Forestry, more extensive excursions are prescribed; and Degree students are required to undergo a training of six months in Continental forests.

The lecturer is in frequent correspondence with owners, agents, and foresters in regard to silvicultural questions; and he takes occasion, during the class excursions, to discuss such questions on the ground. He has drawn up a working-plan for the woods for the Novar estate in Ross-shire; and he has, from time to time, given advice to local institutions on the planting of their lands.

The accommodation provided for the lecturer on forestry includes a lecture-room, and a class-museum containing a considerable number of illustrative objects. The university has a

large library with reading rooms; and the Royal Scottish Museum possesses a large and separately arranged collection of works on forestry, called the "Cleghorn Library," which was founded by the late Dr Hugh Cleghorn.

Other Forestry Education in Scotland.—Provision is made for instruction in forestry at each of the three agricultural colleges supported by the Scottish Education Department. In Edinburgh the university and the college together supply courses to meet the requirements of all classes of students, including those who make a comprehensive scientific study of the subject with a view to graduation. The West of Scotland College grants a special Certificate in Forestry, and at all three centres (Edinburgh, Glasgow, and Aberdeen) courses are given which cover the ground prescribed when forestry is taken as a subject for the B.Sc. in Agriculture. There is also a comprehensive scheme of Extension Work in Forestry in connection with these centres.

Edinburgh and East of Scotland Agricultural College.—Instruction in forestry has been given at this college almost since its foundation. The courses of study prescribed are: (*a*) A course for the College Diploma in Agriculture, given at the university by the university lecturer in forestry, to whose salary the college contributes in respect of this work. (*b*) An evening class, instituted in 1905-6, and held annually since that date. A course at this class consists of 21 lectures, besides excursions for demonstration purposes. The attendance is principally composed of foresters, gardeners, nurserymen, and the young men employed in the estate management departments of large legal firms. (*c*) Extension courses consisting of from 12 to 20 lectures. Since the foundation of the college in 1901, courses of this kind have been given at eleven different centres within the college area, the average attendance at each course being 48.

Some of the classes of this College are recognised by the University of Edinburgh as qualifying for the B.Sc. in Forestry. Facilities for practical work are provided by several of the landlords in the neighbourhood of Edinburgh, and the large collections illustrative of forestry in the Royal Scottish Museum (an institution administered by the Scottish Education Department) are available for use by the students of the college. The fee for course (*a*) mentioned above is £3, 3s., that for course (*b*) is 5s.

West of Scotland Agricultural College, Glasgow.—The Forestry Department at this college was established in 1904. The

courses of study consist of (*a*) an optional course for the Degree of B.Sc. of Glasgow University; (*b*) a course for the College Certificate in Forestry; and (*c*) Evening classes in Forestry for students who are unable to attend day classes. Students preparing for the Degree and the certificate attend the same lectures, but the latter are required, in addition, to engage in practical work. The course for the evening class follows the same lines as that for the day classes. The college is well provided with the illustrative material required for the study of forestry.

The course for the College Certificate in Forestry is for working youths and men only. It extends over a period of $2\frac{1}{2}$ years, during which time the student is required to spend six months in Glasgow, taking classes throughout one winter session in the following subjects:—forestry, botany, chemistry, soils and manures, zoology, book-keeping and surveying. Previous to undergoing their collegiate course, students are also required to spend eighteen months on an estate, where they perform the duties of a working forester, keep a journal recording full details and cost of the work done each day, and attend lectures held by the college.

The students have to work in the woods, or at any work ordinarily done by estate workmen, and under the same regulations. Students must be between the ages of fifteen and twenty, inclusive, on the day of admission.

The number of students attending forestry lectures during the five years has averaged twenty-three. The fee for the course of day lectures in forestry is £3, 3s., and £8, 8s. for the whole college course for the Forestry Certificate. The fee for the evening class, which consists of two courses, each of nine weeks, before and after Christmas, is 10s. 6d. for each course.

Aberdeen and North of Scotland Agricultural College.—This college provides: (*a*) A course of fifty lectures, with excursions, for students who take forestry as one of the subjects for the B.Sc. degree of the University in Agriculture. The fee for the course is £2, 2s. Provision is also made for a supplementary course of fifty lectures accompanied by laboratory work and practical demonstrations for students who intend to make a special study of forestry, or who wish to prepare for the Forestry Diploma of the Highland and Agricultural Society. There are large wooded areas in the neighbourhood of Aberdeen, and, through the liberality of several of the landed proprietors, excellent facilities

are afforded for practical work. (*b*) There are further courses of instruction in connection with the extension scheme of the college. These are delivered to foresters and forest workers at centres within the district that naturally fall within the sphere of interest of the college, where there are suitable and sufficient wooded areas. In 1907-1908 there were given sixteen such lectures, at which 650 persons were in attendance. In 1908-1909 there were fifteen lectures, with an attendance of 820. As the lectureship in forestry was not established in the college until 1907, these facts are full of promise for the future.

Inverliever Estate.—This estate, containing about 12,530 acres, situate on the west side of Loch Awe, Argyllshire, and lying at an elevation of between 120 and 1400 feet above sea level, was purchased by the Commissioners of His Majesty's Woods and Forests in the year 1907. It is proposed to plant it gradually at the rate of about 150 acres per annum. Planting has been commenced this season near the centre of the estate. A nursery is being formed at Ford, and a number of seed beds have been sown and seedlings planted. A forester has been appointed, who resides on the estate and acts under the general supervision of the committee. At present eleven men and four boys are employed. (Further information respecting this estate appeared in the *Journal of the Board of Agriculture* for June 1909, p. 219.[1])

Alice Holt Forest.—In the Report of the Departmental Committee on Forestry, to which reference has been made, it was recommended that the forest of Alice Holt should be made available as a demonstration area for the practical study of forestry. In order to carry out this recommendation, as far as possible, the Commissioners of His Majesty's Woods and Forests obtained in 1904 from Dr Schlich, Ph.D., C.I.E., an exhaustive report on the condition of each of the woods comprised in the forest. In this Report Dr Schlich expressed his general approval of the operations which had recently been carried out, and developed in detail a working-plan for their continuation in the future. In drawing up the working-plan regard was had to this point, one of the objects being the provision of the best object-lesson in the treatment of woods of this description from a practical point of view, according to the methods of scientific forestry.

[1] See *Trans.* xxiii., p. 106.

21. Belgian System of Planting on Turfs.

(With Plates.)

By Sir John Stirling-Maxwell, Bart.

In 1906 I contributed to this Journal an account [1] of the method adopted for planting high moorlands in Belgium, and described some experiments which had been begun on the same lines at Corrour in Inverness-shire. It is too soon to pronounce anything like a final opinion on these experiments either in Belgium or Scotland, but some report may be welcome to a few readers who have taken an interest in the subject.

For the benefit of those who are not familiar with it, I may here recapitulate the rudiments of the system, referring the reader to the former article if more detail is required. The ground is prepared some months before planting by cutting shallow drains, the turfs from which are placed upside down in rows between the drains. Each tree is planted on a turf in a hole cut with a heavy trowel,[2] and is given two handfuls of such soil, sand, or gravel as can be obtained near at hand, mixed with a small proportion of basic slag or other manure, the plug cut out by the trowel being broken up and used to fill up the hole. This method is specially adapted for planting water-logged peat. The advantages claimed for it, as compared with notching, are :—

(1) That smaller plants can be used.
(2) That they begin to grow at once.
(3) That they are not smothered by grass.
(4) That they suffer less from drought and frost.
(5) That they develop a better root-system.
(6) That they are easier to beat up.

The ultimate success depends upon the broad fact that most kinds of peat, though utterly unsuitable for tree life in their water-logged state, form very fair soils for several coniferous species when air and water can circulate freely through them. The lifted turfs achieve this desirable transformation in a few months, and it extends gradually to the surrounding surface, as

[1] Vol. xx., page 4.

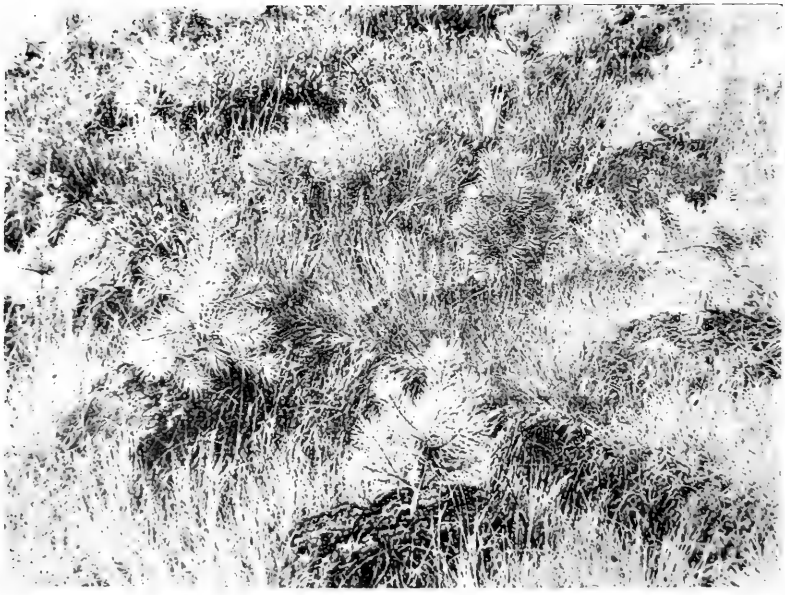
[2] This tool is illustrated in the former article. It can be obtained from Messrs P. & R. Fleming, 29 Argyle Street, Glasgow, price 7s.

the result of drainage, before the roots of the young trees begin to penetrate beyond the turfs.

In the Hertogenwald, easily reached from Verviers or Spa, this kind of planting may be seen on a very large scale. It has been in operation for some ten years, on moss land indistinguishable from a Scots moor in the nature of the soil and the variety of plants which cover it. The Belgian Government appears to be satisfied with the result, as its operations still continue, but the forest officers have laboured under very great difficulties. To begin with, the scene of operations is 1800 to 2000 feet above the sea, and it is absolutely without shelter, being the summit of a very long acclivity. The plantations are open to red deer and roe, not a heavy stock, but enough to do great damage. The Government, eager to afforest the largest area at the least expense, plants at six feet, which is much too wide, and the drains are too far apart to dry the ground effectually. Almost the only species employed is the common spruce (*Picea excelsa*), which suffers more than most trees from careless planting. The work is all done by contract, though under supervision of the forest officials. The work of preparation, which can be strictly specified and examined, is well done, but the plants supplied by the contractors are often unsatisfactory, and imported from too low an elevation. The results obtained are consequently slow, unequal, and rather disappointing.

The experiments at Corrour were begun in 1907. They have been made partly at an elevation of 800 to 900 feet, and partly at 1300 to 1400 feet. The figures which follow all refer to the latter group of experiments, which now extends to rather more than 100,000 plants, not including the area to be planted this spring. The planting has all been done in spring (as it is in Belgium). There is no object in putting out the plants in autumn to be targets for the wind and frost. At the end of the first year's growth, under this method, they are well rooted and fit to hold their own. The species employed have been—

Pinus sylvestris . . .	27,000
Picea excelsa	15,000
Picea sitchensis . . .	14,000
Picea alba	10,000
Pinus montana uncinata (erect variety from the Pyrenees) . .	32,000
Pinus strobus	1000



2-YEAR SEEDLINGS OF SCOTS PINE.

"Planted" on turf April 1907, photographed October 1909. The upper figure shows a single tree; the lower, a portion of the plantation with the young trees among the herbage.

[*To face page* 155.

The preparation of the ground has cost hitherto £2, 6s. 8d. per acre for 4840 plants per acre. The planting, including the conveyance of sand, has cost 16s. 8d., making £3, 3s. 4d. in all. This does not include the cost of the plants. They were for the most part 2-year seedlings from the home nursery, and their cost, though it cannot be exactly estimated, is very small. Sand or fine gravel has been found on the spot, and is indeed seldom far off on a Scots moor. A small allowance must be made for the basic slag, which has been added to the sand in the proportion of one to seven. This manure certainly hastens the development of the plants during the first few years. In experiments made seven years ago in the Hertogenwald, its influence is still clearly visible both in the better development of the plants, and in the greater numbers which have survived the attacks of frost, game, etc. Sand without manure has given fairly good results at Corrour. Planting on the turf without the addition of anything has not succeeded nearly so well. When it is remembered that the ground could not have been planted at all without careful draining, and that it would have been useless to dibble 2-year seedlings into the natural surface, it will be seen that the expense has been very little if at all in excess of ordinary notching with 2-year 1-year plants. How the two methods compare in results can be judged from the photographs (Plates I. and II. and Fig. 1.)

In the accompanying figure (Fig. 1) the right-hand specimen is a 2-year seedling of Scots pine, which was planted on upturned turf, the left a 2-year 1-year Scots pine, notched. Both specimens are from the same plantation, they were planted in April 1907, and photographed in October 1909.

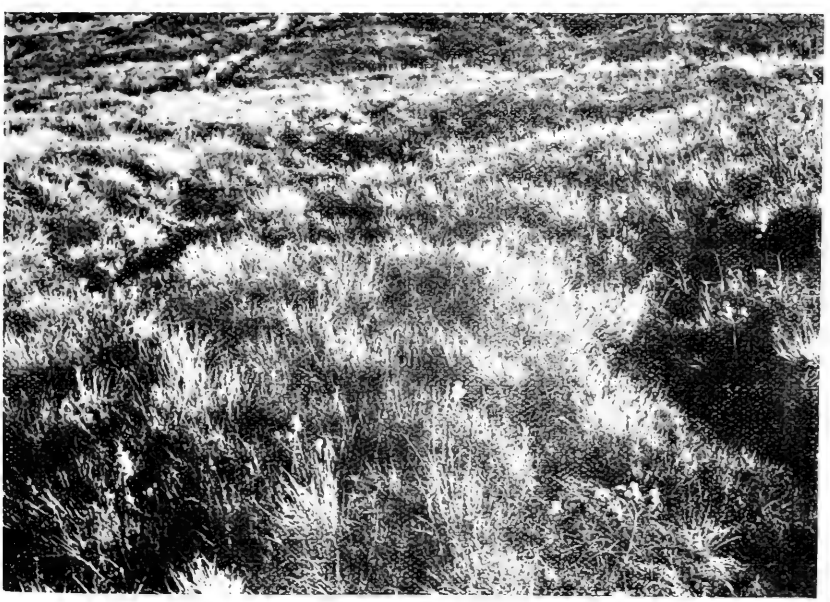
As time goes on the difference will probably become more striking. The notched plants often sit five, six, or even ten years without making any perceptible growth—mere sticks with a microscopic tuft at the top, which once led a scornful person to observe that a rose with two Corrour trees made a nice button-hole.

I am not sure, however, that 2-year seedlings can be recommended for the turfs except in the case of Scots pine, which makes a strong growth in its third year, and always seems to get a good hold in the first season. Spruce and Mountain pine seedlings are delicate things, and unless they make a really good start the first year, are apt to get turned out by the frost.

In these species, 2-year 1-year plants certainly give the best result at 1300 feet. On lower ground, 2-year seedlings would no doubt succeed. The operation of planting, though perfectly easy, requires care, and I have discovered startling differences in

Fig. 1.

comparing the work of different planters. Each planter proceeds along a line of turfs, so it is easy to distinguish his work and compare it with that of the man on each side of him. In making such comparisons, I found that in the case of Norway spruce, the failures varied from 4 per cent. for a good planter to 48 per cent. for a bad one, and in the case of Scots pine from 0 per cent. to 33 per cent. The men were all new to this kind of planting and, I believe, were all doing their best, but their skill varied. The roots of 2-year seedlings are very fragile and require careful handling. In the case of Scots pine our percentage of blanks, 17 per cent., is large, but I attribute the heavy death rate partly to imperfect planting and partly to the



SCOTS PINE 2-YEAR—1-YEAR.

"Notched" in April 1907, photographed in October 1909. The upper figure shows a single tree; in the lower, the plants can be distinguished among the herbage in the plantation.

[*To face page* 156

fact that the seedlings were brought from the sheltered nursery at Pollok, which is less than 100 feet above sea-level. Nothing could be more vigorous than the 83 per cent. which survive, and I have no hesitation in recommending the use of 2-year seedlings of this species. We have reluctantly decided to abandon Scots pine altogether in the higher plantations, because the snow is too much for its brittle wood. Sitka spruce seems likely to give the best results on the turfs at high elevations In a group planted in the spring of 1907 (with 2-year 1-year plants) I could only find two deaths, among the 424 plants composing the group. We also hope for great things from the Pyrenean Mountain pine, but it remains to be seen whether it will keep its upright habit in Scotland. The intermediate (German) variety of this pine has also been tried. This variety, by the way, may be seen 50 years old at Balmoral, where it was planted by the Prince Consort on a considerable scale. It evidently has no value as a timber tree, though it attains a greater height than the dwarf variety which is familiar in British gardens.

The method of planting above described is primarily intended for the conversion of wet moorlands into forest, but there are other cases in which it may be found useful. Mr Munro Ferguson tells me that he has employed it at Novar, and is employing it more every year. Where a good forest soil, clear of weeds, has to be re-planted, it would be obviously out of place. But where a plantation has to be made on grassy or weedy ground, it is probably in the end the cheapest and surest method, especially if it is desired to use small plants. On ordinary soils it will be unnecessary to add imported soil or manure; the decayed vegetation below the turfs will provide sufficient stimulant. If the ground does not require draining, the turfs can simply be turned over where they are wanted.

22. On the Growth of the Sitka Spruce and other Trees in Linlithgowshire and Stirlingshire.

By Henry M. Cadell of Grange, B.Sc., F R.S.E.

Practical experiments, even on a small scale, have always their value, and although I cannot claim to have great things to record, the following discursive notes may be of interest to those who, fortunately or unfortunately, have to do with the ownership of land and trees on the south side of the Forth valley.

Being mainly agricultural or adapted for industry or mining, my land is better suited for small arboricultural experiments than for large silvicultural operations. In Linlithgowshire it extends on Grange and Bonnytoun estates from sea-level at Bo'ness up to 550 feet; and at Banton, in Stirlingshire, on the watershed of the country, 20 miles farther west, it rises from 200 feet at the Forth and Clyde Canal to 1200 feet on the ridge of this part of the Campsie Hills. The rocks in each locality belong to the Carboniferous Limestone formation, and consist partly of coal-bearing strata, mainly argillaceous in character, and partly of basalt and other volcanic materials, the disintegration of which produces a more or less heavy clay or loamy soil. The rainfall in Linlithgowshire is about 30 inches, and in the part of Stirlingshire in question a little over 40 inches per annum, the prevailing wind being from the S.W. The land near the sea is free and open, but the highest ground has a cold clay bottom on barren volcanic rock, and is unfit for anything but rough hill pasture or partial afforestation.

My arboricultural experiments were begun in 1889, when some wood planted by my grandfather in 1805 was cut down, and the site replanted with broad-leaved trees and conifers. The original plantation, on the ancient sea margin, less than 100 feet above the present shore, now consists chiefly of elms and sycamores with some beech and oak; the larches, which were once mixed with the broad-leaved trees, having been nearly all thinned out and used for estate purposes. These trees, now 105 years old, have a girth at breast-height of $4\frac{1}{2}$ to 5 feet, on the average, and as this has not appreciably increased in many cases during recent years, it is time, economically speaking, that the wood was felled and the price

realised. My limited experience of realising grown timber crops is, however, not encouraging. A few years ago, about a dozen of the best sycamores were cut and sold to a local wood merchant, and all I got out of him was a new farm cart, in payment for the lot! In another case, the best price I was offered by a well-known firm of wood merchants in Larbert for over 100 old beeches planted in a glen on my Banton estate more than a century ago, was the magnificent sum of £35. Needless to say, the wood is still standing.

The moral apparently is that beech, sycamore, and elm have ceased to be so valuable in the arts as they were in our grandfathers' times. In Germany the beech in the Bavarian forests, which the Society visited last autumn, is used mainly for fuel, and in our country a century hence, when the coal is becoming exhausted, beech forests planted now may be mainly required, not for structural work or implements, but to eke out our grandchildren's domestic supply of dear coal.

The trees planted in 1889 were chiefly sycamore, black Italian and balsam poplar, elm, Austrian pine, Douglas, larch, and Norway spruce. The larches were planted on old colliery "blaes bings," and the broad-leaved trees on the surrounding ground. After twenty-one years the black Italian poplars have shot up to heights of from 40 to 50 feet, and the girth at breast-height is now from 27 to 34 inches. Of all trees this appears to grow fastest in this district, and for some purposes, such as pulp-making, it may be the most useful species to cultivate. Unlike the black Italian, which remains perfectly healthy, the balsam poplar generally begins about the tenth year to show canker, near the root or a few feet up the stem, and this goes on developing till the tree dies off, leaving the ground full of roots and with suckers very troublesome to eradicate. Except for shelter or to act as a nurse to young trees, the balsam poplar is, in my experience, a perfectly useless tree to cultivate. The sycamores have grown well, but not so fast as the poplars. They have developed comparatively clean poles, 35 to 40 feet high, with a girth of 15 to 16 inches, or about half that of the poplars. This has recently been increasing at the rate of half an inch per annum, and some of the trees have been observed to add as much as 6 feet to their height in a good season. The Austrian pines, although overshadowed by the faster-growing trees, have held their own, but have a girth of only 8½ to

10 inches, and a height of 15 to 20 feet. The Douglas fir, from which great things were expected, has proved a complete failure, growing up thin and weakly, even when in a well-sheltered place and on good soil.

No Sitka spruce or Japanese larch was tried in the locality till 1904. In that year some waste ground near the first wood at an old colliery south of Bridgeness, a little over 100 feet above sea-level, and half a mile inland from the Firth of Forth, was planted with beech, birch, sycamore, Japanese larch, spruce, Austrian pine, and some specimens of Sitka, *nobilis*, and Douglas spruce.

After six years the growth of these different trees can be noted. The Japanese larches are 11 to 12 feet high, with an average growth during the last four years of 2 feet. The Austrian pines are $5\frac{1}{2}$ feet high at most, with an average growth of not more than 1 foot, and the beeches are the same height as the pines. The Norway spruce is only 4 feet high, and the *nobilis* not more than 2 ft. 6 ins. The Sitka firs, of which there are only a few specimens, are from $7\frac{1}{2}$ to $9\frac{1}{2}$ feet high, with strong robust stems, with an annual growth increasing every year, and reaching from 24 to 30 inches for the summer of 1909. The best of the Japanese larches added from 27 to 32 inches to their height, and thus it appears that among the conifers, the Japanese larch and the Sitka spruce have grown about equally fast, and have far outstripped all the other species. As for the Douglas firs, the best are not more than a couple of feet high, and many can hardly be seen among the grass.

In the spring of 1904 I sowed plots of Oregon Douglas, and Sitka spruce, as well as *Robinia pseudacacia*,[1] larch, and other trees recommended as suitable for afforestation in this country. The Douglas came up well, but after six years the majority have been killed by the frost, and the tree appears to be too delicate for this locality. The plants were sown in good free ground near sea-level, and in 1906 the survivors, after one transplanting, were transplanted again, this time to a new nursery on the south slope of Bonnytoun Hill at the new Grange Mansion House, at a height of 440 feet, where the soil is good loam on a subsoil of clay and decomposed basalt. There are strong S.W. winds on this site, but the nursery is partially sheltered

[1] Called "Locust" in America.—Hon. Ed.

by a clump of old wood. Every winter there have been a good many deaths from cold and exposure, and apparently before long hardly any individuals will be left to tell their melancholy tale.

The *Robinias* also came up well, but this tree seems quite unable to produce a top, and although very ornamental when once in leaf, it is late in starting to grow, and appears quite useless as a future forest tree in this country.

The Sitka spruce, on the other hand, came up well, and throve remarkably from the very start. The seed of this and the other species was obtained from Johannes Rafn, Copenhagen. After transplanting there are practically no losses to record. The Sitka spruce and Japanese larch, which, with European larch from Silesia, were sown in 1904 in the low-level nursery, were transplanted to the high site, and are now mostly all planted out. The spruce promises to be the best of all trees for an exposed situation with a loamy and stiff rather moist soil, such as is common in the district. In rate of growth the Japanese larch slightly surpasses it, but so far as strength to resist wind is concerned the Sitka spruce is apparently the better tree. In a gale that swept the hill last autumn, both European and Japanese larches were considerably shaken, but the largest Sitka spruces, with their robust stems well anchored to large roots, never budged in the least degree.

The King's Coronation in 1902 was celebrated on my estates in an evanescent way by bonfires, and, in a permanent and practical way, by building model workmen's dwellings and planting trees. After eight years have passed, the woods have entirely disappointed the hopes of their loyal planter, and have behaved in the very reverse of the monumental way that was expected of them in connection with that great event.

I began with great enthusiasm and arboricultural zeal, without counting the cost, and planted (A) 11 acres on the Campsie Hills above Drumnessie Farm on Banton estate, on the 1000-feet contour line, with 39,000 trees, chiefly spruce, Scots fir, Corsican pine, and some larch. The situation is bare and exposed, and the soil a poor, thin clay, with a covering of rough bent grass on an outcrop of whinstone along the steep hill slope. The trees were mostly notched-in during the autumn and winter months by an experienced forester. The result is that now, out of all the 39,000, hardly one solitary tree is to be seen.

At a less exposed and more level part of the ground on the same hill slope a smaller area (B), about two acres in extent at a height of 750 feet, was fenced off and planted. It was to have formed the beginning of a large plantation, and was named the Coronation Wood. The trees were put in as in wood A, $3\frac{1}{2}$ feet apart, and consisted chiefly of Norway and black spruce, Colorado Douglas, Austrian, and Corsican pines, with some larch, alder, sycamore, and balsam poplars to form nurses. All the black pines soon died, none of the Douglas firs made any growth, and now only some of the spruces are left, with a few dwarf larches and hardwoods here and there. The soil is cold and stiff, covered with rough bent grass. It is proper to mention here that a considerable part of the damage was done by black-faced sheep, which show extraordinary agility in jumping dykes and wriggling through wire fences, no matter how well made, in order to taste the sweets of forbidden places. Hares and black game also contributed to the damage. Sometimes the snow drifted to the top of the fences and provided an easy bridge in winter, and the tops of the trees being the only green thing in sight, were attacked with avidity by the starving creatures. Some of the spruces, many of which had to be replanted of course, are now growing up, the Black American being the leaders. A few Sitkas were subsequently put in, and some of them are now growing well.

In another clump of trees (C) 300 yards east of the Coronation Wood, on the same level, planted by my predecessor about twenty years ago with spruce, larch, and birch, all the larches, now about 15 feet high, are rapidly being destroyed by the larch fungus, and the spruces are considerably injured by the south-west winds to which the hillside is fully exposed. The ground is cold and wet, and obviously, although European larch can be got to grow, it will not ultimately thrive on such a soil. No Japanese larch has been tried here. Some Scots firs, which were planted in 1902 round the original wood, are now beginning to shoot up. No Sitka spruces were planted, but from recent experience this would appear to be the very place where they would grow to advantage.

In the winter of 1903-4 another patch (D), $4\frac{1}{2}$ acres in extent, was prepared for planting. The ground is nearly flat, and is situated at a height of about 650 feet, near the old farmhouse

of Craigdouffie. This land has once been cultivated, and the soil is a little better than in plantation C, which is half a mile further west on the same hillside. After fencing it and cutting numerous ditches and sheep drains, the whole area was planted with 15,000 trees, the principal species being Norway spruce (4000), Scots fir (4000), European larch (3000,) Japanese larch (1000), Sitka spruce (800), Douglas (green) (500), Weymouth (500), birch (500), and some alder, oak, ash, rowan, maple, and poplar. Most of these trees were bought from home nurserymen. At the end of six years the result is not encouraging. Three-quarters of the trees are dead or sickly, and of those which have survived, the birches and alders are by far the most vigorous. Next come the Scots firs and Japanese larches, which appear much more hardy than their European relatives. The trees were planted $3\frac{1}{2}$ feet apart, in alternate lines of Scots fir and spruce, or larch and spruce, with the other kinds scattered at irregular intervals over the ground. The lines of spruce and larch can hardly be seen, but the isolated specimens of Sitka are strong and vigorous. The Japanese larches, wherever there was any shelter, are growing, though not so well as to encourage much more planting, but the Douglas has disappeared entirely from the scene.

The inference is that a mixture of Sitka spruce and Scots pine, with some birch and alder for nurses, would be the best to plant on a wet and windy place such as this. Norway spruce can nowhere compare with Sitka in situations and on soil such as this, and European is inferior to Japanese larch, which is not to be recommended in such moist and exposed situations.

The locality was once rich in coal and ironstone, the Banton Blackband seam having been for generations a valuable source of the iron made in the Carron Works after the estate came into the possession of the writer's family in 1767. The huge black blaes bings at the mouths of the abandoned pits form conspicuous landmarks, and cover a good many acres of waste land. Several of them have, however, been removed for brick-making purposes within the last twenty years, and both the bings, and the sites of those that have been removed, are tempting places for aboricultural experiments.

Before speaking of planting trees on such ground, a few general remarks by an old geologist as to the rubbish heaps, or

"bings" at old disused collieries or shale mines, may be of interest in this connection.

Coal, oil-shale, and ironstone, particularly the last-named mineral product of the Carboniferous formation, is associated with black argillaceous shale, or "blaes" as it is called in Scotland, which must be removed to make room for the miners to work the valuable mineral. Ironstone seams, being, as a rule, less than a foot thick, produce large blaes bings and are thus expensive to work, since for every foot of useful ironstone one or two feet of useless blaes must be excavated.

Blackband and clayband ironstone are always associated with blaes—the mud of the Carboniferous waters—but coal seams, which are generally thick enough to be worked without removing much extraneous material, are often associated with sandstone, fireclay, or sandy blaes, and hence both the amount and quality of the rubbish at the mouths of old pits depends on whether coal or ironstone has been the mineral worked.

The rubbish heaps again sometimes contain, or consist of alum shale produced by the decomposition of iron pyrites or marcasite (the sulphide of iron). This mineral, when oxidised, produces sulphuric acid, which combines with part of the alumina in the blaes to produce sulphate of alumina, or alum, a soluble salt, absolutely destructive to vegetation. Wherever shale of this kind occurs, the heaps remain bald and bare for many years, and not even a blade of grass will grow on them. Indeed, I know of one such heap on a hillside, where whenever there is a wet season the water that runs off is so poisoned, that a brown streak of dead grass may be seen extending down the slope along the track of the noxious flood. Needless to say such a soil would at once destroy the hardiest trees, and before considering the afforestation of old bings, the absence of pyritous shale should be made sure of.

In the Lothians a third kind of mine refuse is produced in vast quantities, and the production will continue to increase as long as the oil-shale industry lasts. Oil-shale contains about 25 per cent. of volatile matter and carbon, and 75 per cent. of ash. The latter is thrown out in enormous heaps, compared to which the largest bings at coal or ironstone pits are but as mole-hills to volcanoes. These "spent shale" bings generally go on fire, in time, either spontaneously or because the materials are emptied hot out of the retorts, where the organic matter has

not been completely consumed, and some oxidizable carbon still remains to be burnt in the open air. The final result is that the spent shale is burnt into a red, porous mass which becomes slowly weathered, and crumbling down on the surface, will in time make good enough soil for some kinds of trees, such as larch, birch, and Scots fir suited for dry, porous land. The drawback to afforestation on such places at present is the quantity of dust and smoke in the air. But when, and if the adjacent oil works were to stop, and the smoke cease,—an event that will happen sooner or later—tree planting might be attempted with prospects of good success. These ugly and very prominent landmarks in the West Lothian landscape may then hide their forbidding volcanic outlines under an attractive mantle of arboreal greenery.

We may now return from this little geological excursion to my attempts at growing trees on the old colliery bings at Banton.

Colliery debris containing fireclay breaks quickly down into common clay, and if there is a mixture of sandstone and perhaps engine ashes, the whole may produce suitable mixed soil for trees or grass. But here the blaes contain, like oil-shale, some bituminous matter, and so do not break down in such a way as, with the help of grass, to produce much humus on which trees can make a start. The black, loose material, although devoid of pyrites, has lain, in some instances, for more than a century without accumulating much natural vegetation. It absorbs the sun's rays, and becomes hot and dry in summer, so that the tender plants have great difficulty in starting away at first.

Many hundreds of larches, and some spruces and Scots firs were planted on the blaes heaps in little pits, into each of which a shovelful of good soil had been thrown. A few, particularly *Larix leptolepis*, have thriven, but most have failed to establish themselves in the first two years. Sitka spruce is, of course, not the tree for such a soil, and common Norway spruce has proved quite a failure where tried.

Some of the largest of the old bings have, however, been removed for brick-making, and the waste land which they occupied has been planted with more success. The area first planted in 1904 extends to about 4 acres, and is situated about 350 feet above sea-level. The original land is here gravelly, with some blaes and stones scattered about, and a little good soil in places. Part rises into a dry knoll and part forms a wet

hollow, fairly well sheltered. It was soiled where necessary at considerable expense, and planted, chiefly with Japanese larch, European larch, Scots pine, Douglas, Norway, and a few Sitka spruces; the spruces being chiefly in the damper spots.

After six years the result is interesting. All the Douglas firs are dead or dying, the Sitkas are not conspicuous, and the common spruces not very large, but larger than the Sitkas. The Japanese larches are all in splendid form, and on the dry knoll the common larch and Scots pines are doing well, but are not equal in quality to the *Larix leptolepis*. The trees were all carefully planted in pits in regular lines and exactly $3\frac{1}{2}$ feet apart, the spruces and Douglas firs in one line and the *L. leptolepis* in the next. The larches are 6 to 8 feet high, with a growth of 1 foot to 18 inches, while the spruces are not much more than a foot or two high altogether.

This plantation is nearly a mile from the clump (C) in which the larch disease is so rampant, and my idea in planting so many of the Japanese species, was to test this tree on a gravelly soil under good conditions which do not exist at the higher level, where the soil is stiff and wet. The gravelly land, although fairly moist at places, is devoid of clay and therefore does not seem to suit the Sitka fir.

These observations may perhaps appear to the professional forester, with large resources at his back, trivial and premature, as all my recent planting operations are on small areas, and do not extend beyond the last ten years; and it is possible that a very different story may have to be told after another decade has passed. The Sitka spruce and Japanese larch may thrive quite well at first in this country, but, like precocious children, they may live to disappoint the hopes of their early years. I have, moreover, no experience of the quality of the timber these trees will produce; but this is certain, that the Sitka spruce develops an exceedingly strong, tough stem with a good, red heart at an early age, and although it grows so fast, it is, in its youth at least, a far stronger tree in a gale than either the common spruce or the Japanese larch. To succeed in living well when other trees will not live at all must in itself be an excellent testimonial to the hardiness of its constitution, if not to the quality of its timber, and a tree that adapts itself so well to our climate and soil from its very babyhood, is surely a desirable immigrant whose acquaintance is worthy of further cultivation.

As for the Douglas fir, my twenty years' experience of the tree is that whether reared from seed at home, or bought from good nurserymen abroad, whether grown in sheltered or exposed places, in good soil or bad, wet or dry, high up or low down, it is so delicate as to be worthless for practical afforestation in this part of Scotland, although it may and does thrive well in other and milder districts. Possibly the small amount of smoke in the air may have something to do with the explanation. If so, this is another point in favour of the Sitka spruce, which does not seem to mind the presence of a little smoke.

The difficulty in the way of planting Sitka forests arises at present from the high price nurserymen charge in this country for the young trees. The price in some foreign nurseries is considerably lower, and it is high time that practical men at home turned their attention to the propagation in large quantities of this admirable and very handsome conifer, instead of allowing the enterprising foreigner to get ahead of us, and do the elementary work we should be doing ourselves. The seed is not always easily obtainable, but one advantage of the Sitka is said to be the facility with which it can be propagated from cuttings. This fact only recently came to my notice, but the cuttings I have lately put in to test the matter will not show any results for some months. I may be able, perhaps, to report progress in some future communication.

In conclusion, I entirely agree with Mr Crozier's words in his excellent and most useful paper, on page 11 of this (twenty-third) volume of the Society's *Transactions:* "As a tree for hill planting Sitka spruce has proved its superiority over larch, Scots pine, and Norway spruce in a marked degree, its power of resistance against winds, and its general reliability on exposed sites far surpassing any of those species." I might add that its virtues are apparently not necessarily confined to its behaviour on hilly sites. It is a noble and ornamental tree for a park, and will probably produce, in sheltered places with a moist clay soil, more wood than most other conifers, while for shelter belts and where cover is wanted, it may prove in certain districts to be the most valuable member of the whole fir tribe.

23. Seed Experiments with *Pinus sylvestris*.

(With Plate.)

By Fraser Story.

It is generally taken for granted that Scots pine seed yields the best plants when obtained from trees grown in Scotland. For proof that this opinion prevails, one need only refer to nurserymen's catalogues where such expressions as "grown from Scotch seed," "true native Scotch fir," "must not be confounded with the cheap Scotch fir obtained from the Continent," and the like are so commonly used It may turn out that the reliance on Scots pine seed emanating from Scotland is not misplaced; but the present series of experiments (conducted at Bangor, and at many Investigation Stations on the Continent) seem to suggest that we may require to reconsider our decision, at least as regards height-growth in youth. The following statement deals chiefly with the results as shown at the end of the second year, but a table is also appended giving the size attained after transplanting into nursery lines. It will be seen that, in the seed beds, Scotland had the poorest plants. They are still no bigger than the smallest of their neighbours, but a close examination of the type of plant produced, leads one to regard them more favourably than when judged merely from their size. This opinion I find is shared in North Germany, and in Austria, where, as at other stations, the Scotch plants show least growth in height so far.

Below will be found a list of countries taking part in the investigation. Cones were collected to a quantity of about eight bushels in each country, according to directions issued by the Prussian Forest Investigation Station. The seeds were separated from the cones in the seed kilns at Eberswalde, and distributed from there to all countries participating. The Scotch seed was kindly supplied by Mr J. Grant Thomson, Grantown-on-Spey, who writes as follows :—

> "8¼ bushels of Scots fir cones were collected on 17th December 1906 in beautiful, dry weather from trees averaging 112 years of age. The trees were sound and vigorous, and had been grown in a fairly dense wood, well thinned now. The cones are from trees which we are sure were produced by natural reproduction."

Professor Schwappach kindly sent me a portion of all the seeds, and these were sown in April 1907 upon seed beds in the College grounds at Bangor. The individual plots were not large but

were uniform in quality of soil and situation, while all received precisely similar treatment throughout.

The following table gives particulars regarding the source of the several lots :—

Plot.	Country.	District.	Owner of Forest.	Longitude.	Latitude.	Altitude.	Description of Soil.
						Feet.	
1	Scotland	Inverness-shire.	Countess of Seafield.	3°42′W.	57°14′	786	Gravelly sand.
2	France	Haute Loire.	Commune.	3°7′E.	44°58′	3705	Soil from granite.
3	Prussia	Allenstein.	State.	21°30′E.	53°40′	422	Diluvial sand.
4	Belgium	Campine.	Commune.	5°40′E.	50°54′	338	Dry gravelly sand.
5	Bavaria	Rhine Palatinate.	State.	7°45′E.	49°25′	975	Loamy sand.
6	Russia	Baltic Provinces.	State.	25°45′E.	56°45′	32	Dry humose sand.
7	Prussia	Eberswalde.	State.	14°10′E.	52°50′	130	Diluvial sand.
8	Russia	Ural Mountains.	Count Stroganow.	64°E.	57°	975	Sand.

The approximate ages of the trees from which the seed was taken are as follows :—

Plot 1,	112 years.
,, 2,	80 ,,
,, 3,	120 ,,
,, 4,	40 ,,
,, 5,	100 ,,
,, 6,	120-140 ,,
,, 7,	120 ,,
,, 8,	100-140 ,,

In sowing the seeds at Bangor, Spitzenberg's Drill-maker was used, double drills being made 2 inches apart with 4 inches between each pair of drills, and the seeds were covered with soil to a depth of half an inch. Care was taken to distribute the seed as evenly as possible, but, as the following table shows, the weight varied slightly—partly owing to differences in the size of the seed. Exactly the same space was allotted to each plot, with the exception of No. 8, of which only a very small quantity of seeds (5 grams = ·160 oz.) was received; in this case only one double drill was sown. On the other plots the following quantities of seed were sown :—

Plot.	Grams.	Equivalent in oz.
1	26	·832
2	30	·960
3	28	·986
4	29	·928
5	37	1·184
6	26	·832
7	24	·768

The number of seedlings obtained from the different plots were as follows:—

Plot.	Country.	No. of Seedlings of 2 years old.	Average Height of Seedlings.
			Inches.
1	Scotland	2440	3
2	France	2960	3½
3	Prussia (East)	2750	4
4	Belgium	2520	5¼
5	Bavaria	2570	4
6	Russia (Baltic Prov.)	2700	3¼
7	Prussia (Eberswalde)	1660	4¼
8	Russia (Ural Mountains)[1]	440	4¼

[1] Only 5 grams of seed sown.

In all cases the seeds germinated well, the seedlings coming through the ground equally and showing little variation in growth until about the middle of the first summer, when plot No. 1 (Scotland) began to lag behind somewhat. Thenceforward this section never looked quite as well as the others. It was more regular than some of the plots and produced a normal quantity of plants, but the seedlings made less progress and had shorter needles.

The plants from Belgian seed were much the best in every respect, there were no dead needles, no gaps, and the colour was a fine dark green; although the average height was not more than 5¼ inches, many individual plants were 7 inches high. In plot 5 (Bavaria) the seedlings were uniformly well developed, the height ranging from 3 to 5½ inches. Plot 6 (Russia, Baltic Provinces) gave small plants but was regular and otherwise satisfactory; the seedlings had the appearance of being taller than when measured as the needles were held erect over the terminal bud in a curious manner. Plot 7 (Eberswalde) was unequal in growth and decidedly patchy, a fact which is reflected in the comparatively small number of plants produced. The seedlings from the Ural Mountains (No. 8) were strong and equal, and did well considering the small quantity of seed sown.

Plate III.

SOME OF THE PLOTS AT BANGOR, SHOWING THE SUPERIORITY OF THE PLANTS IN PLOT 4.

[*To face p.* 170.

None of the plots suffered from leaf-shedding, the "blight" so common in many of the countries from which the seed came, which is generally attributed to *Lophodermium* (*Hysterium*) *Pinastri*.

The experiment is of course still in its earliest stages; the plants were pricked out into nursery lines last spring, and will afterwards be planted in various soils and kept under observation. In the meantime, I merely wish to record what has happened so far. It is true that similar results will not always be obtained, and of course no final conclusions can be drawn from those obtained here, but they encourage further inquiry.

The plants at the end of the third year (first year after transplanting) gave the following results:—

Plot.	Country.	Average Height.	Tallest Plants.	Remarks.
		Inches.	Inches.	
1	Scotland	4	7	Small, but good.
2	France	4½	7	Very dark green.
3	Prussia (East)	4¾	7½	Healthy, but the green tinged with brown.
4	Belgium	6½	10½	Much the best.
5	Bavaria	5	8	Second in quality.
6	Russia (Baltic Prov.)	4½	7½	
7	Prussia (Eberswalde)	5	8	Unequal.
8	Russia (Ural Mountains)	4¾	5	Very regular.

Seed was sown in the same way as that described above, in each of the several countries concerned, but I believe that no report has yet been published regarding them. I had an opportunity, however, of seeing the different lots in the Eberswalde nursery in 1908, and those in Grafrath (Bavaria) and Mariabrunn (Vienna) last year. On the whole, the results corresponded fairly closely with those obtained at Bangor.

One of my students (Mr E. Baker) has supplied me with the following particulars regarding the growth of the plants at Chorin (Prussia):—

Country.	Growth during 1909 (in millimetres).
Scotland	56·8
France	112·9
Prussia (East)	166·3
Belgium	179·0
Bavaria	164·9
Russia (Baltic Prov.)	148·7
Prussia (Eberswalde)	166·3
Russia (Ural Mountains)	103·3

24. Notes on Creosoting.

By A. T. Gillanders.

Various methods for the perservation of timber have been adopted, but it is not intended in this paper to discuss their respective merits. It is assumed here that for general estate purposes creosoting is one of the best methods.

As a general rule on an estate the best of the timber is sold, and what is unsaleable is creosoted and manufactured for home requirements. The object of the creosoting process is to prolong the life of the timber; but the process must be preceded by the drying or seasoning of the timber; for not only does this facilitate the creosoting process, but the seasoning is also in itself a preventive to decay.

The felling of timber is generally carried out during the winter months, because it is supposed that there is then less sap in it. Experiments have, however, proved that this assumption is not strictly correct, so far as the solid constituents of the sap are concerned, for these have been shown to be most abundant during December and January. All practical men, nevertheless, prefer to cut the more valuable classes of timber during the dormant season, as there is then less risk of deterioration than when the sap is in a more active condition. In the ordinary course of the exploitation of coniferous forests, however, with a moveable sawmill plant, cutting and felling are most successfully carried out in summer, say from the beginning of April till the end of October. The timber may either be felled sometime before it is sawn, or it may be felled and sawn up at once. In the first case, the timber becomes to some extent seasoned in the log, and the drying process may be accelerated by partially barking or squaring the logs. In the second case, the sawn timber must be stacked at once. It cannot be too strongly emphasised that whatever method be adopted in creosoting, the timber must be thoroughly dried before the process is begun. In the case of timber which is dried in the open air, it is to be noted that in addition to the drying process there is a certain amount of re-absorption of

moisture from rain and dew. As the seasoning process goes on, however, the timber loses more and more its power of taking up atmospheric moisture. This illustrates the process of natural seasoning, which reduces the moisture content of the log by 15 to 18 per cent.

During the drying process certain obvious changes occur in the logs, notably a process of splitting in the more exposed ends. Cracks or shakes appear in all directions, either following the course of the medullary rays or of the annual rings. As the drying process continues, however, these disappear, and the wood closes up again. The reason is obvious. The drying process takes place through the surface, which dries first. As this surface shrinks in drying, it can no longer cover the undried central regions. With a continuation of the drying process, however, the central region also loses moisture, and a re-adjustment takes place, resulting in the closing up of the fissures.

Something must now be said in regard to the composition of wood, in order to appreciate fully the meaning of the process of creosoting. In the very young plant the component cells are enveloped in cellulose, a substance similar in composition to starch. As the cells grow older this cellulose is converted into lignin, and the form of the wood cells is modified. Further, the timber of comparatively old trees of most species is divided into heartwood and sapwood. The former is the more durable part of the wood, and in the case of some classes of timbers is long-lived even if no preservative be applied.

The sapwood contains much moisture, and it requires most drying. When this moisture has been driven off in the process of drying, it must be replaced by creosote oil, in order to render the timber durable.

Something may now be said as to the causes of decay. The organic causes of decay include the action of bacteria and of fungi. In a general way it may be said that these dissolve the woody portions of the cells, reducing them to a condition in which they can form food for the decay-producing organisms. Such organisms usually begin their action from the outside, and require moisture and warmth for their development. These conditions are best fulfilled immediately below the surface of the ground, or to give the technical expression used in regard to fencing-posts—"between wind and water." These facts make

it clear that what is wanted is to form, by means of the creosote, an antiseptic ring in the outer layers of the timber.

The season of the year at which the timber is cut has an important bearing on the liability to attack by decay-producing fungi. Thus coniferous timber felled and cut up in the autumn is liable to "blueing," which is due to the organism known as *Ceratostoma piliferum*. Such timber has to be stacked and dried with the greatest care, as it deteriorates rapidly, and does not take creosote well. On the other hand, timber cut in spring or early summer is less susceptible to attack by fungi, and takes creosote much better.

We have now to consider the composition of creosote. It is a product of the distillation of coal tar, which is, in its turn, an extremely complex mixture of organic compounds, varying in composition not only with different kinds of coal, but even with different treatment of the same coal, according to the amount of heat applied. The creosote oils of commerce come off when the temperature of distillation varies from 435° to 520° F., and are heavier than water, the specific gravity varying, but being about 1·070. Creosote oil contains napthalene and other solids which, however, tend to form a sediment, and can only be introduced into the timber when in solution. In this country such solids are usually removed from commercial creosote in the process of manufacture, but in some parts of the Continent, where the pressure method of impregnation is adopted, this is not done. This fact has an important bearing upon methods. As on the Continent a viscous, solid-containing oil is employed, it is considered advisable to heat the creosote by means of a spirally-arranged steam pipe within the operating cylinder. This method is not usually adopted here, on account of the fact that the oil employed is thinner, and has had most of its solids removed. Any remaining solids are most conspicuous in cold and frosty weather, which also increases the viscosity of the oil and retards the impregnating process. The composition of the commercial oil varies greatly, and there are associated differences in colour, physical properties, and effects upon timber. The following table shows the results of analyses of three separate samples of oil, withdrawn from the overflow pipes of the cylinder in use at some large works. These analyses have been kindly supplied by a friend of the writer's.

	Sample 1.	Sample 2.	Sample 3.
Specific Gravity of Oil . .	1·073	1·067	1·068
Total Distillate at 212° F. . .	6·5 %	Trace %	Nil
„ „ at 600° F. . .	75·5 %	70·5 %	72·8 %
Tar Acids (Carbolic and Cresylic)	3·4 %	1·9 %	Nil
Other Phenols	5·3 %	9·7 %	10·8 %
Napthalene	30 %	36·2 %	23·4 %
Water	6·5 %	Trace %	0·4 %

Of the various methods of creosoting which have been suggested at different times, only three are important. These are by pressure, by boiling, and by simple immersion.

1. In the pressure method, the necessary plant consists of three parts—a boiler or receiver for the timber, a storage tank for the creosote oil, and a duplicate pump—vacuum and pressure. The size of the boiler must naturally vary with the material to be operated upon, but one made of malleable iron, 26 to 28 feet long and 4 ft. 6 ins. in diameter, is a useful type. At the bottom of the boiler there should be two rails on which run trolleys used for carrying the timber. This is an enormous advantage as compared with the method of moving the wood in and out of the boiler by hand. The filled boiler should be closed by a cast-iron swing door, hung by an overhead derrick. The storage tank should stand alongside the boiler, and its proportions should vary with those of the boiler.

The boiler is filled with wood and closed up. The vacuum pump is then applied and the air is thus exhausted. The result is that the creosote is forced upwards into the boiler by atmospheric pressure from the storage tank, which stands about six feet below the boiler. In about twenty minutes' time the boiler is partially filled with creosote, and a tap is turned to shut off the storage tank. The vacuum pump is then disconnected and the pressure pump applied. Its valves are so arranged that the oil is forced forward, but is prevented from falling back into the storage tank. Pumping may be continued for two or three hours, according to the dryness of the timber, until the pressure gauge registers 90 lbs. to the square inch. Then the door is swung open to allow the surplus creosote to

escape, and the timber is left to drip until the following morning. The trolleys with their load of timber are then withdrawn and the process is completed.

The cost of erecting a creosoting plant of the size named above would amount to £300 to £350.

2. The second or boiling method[1] has long been adopted with considerable success, especially in the West of Scotland. In this case, the plant may be either very simple or comparatively elaborate. It may be said generally to consist of a boiler, either oval-shaped or with a flat bottom, which is enclosed in brickwork and has a straight or winding flue. The flue is furnished with a fairly long chimney, which has a damper to regulate the draught. It is also advisable to have a storage tank for the creosote, which may consist of a disused boiler, to which is attached a pump. The pump is used to introduce the creosote into the boiler, and a tap attached to a pipe connecting the boiler with the storage tank is used to withdraw the surplus at the close of the operation.

The general principle is the same as in the previous method, but there are variations in detail. It is desirable that the timber should be as dry as possible, but if it is damp, the excess of moisture may be removed during the operation of creosoting. This naturally results from the fact that the fluid contents of the timber consist mainly of water, which, under the pressure conditions existing in the boiler, boils at a temperature lower than that reached in the impregnating process, and it is thus driven off in advance.

The temperature in the boiler should not, however, be allowed to rise too high, as this is apt to partially char the wood, and thus reduce its strength. The respective boiling points of water and creosote are 212° F. and 365° F., and the desirable temperature is one only slightly above the former. There is grave risk of fire if it rises too near the boiling point of creosote.

It is not easy to give the exact number of hours during which the timber should remain in the hot creosote, but 36 to 48 hours is usually considered to be the most suitable period. It is further advantageous to leave the timber in the boiler for a few hours after the fire has been put out. The reason is as follows:—Cooling causes a condensation of the steam or a contraction of

[1] *Cf.* paper by Mr George Leven in Vol. xvii. p. 93.

the air remaining in the cells of the wood, and this causes a lowering of pressure in the cells, which again forces more creosote into the wood to fill the partial vacuum so produced.

The initial cost of a small creosoting plant of the type described above, with a boiler say 20 feet long, 4 ft. 6 ins. wide, and of the same depth, would be about £60.

3. The third and simplest method is that of simple immersion. This means simply soaking the timber in cold creosote contained in a suitable tank. An old boiler answers very well indeed, and is cheap. In this case very dry timber and thin oil are essential. The method has much to recommend it in the case of small estates, where the operation can be attended to at intervals by an odd man.

The question as to which of the three methods described is the best is a difficult one. It may, however, be said that under special circumstances all are quite successful. At present considerable confidence in both the pressure and boiling methods prevail, among those specially concerned with the matter, but the method by simple immersion is as a rule less favourably regarded. This is unfortunate, for in dealing with inferior timber on small estates, or with similar timber in the out-lying portions of large estates, creosoting can only be profitably carried on with a cheap form of plant. The great obstacles to the impregnation of timber with creosote are the air and the moisture in it. In the pressure and boiling methods, the method itself includes means for getting rid of the air, and the moisture should be got rid of by preliminary drying. In the method by simple immersion, the air is got rid of by prolonged soaking, and the process is probably accelerated if the timber is placed at an angle of 30° or so in the tank.

With a view to investigating the value of the last method, the author carried out an experiment, the results of which are given below.

In this experiment pieces of timber creosoted by the pressure method (pressure employed 90 lbs. to sq. inch) and by the immersion method (the period of immersion being one week) were alike plunged in water for fourteen days. To ensure uniformity each log of timber was split into two, half being treated by immersion and half by pressure. The table shows the results :—

Pressure.

Kind of Timber.	Weight Uncreosoted.	Weight Creosoted.	Amount of Creosote taken in.	Increase of Creosote taken in from Pressure over Absorption.	Weight after Immersion in Water for 14 days.	Weight of Water Absorbed.	Comparison of absorbed water Pressure *v.* Absorption.
Ash	9 lbs. 9 oz.	10 lbs. 5 oz.	12 oz.	5 oz.	10 lbs. 15½ oz.	10½ oz.	1½ oz. increase.
Elm	11 „ 6½ „	13 „ 1 „	1 lb. 10½ „	2 „	13 „ 8 „	7 „	2 „ decrease.
Larch	8 „ 6 „	9 „ 15 „	1 „ 9 „	13 „	10 „ 8 „	9 „	2 „ increase.
Spruce	7 „ 6½ „	9 „ 6 „	1 „ 15½ „	14 „	9 „ 14 „	8 „	6 „ increase.
Scots Fir	7 „ 2 „	11 „ 5 „	4 „ 3 „	3 lbs.	11 „ 7 „	2 „	equal.
Beech	8 „ 9 „	11 „ 5 „	2 „ 12 „	10 „	11 „ 13 „	8 „	3½ „ decrease.
Oak	9 „ 9 „	9 „ 14 „	5 „	1 „	10 „ 8 „	10 „	2 „ increase.

Immersion for one Week.

Ash	9 lbs. 9 oz.	10 lbs.	7 oz.		10 lbs. 9 oz.	9 oz.	
Elm	11 „ 6½ „	12 „ 15 oz.	1 lb. 8½ „		13 „ 8 „	9 „	
Larch	8 „ 6 „	9 „ 2 „	12 „		9 „ 9 „	7 „	
Spruce	7 „ 6½ „	8 „ 8 „	1 „ 1½ „		8 „ 10 „	2 „	
Scots Fir	7 „ 2 „	8 „ 5 „	1 „ 3 „		8 „ 7 „	2 „	
Beech	8 „ 9 „	10 „ 11 „	2 „ 2 „		11 „ 6½ „	11½ „	
Oak	9 „ 9 „	9 „ 13 „	4 „		10 „ 5 „	8 „	

Now as timber creosoted by the pressure method takes up most creosote, it was anticipated that it would take up less water than the timber treated by the immersion method, with its smaller creosote content. The comparison column shows that this was not the case. The results are not conclusive, as one experiment only was performed, but they suggest that an elaborate creosoting plant is not really necessary, provided seasoned timber is used. There is no real difficulty about this if the timber is always cut one season in advance, so that it may be left to dry until the next season.

We may sum up the merits of the different methods as follows:—

1. On very large estates where it may not be possible to allow a long period for drying, owing to much timber being required, the pressure method is the best. In it the operation is more quickly performed than in the boiling method, there is no danger of fire, and as a rule the wood is more thoroughly permeated, and is thus more thoroughly protected from decay-producing organisms.

2. On comparatively small estates, where a large expenditure on plant is not justifiable, the boiling method is the best.

3. On very small estates the immersion method is best, and may be managed so as to be quite successful.

The cost of creosoting naturally varies with the price of the product, but with creosote at 3d. a gallon the cost may be put down as approximately 2½d. per cubic foot, or, in the case of fencing timber, at 1d. a post and 1d. a rail. The quantity required per cubic foot varies greatly, but with the pressure method ¾ gallon per cubic foot may be said to be ample. The weight of a gallon of creosote is about 10 lbs. The limit of durability of creosoted timber is difficult to determine, as large quantities of creosoted wood used for fencing purposes, railway sleepers, etc., have been found in good state after having been in the soil for 25 to 30 years. In general, creosote may be said to quadruple the life of the timber.

As regards uses, it may be said that creosoted timber answers well for all kinds of outdoor work, including not only fences but also many kinds of buildings.

25. An Infestation by Pine Weevil (*Hylobius abietis*).

By Donald Macdonald.

On an estate in the south of Scotland two separate areas had been planted in clumps, by "pitting," the one area with 2-year 2-year-old plants of Scots pine and spruce, and the other with 2-year 2-year-old plants of *Larix europæa* and *L. leptolepis*. There is a difference of one year in age between the two plantations, the second having been planted in the autumn preceding the attack. Both stand on areas from which a mature crop of Scots pine, about 90 years old, had been cut, and in both cases a forest of spruce and Scots pine more or less surrounds the plantations. The total area of the two plantations is approximately 36 acres.

The presence of the Pine Weevil (*Hylobius abietis*) was first discovered on 13th May 1908, when the plantations were found to be not uniformly infested. Those parts where the grass grew longest were most severely attacked, this being apparently due to the susceptibility of the weevils to variations of temperature. On cold raw days, or days with hot sun, fewer were to be found than on other days. On warm sunny days the beetles were found feeding most frequently from 10 till about 11.30 A.M., when they disappeared, not returning to resume their feeding till about 2.30 P.M. They are also sensitive to cold, being less numerous and less virulent in their attacks in cold seasons than in more genial ones.

They appear to be strongest in flight during June and July. A fellow-workman here, while standing among logs of timber at this season, was struck by a flight of beetles, two of which attached themselves to his clothes, and proved to be weevils. This flight doubtless contained beetles of the current and the preceding years, in search of suitable breeding-places. It is obvious that at such seasons trenches with perpendicular sides, sometimes recommended as a preventive of the attacks of the beetles, could be of no value whatever.

Remedial Measures Adopted.

1. *Sawdust Traps.*—Numerous traps were laid by spreading layers of fresh sawdust at regular intervals between the lines of plants, and covering these over with fresh slabs and bark of Scots pine. The weevils were gathered from the traps every

morning. The success of this method depends entirely upon the attraction exercised upon the weevils by the oils of the sawdust and the cambium. It proved disappointing, and was only continued as a measure subsidiary to the more fruitful method of hand-gathering.

2. *A Proprietary Insecticide.* — A well-known and much advertised insecticide was then tried. It takes the form of a viscous substance which was painted on the stems of the plants over about an acre of ground. This had no appreciable effect, as the plants treated continued to show fresh weevil marks; the method was therefore discontinued.

3. *Paris Green.*—To prepare this, soft soap was incorporated with lukewarm water till the mixture attained a gummy consistency, and the compound was afterwards added in the proportion of 1 ounce to 2 gallons of the soapy solution. The mixture was used over an acre of stems and had good results, the plants treated showing few signs of insect attack. The method was not, however, adopted till near the end of the infestation, and it is not known how long the mixture would have retained its protective qualities, nor to what extent it is fatal to the insect, as no dead weevils were found after the application. It may therefore simply render the treated plants distasteful. The treatment was experimental only, as Paris green, like other arsenical compounds, is known to be injurious to plant tissues. The mixture should be made in small quantities only, should be stirred before being used, and should be applied to the stems only, as they are less sensitive than the leaves to its action. The plants treated have apparently not suffered at all from the application, and in the case of another attack from the weevil here, this method will probably be more extensively used. In an attack by saw-fly (*Lophyrus rufus*) on this property, young Scots pine were sprayed, under a sweltering sun, with a mixture of 1 oz. of Paris green to $6\frac{1}{2}$ gallons of water, with very trifling damage to the plants (cf. *Transactions*, xxi. pp. 53, 54).

4. *Hand-Gathering.*—This is a very simple operation; it consists in gathering the insects from the plants and the grass (in which they are generally most numerous), and putting them into suitable receptacles for destruction. Bottles form the best receptacles, as their smooth, slippery sides prevent the insects climbing out. Care and quietness are essential for success, as on the slightest alarm or vibration the weevils drop from the

plants to the grass, and there feign death in the fashion characteristic of so many of the Curculionidæ. In this position they are difficult to find.

At first we devoted about four hours per day to the search for the insects. Later, when they became less numerous, an occasional day's work was all that was required. The period between the 13th and 19th of May was that in which the weevils appeared to be most numerous and most voracious. Occasionally during this period as many as ten insects were picked from a single plant. The infestation ceased about 2nd June, and during the whole period of its duration the number of perfect weevils destroyed was approximately fourteen thousand nine hundred. The plants which suffered most were the Scots fir, and afterwards, in the order in which they stand—spruce, European larch, and Japanese larch. The damage was most pronounced in the case of plants surrounded by a rank growth of grass, and in the case of those round which the turf had not been inverted at the time of planting. On the other hand, those found growing on an area where the turf had been burned previous to planting, were as a rule only slightly damaged. Oak and birch saplings, together with several young *Prunus pissardi* and other fruit trees, were found to have been no less severely bitten than the conifers, proving that, in the absence of conifers, the insect can subsist, for a time at least, on young hardwoods.

In the present attack hand-gathering, in spite of its obvious drawbacks, may be said to have given splendid results.

In addition to measures of destruction directed against the imago, it is necessary to attack the insect also in the larval stage, especially by uprooting and burning sickly plants, and by barking and otherwise treating the stools where timber has been felled. In the course of 6 days, 4 men engaged in collecting larvæ from the stools accounted for 5790, which gives an average of about 55 per stool. If we assume that the trees stood at the rate of 200 per acre, this would work out at about 11,000 collected from every acre. Several weeks were devoted to this work, and its effect may be gathered from the figures given. The larvæ, which are about three-quarters of an inch in length, white and wrinkled, with brown heads and strong mandibles, live in the cambium region in sickly trees or in those recently dead. In the stools of trees which had been cut during the preceding August, and were stripped of their bark

in February, many larvæ were found, which were full-fed, even in this short time, and had in some cases begun to prepare for pupation. It may be of interest to mention here that only four perfect insects were found by the squad on this breeding-ground. The larvæ of the weevil were found here to be infested in several cases with parasites. These, which were probably the larvæ of an ichneumon, were about three-tenths of an inch in length, apodal, pointed at the extremities, smooth, and of a yellowish-white colour. Eight or ten parasites were usually found in August on a weevil larva, and they usually selected a well-fed form as a host. They completely demolished the weevil larva with the exception of the hard chitinous head, and in April spun a cluster of whitish cocoons. Another check to the natural increase of the weevils was found in the shape of a small red mite, found attached to the abdomen of live weevils. These apparently destroyed many of them, from the parts of dead beetles found at the bases of the plants.

To minimise the danger of attack from weevils, the ground, after being cleared of its timber, is sometimes allowed to lie fallow for five or more years, before being re-planted. This detracts considerably from the profits of timber-growing, and is not always attended with the best results. In the first place, the subsequent planting is rendered more difficult and more expensive, owing to the ground becoming overgrown with grass and weeds; and in the second place, such a fallowed area is by no means immune from weevil attacks, if it is situated in a part of the country where infestations are frequent. In any case, however, it is well to bark the stools and clear the ground from which a timber-crop has been cut, whether it is to be planted up immediately or after an interval, for the unbarked stools only afford facilities for the reproduction of the beetles.

In autumn, during the process of beating-up, those plants which were most severely damaged were found to be infested with a very small black beetle with ferruginous legs (*Pityogenes bidentatus*), and, as these were very numerous, six being often found on one stem, it was necessary to uproot and burn a considerable number of plants, which, but for their presence, would have been left. Plants which were but slightly bitten by the insects had no special dressing applied to them, as the exudation of resin, by excluding the air and by its antiseptic properties, made the natural healing of the wounds possible

in the shortest time. It is important to have wind-blown, sickly trees and green branches removed from the woods so far as the former do not interfere with the canopy, for this is a means of obviating danger from weevils and arboreal insects generally, since the majority of the insects injurious to forest trees prefer such half-dead wood for breeding purposes.

The annual fellings on this property are now done by the "*Pan*" method—a process which may be described here. All the strong lateral roots are cut about 4 feet from the stem of the tree, to which a steel rope is made fast at about 18 or 20 feet from the ground. This rope passes through a block which is fixed at a predetermined point, and which answers the dual purpose of giving the falling tree the desired direction, and of helping the rope to wind regularly on the barrel of a winch, from which the necessary power is obtained. The winch is lashed to a tree and forms the centre of a circle having the length of the rope (which in this case is about 40 yards) as its radius. The trees felled by this method are Scots pine of about 90 years of age. The roots are subsequently blasted with powder and burned, thus giving the beetle no chance whatever to breed in them. With the same object in view, the various plantations and woods were gone over, and trees likely to attract the pests were removed. A strict watch should be maintained after the passing of a weevil infestation, as the pest is liable to return. On the 6th of October, while we were engaged in "beating-up" one of the infested plantations, thirteen weevils were collected from a part which had hitherto been immune from their attack. Apparently, from their light colour, these insects were members of a generation which had issued from some old neighbouring stools, and had been enticed, by the warm sun then shining, to feed and probably to copulate.

As the damage done by the weevil to coniferous woods in Scotland alone means the loss of thousands of pounds annually, perhaps in the near future, in the event of the State acquiring land for afforestation, legislative measures will be forthcoming compelling the owners of coniferous woodlands to do their utmost to exterminate the pest. In the meantime, the subject of its attack should be closely studied by all foresters and others interested in woods, as it is only by combined efforts that our woodlands can be effectually cleared of this, perhaps, the most destructive of forest pests.

26. An Attack by the Weevil *Strophosomus Coryli.*

By JOHN MACRAE, Forester, Highfield, Muir of Ord.

In the month of July 1909, while inspecting a mixed plantation of Scots fir, Douglas fir (Oregon variety), and Japanese larch, I found the foliage of Scots fir damaged by a weevil. Specimens of the weevil were sent for identification to Dr MacDougall, and he has informed me that its name is *Strophosomus Coryli.* The plantation in which I found the damaged Scots fir is about 1 acre in extent; it was formerly part of an old wood, consisting of beech, oak, larch and Scots fir, of which the greater part was cut some fifteen years ago. But a part of the ground still carries a crop, composed of beech, larch and oak, about ninety years old.

The attacked plot is well protected from ground game by a wire-netting fence, 36 inches high, of $1\frac{1}{4}$ inch mesh, which has 6 inches of the netting let into the ground to keep rabbits from burrowing under it. The soil is a sandy loam, the exposure is to the south and west, and the ground is sheltered on the north and east by the old wood. The crop consists of alternate rows of Scots fir, Douglas fir and Japanese larch, the object being to have Douglas fir and Japanese larch as the main crop. The Scots fir was put in alternate rows, so that it might be removed when suppressed by the Douglas and Japanese larch.

It is worthy of note that while but few of the Douglas fir and Japanese larch have been yet attacked by the weevil, the foliage of the alternate rows of Scots fir is much damaged.

The method I took to destroy the weevil was to handpick it from the plants, searching well in the covering of grass and leaves at the stem of each plant, and destroying the weevils by crushing them. This is a very tedious method when a great number of plants have to be examined, and it must be gone about very carefully, as when the plants are shaken and the weevil discovers that it has been seen, it immediately drops to the ground, and lies quite still as if dead; it is then not easy to discover among leaves and grass of a brown and grey colour.

The plants damaged last year are not yet dead, but are in a bad state, being stripped of their foliage.

On the 3rd of May 1910, in a plantation $1\frac{1}{2}$ miles distant from the above, I found the same weevil on Scots fir, planted in the month of November 1909, on more exposed ground, off

which a former Scots fir and larch wood was cut twenty-five years ago. The extent of this plantation is 20 acres. Since the old wood was cut, birch has come up, with a thick covering of heather. The heather was burnt early in the autumn before planting, and the clumps of birch were cut, leaving good stems about 40 feet apart as shelter for the young plants. The species used for replanting were Scots fir, 2-year 1-year, and larch 1-year 1-year, planted in rows, two rows of Scots fir to one row of larch. I found the weevil near the place where a clump of birch had been cut and burnt. I have not yet found any larch attacked here, and the attack on Scots fir is not yet severe.

Strophosomus Coryli is a small beetle measuring from less than a quarter of an inch up to one quarter of an inch in length. It has a rounded body, and is brownish-grey in colour; the legs are reddish. The wing covers are punctured and, as Dr MacDougall has pointed out to me, a very characteristic mark is a small longitudinal central black line or patch at the base of the wing covers.

27. The Large Larch Saw-Fly.

In the *Journal of the Board of Agriculture* for March, there appears a report upon an investigation undertaken by the Board into the distribution of the large larch saw-fly (*Nematus erichsoni*, Hart.) in Great Britain. As a result of this investigation, it is found that the insect is more widely spread in the British area than was formerly believed. As yet it does not seem to have done any very great damage, but its wide distribution is full of risks for the future. The matter is the more serious in that in America, where the insect is excessively destructive, no satisfactory method of getting rid of it has been discovered. In this country the plantations of the Manchester Corporation at Thirlemere have been considerably damaged, and there also the various methods of destruction tried have not been very successful. The chief recommendations by the Board of Agriculture are that the natural enemies of the insect, especially voles, various insect-eating birds, and especially an ichneumon fly (*Mesoleius aulicus*), should be encouraged by every possible means. It is even suggested that an attempt should be made to breed this ichneumon, in order to distribute its cocoons in infected districts.

In addition to the report summarised above, the Board for Agriculture has also issued a leaflet which, owing to the importance of the subject, we publish in full:—

Memorandum on the Large Larch Saw-Fly.

In recent years the larch plantations of Great Britain have been visited by a pest which has already caused great losses in certain places, and threatens to inflict serious injury on British forestry. The large larch saw-fly is known to have done much damage in Denmark about sixty years ago, and in more recent times has devastated the larch forests of North America. How long it has been present in Great Britain is not known, but its presence was not officially confirmed till 1906, when it was reported from Cumberland. It has since been found over a large area in Wales, a wide district in the north of England, and a very considerable area of the south of Scotland. It probably exists in other parts of the United Kingdom. There is reason to believe that the general attack is but slight, but in the spots where the prevalence of the pest is greatest many thousands of trees have been killed. Nor is it likely that the plague will go no further. There are evident signs that it has spread in recent years, and it is recorded that in the United States and in Canada it did not stop till 50 to 100 per cent. of the matured larch over vast areas was destroyed, with the loss of many billions of feet of timber. The serious nature of this prospect has led the Board to place the saw-fly among the dangerous insects scheduled under the Destructive Insects and Pests Order, the presence of which on any plantation must at once be reported to the Board. They are also engaged on an investigation of the extent to which it prevails in this country, in the hope of discovering some preventive or remedial measures. Every occupier of any premises on which the insect is found, is bound therefore to report the discovery under a penalty of £10; but few cases have been reported, chiefly on account of the inability of most persons engaged in forestry to identify the pest, or recognise the symptoms of an attack. The saw-fly remains in its larval state for only a few weeks of the year, and for some part of that time it is very small and, consequently, easily overlooked. The appearance of an attacked tree, however, is such that for a much longer period the characteristics can be distinguished by an expert. In spite, however, of this

extension of time, it is not possible for the Board's Inspectors to examine every larch plantation in Great Britain, and the Board feel it incumbent on them to ask for the assistance of every person interested in forestry in tracing the presence of the infestation.

The search may be conducted in two ways :—

1. The actual insect may be looked for as (1) egg embedded in the shoots of the tree, (2) caterpillar feeding on the green needles, (3) cocoons lying in the ground or among the long grass, (4) adult on the wing.

2. The larch trees may be examined for signs of saw-fly attack, even though no insect can be found.

The caterpillars or larvæ of the large larch saw-fly may be first looked for towards the middle or end of June. In 1909 the first seen were not discovered till 4th July, but they were evidently some days old, and the season was rather late. They appear in considerable numbers on the lower branches of the larch, generally towards the terminal shoots in which the eggs are laid. As they grow older they advance towards the stem, and eventually may be found wherever there are any needles. Larvæ begin to spin up their cocoons in July. In 1909 the last caterpillar was seen on 31st August, but in other years they might be found later.

When very small they are not easily noticed, but they grow rapidly, and when full-grown are about three-quarters of an inch long, with round *black* heads, three pairs of *black* thoracic legs, and seven pairs of abdominal legs of a greyish green, the same colour as the rest of the body.

The caterpillars feed at first in clusters, but afterwards they separate in search of food. They assume various characteristic positions, a common one being with their "tail end" curled round the shoot on which they are feeding. When disturbed they erect the hind segments of the body over the front ones. The larvæ of the large larch saw-fly can be distinguished from other larvæ that may be found on the larch by the following characters :—

Moth caterpillars.	*Nematus erichsoni.*
Legs never more than 16.	The caterpillars have 20 legs.
If they are geometer caterpillars they progress by a looping or spanning movement characteristic of this family.	The mode of progression is continuous.

Other Saw-flies :—

The *Nematus laricis*, or small larch saw-fly caterpillar, has a brown head, is grass green or greenish brown in colour. It is full-grown in July.

Nematus erichsoni.

Has a black head, and body is greyish green.

Feeds and grows till the end of August.

The larvæ leave the trees when full-fed, and spin cocoons in which they live till the spring when they pupate. The cocoons may be looked for under the affected tree not only near the trunk but also over the whole surface covered by the crown of the tree. The cocoons are found in the soil under the moss and litter that usually cover the ground under larch trees, and this must be turned back when the cocoons are being hunted for. These are dark brown and cylindrical with rounded ends, and about half an inch long.

The adult saw-fly on emerging from the cocoon, after the pupal stage is over, is in general appearance black, with glassy wings. The female flies at once to the lower branches of the tree, to lay her eggs, but apparently much of the life of the insect in this stage is spent on the wing and round the upper branches. It can therefore easily be overlooked, and is difficult to identify at any distance. The large larch saw-fly is nearly twice as long as the small larch saw-fly and can be distinguished from the latter, which is quite black, by the red segments of the abdomen.

Larch plantations that are suspected of having been attacked should also be examined, with the object of discovering traces of infestation. This work may be carried out from the middle of June to the end of November. The symptoms to be looked for are as follows :—In June and July a search should be made on the terminal shoots of the branches for signs of eggs, which are laid alternately in two rows. The number is usually about twenty, but as many as forty have been found. The easiest sign, however, to notice is the distortion of the current year's shoots, which often curl up when eggs have been laid in them. A closer examination will generally reveal the incisions made by the saw-fly's ovipositor on the concave side of the curled shoot. The slits where the eggs have been laid resemble small eyes less than $\frac{1}{10}$ inch in diameter. A little later, in July and August,

the needles should be examined for signs of feeding. The young caterpillars do not eat the whole needle but bite pieces out of the edges of it. At a later date, when the caterpillars are more fully grown and separate in search of food, the whole rosette of needles will be eaten or only a stump left. In August and September these defoliated dwarf shoots may sprout again, and present almost the same appearance as they did in May, except of course that the growth is irregular. These indications are to be found in varying intensity on all trees that have been attacked, but in the case of a serious infestation the trees present a brown and withered appearance which is noticeable hundreds of yards away, and, after a little practice, the more seriously affected trees can be picked out at a distance. When the attack is very serious and prolonged the trees die, and there is then no difficulty in realising the damage done. Nearly all these manifestations are shown in the articles on the saw-fly which were written for the *Journal of the Board of Agriculture* by Dr MacDougall[1] and Dr Hewitt, and in Leaflet 186.

The Board would be glad if all persons connected with the care of larch plantations would search for the pest during the summer and autumn of 1910, and would communicate to them immediately the discovery, by the presence of any of the above mentioned indications, of saw-fly attack. In order, however, to make any report of value, the following additional information should be sent:—

(1) The name of the wood or plantation, with some indication of the place where it is to be found.

(2) The approximate size of the wood.

(3) A description of the intensity of the attack according to the following scale:—

Intensity I.—(Worst). Some trees already dead; others with crowns very thin and practically defoliated in mid-summer. General appearance of trees moribund. Leading shoots have been attacked.

Intensity II.—No trees dead. Trees badly browned in mid-summer. Few terminal shoots to lateral branches produced during current year, dwarfed shoots thereby stimulated to growth with result that these new shoots have been utilised for egg laying by the saw-fly.

[1] *Cf. Trans.* xx., p. 43.

Intensity III.—No trees dead. Considerable numbers of the terminal shoots of lateral branches have had eggs laid in them. Little or no browning effect in mid-summer.

Intensity IV.—No trees dead. Very few lateral shoots show signs of attack.

The Board are endeavouring to organise an experiment in controlling the saw-fly, and will be glad to hear from owners of attacked plantations who are willing to assist.

28. The Cultivation of Willows.

The following notes on the cultivation of osiers in Scotland and elsewhere will prove of interest to our readers.

Mr Walter G. Coles, Engineer to the Secretary for Scotland, communicates the following :—

THE CULTIVATION OF OSIERS IN THE ISLAND OF SKYE.

In the winter of 1906 permission was obtained by the writer, from the Congested Districts Board, to experiment with the growing of willows on the estate of Kilmuir, recently purchased by them. On the western side of the estate was the site of an old loch, which had been drained out by the former proprietor fifty years or so previously. This site at present grows an abnormal crop of grass year by year. About an acre of this ground was prepared, and cuttings of Black Mauls planted 19 inches apart. Near the loch was the old garden of Monkstadt House, which was also ploughed and planted with the same kind of willows.

It was found that the Black Mauls in the loch did not do well. Great difficulties were experienced in keeping the beds clean, which is a *sine quâ non* of successful willow-growing. In the garden, however, where the soil was richer, the Black Mauls did exceedingly well, and they have continued to do so in the seasons since 1907. In the writer's opinion, the head of the loch is of too cold a nature to encourage a good root growth.

In the winter of 1908, a further experiment was tried with other kinds of willows, namely, Longskins, Whissanders, and Black Osiers. Further sets of Black Mauls were also given to crofters in various parts of the estate. The result of this

latter experiment has shown that the best kinds of willows for that part of Skye are Longskins and Black Osiers. On the site of the old loch these two kinds have done very well for a virgin crop, and in the garden the growth of Longskins is quite remarkable. It has been found that Black Mauls, which of course are a kind of willow which does not grow to an excessive size, have done very well in any ground which has been cultivated in the past.

To enable the crofters to prosecute this small industry to a greater extent, a syndicate of Edinburgh gentlemen has started a basket factory in Kilmuir, Skye, and are now offering to take as many willows as the crofters can grow. The price to be offered for them is about £3 per ton, in their green state. This factory is also taking young crofters and training them to be basket-makers. It is anticipated that it will be possible to get from four to six tons of willows from an acre of the land there.

Mr Webster communicates to the *Timber Trade Journal* the following short article :—

Willows for Basket-Making.

Preferential railway and boat rates, aided by keen foreign competition, have well-nigh rendered the time-honoured industry of basket-making a thing of the past in this country. The best classes of osiers, cleaned and ready for manipulation, are now delivered to our principal markets, from continental sources, at so low a price that competition on our part is almost out of the question. There are still, however, a few stations—such as in Bedfordshire, the fen districts of Lincoln and Cambridge, and along certain reaches of the Thames—where willow culture is engaged in, though not in the same energetic way as was the case some half a century ago.

It is perhaps difficult to estimate correctly, but about 7000 acres, producing roughly 20,000 tons of osiers, are cultivated in this country at the present time, many small plantations having been grubbed out and the land laid down to other crops during the past five-and-twenty years. This falling off is much to be regretted, as the sorting and harvesting of osiers, and basket-making, gave light and remunerative employment to a large number of residents, both young and old, of the

districts in which the willow beds were situated; while rather damp land that could not well be brought under other cultivation, at least without the expense of drainage, gave a good return under a crop of osiers. Taking everything into consideration, and judging from talks that I have had recently with those who are interested in the osier industry, the formation of willow beds, under the plea that considerable profits attend the undertaking, is not to be recommended. No doubt in some favoured districts where carriage is reduced to a minimum, and local demand is considerable, osier cultivation gives a fair return for capital invested; but, until we can get back the once lucrative trade in baskets for fruit and other similar commodities from the hands of our continental rivals, profits to any great extent are quite precluded.

No doubt, too, on soil that is unsuited for farming purposes, willow culture can be made fairly profitable, but it is a mistake to suppose that any marshy piece of stiff ground will grow osiers, and that the planting and tending are matters of small import. It is quite the reverse. The willow will not thrive for long in water-logged soils, though periodical inundations, particularly during winter and early spring, are highly beneficial. The soil, too, must be well worked, the cutting of rods carefully and systematically carried out, and strict attention paid to the clearing of the ground, else deterioration of the crop will quickly ensue. Previous to planting the cuttings or sets, the ground should be ploughed, harrowed, and consolidated, all objectionable weeds being destroyed.

The best willows to plant are *Salix purpurea* (the purple osier), *S. viminalis*, and *S. triandra*; but there are many hybrids, as willows cross freely. Probably the most valuable is *S. viminalis*, the rods being produced freely, while they are remarkably thin and flexible, but those of the others named are very good for basket-making. They produce exceedingly lithe and tough wands. After the soil has been got into good tilth, planting the sets or cuttings should take place. These should be from 12 inches to 15 inches long, and formed of well-ripened rods of one year's growth, the cleanest and straightest portions only being used. In planting the cuttings, great caution should be exercised to prevent the bark becoming loosened or removed from the wood. The rows of cuttings, may be 50 inches from each other, the individual cuttings being

about 15 inches apart. Much depends upon the kind of willow, and the quality of soil. The cuttings may be inserted about 9 inches into the ground, leaving about 3 inches exposed for the future stool. Cutting may begin after the second or third year, and should take place when the crop is dormant, or not later than the middle of February. The following short rules might be observed in willow culture for basket-making :—

1. Willows will not succeed well in peaty, sandy, or water-logged soil ; rich, well-drained loam that can be flooded at will being most suitable.

2. Prepare the ground by trenching or ploughing, and thoroughly cleanse it from weeds.

3. Plant only the best kinds, avoiding a mixed crop.

4. Insert the cuttings from November to March, avoiding such as are bark-chafed, and make the soil firm.

5. Keep the beds clean and free from weeds.

6. Cut the crop close to the ground with a sharp knife, as pollard willows soon decay, and harbour injurious insects.

7. The cost of forming osier beds varies from £15 to £20 per acre. The crop matures in about four years, and yields on an average £15 per acre.

The *Journal of the Board of Agriculture* also discusses the subject in the following article :—

Osier Cultivation.[1]

The most suitable soil for the growth of osiers is a deep, rich, moist, alluvial soil, but an example of how well osiers will grow on other soils and under comparatively unfavourable conditions is shown by their successful cultivation on the Atlantic seaboard of the island of Harris.[2]

An interesting account of osier growing is given in the *Quarterly Journal of Forestry* (April 1907), where the results obtained from an osier bed, situated on an island in the bed of the river Thames opposite Isleworth, are described by Mr B. V. Ramaiengar.

The area of the osier bed is about 6½ acres, and being in the

[1] Printed by permission of the Controller of H.M. Stationery Office.

[2] For an account of willow-growing in the island of Harris, see vol. xxi., 1908, p. 50.

tidal portion of the river, it is flooded during high tides. The soil is a rich stiff loam, being the accumulation of alluvial deposits brought down by the river. The common osier (*Salix viminalis*) is grown to produce rods fit for making small baskets. The area has been an osier bed for a long time, and some of the old stools are about 2 feet in girth, perfectly sound, and yielding as good rods as ever. On one of the old stools nearly seventy-five shoots were counted. The stools stand, roughly, about 18 inches apart, so that there are about 19,000 stools per acre.

The harvesting of the crop is commenced in the latter part of December or early in January, and is completed in about five weeks. Care is taken to cut the rods clean, and close to the edge of the stool, and the rods are then sorted into sizes and stacked until Easter, when they are peeled.

Planting is done soon after the crop is harvested, *i.e.*, about the middle of February. The best 1-year-old shoots are used, and are merely stuck about 9 inches deep into the ground. Weeding is done about the end of May. The bulk of the crop is used for making small baskets for use on an adjacent farm.

The crop is sorted into the following classes, which are stated to be those now used on the London market: (1) rods over 11 ft. in length; (2) rods 9-11 ft.; (3) rods 7-9 ft.; (4) rods 5-7 ft.; and (5) rods below 5 ft. in length. The first four are peeled by means of a simple instrument called a "brake," but the last class is not peeled.

All the operations are carried out by piecework :—

Cutting.—The cost of cutting is 6s. per score of bolts of various sizes. These are generally about 20 inches in circumference near the butt end.

Sorting.—The sorting costs 5s. per score of bolts of 40 inches in circumference.

Peeling.—The cost of peeling varies according to the class of bolts, but average about 10d. per bolt.

Basket-making.—It costs 7½d. to make a bushel-size basket having alternate bands of peeled and unpeeled rods.

Planting.—The cost of planting is 2s. 6d. per 1000 cuttings.

Weeding.—This costs £5 annually for the whole area.

Yield.—The yield is 750 bolts of green unpeeled rods of 40 inches girth near the butt end, *i.e.*, 115 bolts per acre. These 750 bolts of unpeeled rods yield 60 bolts of peeled rods of the

first size, 500 bolts of peeled rods of other sizes, and 100 bolts of unpeeled rods of the "small" size. With these 600 bolts, 5000 baskets are made for use on the farm. The average weight of a bolt of peeled rods (in August) is 56 lbs., and of a bolt of "small" rods 28 lbs., the total yield being at the rate of 2 tons 7 cwts. per acre.

The accounts for 1905 showed a net revenue of £15, 7s. 8d. per acre.

29. *Teredo navalis* and other Sea-Worms.[1]

By Lieut.-Colonel Bailey.

Wood immersed in fresh or in brackish water, or even in polluted sea-water, is not exposed to attack by these pests; indeed, by prolonged immersion in such water the tissues become harder and more durable, as is proved by the present condition of the piles in Venice, and of timber which has long lain buried in peat. Knowledge of the practical indestructibility of timber thus used led to the erection at Venice, Amsterdam, and hundreds of other places, of vast and enormously heavy buildings, resting entirely on piles driven deep down into the water-laden soil; and results have in all cases justified the confidence with which timber has been employed under such conditions.

But wood immersed in pure and fresh sea-water is far from enjoying a like immunity; ships, boats, piles, dock-gates, sheathings of quays, and other structures which remain in prolonged contact with such water, being exposed to attack by certain animals which, boring into them, riddle them by their galleries, ultimately, and often very rapidly, rendering them completely useless. The only such animals which are of practical importance in this connection are *Teredo navalis*, a very destructive mollusc, the most serious attacks by which occur in sea-water of high salinity, which is also warm and pure; and two crustaceans, *Limnoria terebrans* and *Chelura terebrans*, which are almost as formidable as the *Teredo*, and which attack all species of timber, though they prefer soft species.

During recent years, the port of Marseilles has suffered

[1] Summary of *Invasion du Taret dans le port de Marseille, par Monsieur E. Henry.*

severely from damage by the *Teredo*. Until the year 1890, the water of the Old Port was certainly, as it now is, warm; but the port was then receiving all the filth of the town, which overlooks and partly encloses it. The few sewers that then existed discharged into the port, and secured its immunity from the *Teredo*, which could not live in its polluted and evil-smelling water.

In 1890 new sewers, which left the water of the port almost uncontaminated, were constructed; but this advantage is now heavily outweighed by the damage caused by *Teredo*. In 1895, that is some four or five years after the construction of the new sewers, its depredations became apparent, all the lighters not sheathed in zinc being simultaneously attacked. Specimens of silver fir, pine, and oak timber, obtained from this port, prove the terrible activity of this borer, which has literally riddled the wood and reduced it to one-half of its original solid volume.

M. Henry quotes from an article in the *Bulletin de la Marine marchande*, by M. A. Cligny, Director of the *Station aquicole* at Boulogne-sur-Mer, who states that the *Teredo* appears to be much less abundant in that port now than formerly. Cold, he says, destroys the pest, which is hardly to be found during winter, especially during rigorous seasons, and similar observations have been recorded in northern countries.

Is it necessary, asks M. Henry, as some think, to abandon the use of wood in ports, and to substitute metal or ferro-concrete, notwithstanding that these substances have already disappointed the expectations formed regarding them, as they do not possess the suppleness, elasticity, and tenacity which renders timber so valuable in such situations? It is universally held to be preferable to continue the use of timber, which is superior to all other substances.

And again—is it necessary, in order to protect timber from the *Teredo*, to coat it with a costly metal cuirasse? Not at all! We know that it can be protected from attack by fungi and insects of all sorts by means of antiseptics penetrating its entire substance; and why should not similar measures be adopted against the *Teredo*?

As may be supposed, all possible methods of coating and impregnation have been tried. "None of them" (says M. Cligny) "is completely efficacious. The injection of creosote and creosoted oils confers but a precarious immunity, which is hardly

superior to that obtained by a superficial application of these substances. It may indeed be said that they act so long only as the outer coating of creosote lasts; for, from the time that this has disappeared, through the action of the waves, or some other form of friction, the *Teredo* bores into the wood in spite of the creosote which it still contains. And similar results are observed when arsenic, copper, or other substances are injected."[1]

In fact, says M. Henry, it is very probable that if the preservative substance has not penetrated deeply, its efficacy will cease under superficial wear; but timber should be used of species which admit of thorough impregnation,[2] and the antiseptics should have sufficient fluidity. It has been estimated that creosote injected to the extent of 300 kilogrammes to the cubic metre[3] affords absolute protection.

From an American official circular on "The Preservation of Piling against Marine Borers," it is learnt that in America, many methods of protecting piles from *Teredo* have been tried, and that the following conclusions have been drawn:—A very small exposed surface enables these marine borers to penetrate a pile and to completely destroy it. To act effectively, all coverings must be absolutely continuous, and the antiseptics must penetrate all the elements of the woody tissue. But all such measures of protection are costly, and it is essential that they should prolong the life of the pile sufficiently to make it worth while to employ them. A comparison of the results obtained by protective outer coverings and by injected antiseptics shows that, properly applied, the latter are much more efficacious than the former. The injected substance ought to be insoluble in salt water, and it should penetrate deeply into the wood. "If well carried out, this treatment yields a solid antiseptic magma, into which the borers will not penetrate, and the cost of the process is well covered by the result." Where failure has occurred, this is attributable either to the use of oil which was of inferior quality, adulterated, or insufficient in

[1] Presumably M. Cligny is speaking of timber such as larch and Scots pine in the round, with a penetrable zone of sapwood.—F. B.

[2] In correspondence, however, M. Henry says that, for practical purposes, if a pile is surrounded by a wide and well impregnated zone, it is not necessary that the oil should penetrate to the centre.—F. B.

[3] Equivalent to 19 lbs to the cubic foot, which seems a very high figure. —F.B.

quantity, or to incomplete seasoning of the wood before treatment.

M. Henry agrees with Mr Howell Smith, the American writer, in thinking that soft woods, or species having wide sapwood, will resist attack the longest, and he advocates the making of experiments to prove this. He suggests that poplar, beech, and silver fir, all of which, he says, become impregnated to the centre, will, on simple immersion in heated carbolineum, contained in an open vessel, remain immune from attack for a very long time.[1]

Experiments have been undertaken to determine the actual value, in this connection, of certain antiseptic substances. M. Henry has seen two pieces of silver fir, taken from piles driven in the port of Pola, in March 1901, and withdrawn in November of the same year. One of the piles had previously been twice coated with Carbolineum Avenarius (Sotor), made by the firm Avenarius; the other was untreated. After six months in the Adriatic, the treated pile was found to be intact, while the other was riddled by galleries of the *Teredo*, which occupied one half of the transverse section, and the original outer surface of the pile had been destroyed.

Blocks of oak, pitchpine and poplar, some untreated and others coated with Sotor, were immersed at Heyst-sur-Mer, and withdrawn a year later; the treated blocks were uninjured, while the others had been damaged by *Teredo*.

In regard to the efficacy of Sotor, M. Coomans, Marine Engineer for Zeeland, writes:—"In the summer of 1904, we attached to the landing pier at Catsche Veer, at a depth of 70 centimetres (27½ inches) below the level of low tide, two pieces of silver-fir wood, each measuring about 40 ins. × 12 ins. × 8 ins. One of them was untreated, while to the other Sotor had been applied in the following manner:—After being thoroughly air-dried, the wood was plunged into a cask from which the head had been removed, and which had been three parts filled with Sotor, which was kept hot. The wood remained thus in the Sotor bath for two days, when it was reversed, and the other end was similarly immersed for two days; the wood had then

[1] Such timbers would make good sheathing. I am not aware of poplar or beech having been used as piles, but there seems no reason why they should not be serviceable as such. Experiments in this direction are to be undertaken at Marseilles.—F. B.

increased in weight to the extent of 8 per cent. by absorption of Sotor. In September 1907, that is after three years of submergence at the pier, a transverse section was cut from each of these pieces of wood, when it was seen that the untreated specimen had been severely injured by *Teredo*, while the piece treated with Sotor was absolutely untouched."[1] In M. Coomans' opinion the experiment was not sufficiently prolonged to enable a definite conclusion to be based on it, and he advises further investigation.

What has been said regarding measures of protection against *Teredo*, applies equally to meeting the attack of *Limnoria* and *Chelura*.

M. Henry concludes by saying that the above-mentioned encouraging experiments ought to incite marine engineers and others to achieve their desired end by such means as those indicated, rather than by costly sheathing, or by the use of other materials in the place of wood. Without doubt, he says, antiseptics more efficacious and cheaper than those now in use will be discovered; and he invites all who are interested in the question to repeat, with variations, the experiments that have already been made in the United States, Denmark, Holland and Germany, with antiseptics derived from coal—creosote, carbolineum, and Sotor, etc.—and to encourage further study of the subject by chemists.

Sea-Worms in British Ports.

Mr Walter G. Coles, Engineer to the Secretary for Scotland, writes as follows:—

We have had several experiences of the ravages of the *Teredo navalis* on the west coast of Scotland. It used to be thought that greenheart piles were immune from the attacks of this worm, but it is now recognised that in certain waters the worm will destroy this wood as well as others.

In 1906, the piles at Portree Pier were found to be eaten. They were of greenheart and had been built for twenty-five years. Again at Blackmill Bay Pier, in the Island of Luing, Argyllshire, it was found in 1906 that the piles of this pier, which had been built for only eleven years, were badly eaten by the

[1] M. Henry tells me that Sotor is far superior to creosote. It can be obtained from the Fabrik Carbolineum Avenarius, Stuttgart, Wurtemberg, at a price of about 6d. a quart.—F. B.

worm. The horizontal timbers and the joints in this case appeared to have been more attacked by the *Teredo* than the other timbers of the pier. On the other hand, we have greenheart piles at Croggan Pier, Loch Spelve, at Craignish in the same neighbourhood, and at Mingary, and up to date we find that they have not been touched. At Badentarbert Pier in Loch Broom, it is found that the timbers (greenheart) between low and high water-marks are badly riddled by the worm, and I am afraid this will mean that the whole pier will have to be incased in concrete. This case is now under consideration.

As you are probably aware, greenheart is supposed to contain some acid or poison which is not at all liked by the *Teredo*, and my opinion is that in the instances cited above the greenheart may have been lying in the timber yards at Greenock for some period, and thereby have lost some of its natural protective properties. The timbers used at Craignish and Croggan were part of a salved cargo coming direct from British Guiana; they were splendid sticks and quite fresh, which may account for the fact that they have not as yet been touched by the worm.

In connection with the work of this worm on other woods, I saw rather an interesting case two summers ago at Dunvegan Pier, Skye. This pier was made by local labour, and the fenders are of Scots pine taken from the woods of Dunvegan. At the period referred to, the late factor was replacing some of the fenders, and he showed me some he had just taken out of the water. The worm had got into the exposed end of the stick, but in those places where the bark had remained on we stripped some of this and found the wood almost as fresh as the day it was put in, and not touched at all by the worm. This would appear to show that the bark of the pine is not relished by these little busybodies. The late factor naively remarked that his pier would have stood all right if he could only have got the bark to grow at the end of his stick.

These are the only cases which have come under my own notice, and I trust they may be of interest to you.

Mr Hall Blyth, C.E., has favoured me with the following note on the timber used in Methil Docks:—

Gates of No. 1 Dock.—Built in 1886. Two sets of gates (4 leaves), width of entrance, 50 feet; depth of water to sill of

gate, 23 feet; range of ordinary spring tides, 16 ft. 6 ins. The gates are built of yellow pine, with greenheart sill timbers, heel posts and mitre posts. They are partly cleaded[1] with $1\frac{1}{8}$ inch thick greenheart. The yellow pine was creosoted with $\frac{5}{6}$ of a gallon of oil to each cubic foot of timber. These gates have been repeatedly repaired, and all the timbers are more or less perforated and decayed. The greenheart cleading has been renewed at different times.

Gates of No. 2 Dock.—Built in 1896. These gates are of the same width and of construction similar to the above, but with 27 feet depth of water to the sill. They are built of Kauri pine, with greenheart sill timbers, heel posts and mitre posts. They are cleaded with $1\frac{1}{4}$ inch thick greenheart. The Kauri pine was creosoted with 1 gallon of oil to each cubic foot of timber. These gates are all more or less perforated by the worm, more particularly so near the edges of the timbers and below the low-water level. The greenheart cleading is much decayed, and part of it is about to be renewed. The actual condition of the Kauri pine timbers can be better ascertained while the cleading is off.

Timber Jetty.—Constructed entirely of greenheart, erected in 1886, removed about 1897. Built of timbers mostly *sawn* square, and when they were removed very few were found to be fit for re-use—more especially those which were below low-water level.

Timber Jetty.—Entirely of greenheart, erected 1898. Built mostly of *hewn* logs. Judging from a few timbers which have recently been removed, they have only been attacked by the worm to a very slight extent when above low-water level. Below low-water level they are very thickly encrusted with barnacles and mussels. One pile which was removed some time ago showed considerable perforation when the barnacles had been scraped off.

A piece of Jarrah timber and a piece of greenheart, each 7 ft. by 12 ins. by 2 ins., were placed in the sea at about the level of low-water of neap tides, so that they were exposed at nearly every tide. They remained there for six months. When they were removed, it was found that while the Jarrah timber was thickly encrusted with small barnacles, no worm-

[1] *I.e.*, covered to protect the timber below.

holes were found in it, and it was in every way perfectly sound. The greenheart timber, while not coated with barnacles to the same extent, was slightly perforated, more particularly near the edges where sap-wood would be found.

Two similar pieces of timber remained in the sea under similar conditions for twelve months. The results when the timbers were removed were much the same as above, except that the Jarrah timber had *fewer* barnacles adhering to it, and the greenheart had *more*. The latter result would probably be caused by the gradual washing-out of the acrid matter from the surface of the greenheart.

Mr Hall Scott, of Sir John Jackson, Ltd., has kindly furnished the following information :—

At Keyham we were troubled with the *Teredo navalis* and the *Chelura terebrans*. The latter was really the worse of the two. Within three years of the piles being driven many of them were reduced from 12 or 13 inches square to 4 inches square, which necessitated additional piles being driven alongside each original one. The *Chelura* eats away the softer parts of the timber, longitudinally, between the annular rings, which fall away in thin flakes as the animal goes deeper. Some of the holes or tunnels made by the *Teredo navalis* were found to be $\frac{3}{4}$ inch in diameter, and the timber was riddled through and through, the animals themselves being in some cases 18 inches long.

I have had no experience in Scottish waters, but assume that the conditions are very similar to those in England. I have always found the ravages caused by these worms to be worse as the water gets salter; as an example, at Devonport Dockyard they were distinctly worse than even with us at Keyham, while a little farther up the Hamoase, at Bull Point, where we carried out some work, and where the water was more brackish, they were not nearly so bad as at Keyham. At Mevagissey, in Cornwall, where the water is quite salt, I saw timber which had only been driven some twelve months, and which was absolutely eaten away.

Mr James Currie, shipowner, Leith, writes :—

I am informed that no British port is free from the ravages of this ferocious beast (*Teredo*). It is said, however, to be less

destructive in the colder waters of the north than in the warmer south, and that this is observable even in a comparison between the Firth of Forth and the English Channel, but still more markedly so if either of these is contrasted with the Mediterranean. I am also informed, as a further illustration of this difference, that the only wood which will withstand the *Teredo* upon our coasts is the "greenheart" (*Nectandra*), but that even this is attacked in the Mediterranean.

30. Continental Notes—Germany.

By B. Ribbentrop, C.I.E.

Retrospect.

General.—Economic prosperity in the German Empire appeared still to be in a thoroughly sound and favourable condition in the beginning of 1907, but owing to unhealthy over-speculation, over-production, the reckless use of the money markets all over the world, and the American crisis, clouds began to rise, and soon a rapid change took place. Deep depression, extending over the whole of 1908, followed the years of prosperity.

German industry did not give way without an obstinate struggle, and tried to stave off the evil days by increased exertions. The seriousness of these efforts can best be judged by the extent to which the banks were indented upon, in excess even of the prosperous years preceding.

The following table of the Imperial Bank of Germany clearly proves this. In million marks—

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1906	442·1	302·5	375·5	374·1	338·4	427·9	487·3	434·8	615·8	788·7	678·0	704·0	497
1907	554·0	428·1	541·7	555·9	439·8	564·9	616·7	536·9	689·3	811·0	823·0	934·7	625
1908	716·9	519·3	543·9	527·4	388·5	397·0	339·0	265·9	334·4	382·6	189·7	314·0	410

In spite, however, of a well-organised resistance, it proved impossible to stop the downward slide. The least to suffer were the producers of raw materials, who, owing to a Kartell (semi-trust) policy, were in a position to regulate outturn and prices; the same policy protected, to a considerable

extent, the manufacturers of unfinished products; but those of finished articles found themselves in a cleft stick between the syndicates and the reduced demand for their wares. However, by forming associations, even they were able to reduce their outturn, and to hold over temporarily unsaleable articles. Moreover, the purchasing power of the agricultural population had very largely increased since the last crisis of 1901-2, a fact which greatly helped to reduce losses. The labouring classes, as is evident from the table compiled by the German labour agencies, were the chief sufferers.

For each hundred open places the number of applicants was—

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1906	139·6	125·6	102·5	99·3	101·5	102·3	105·4	98·4	91·3	107·3	133·6	122·8
1907	127·9	120·7	95·5	92·8	103·7	109·5	119·7	107·9	100·5	122·7	152·5	162·6
1908	158·9	151·7	130·5	141·8	161·5	144·3	157·6	153·3	142·6	166·1	212·4	195·2

Agriculture.—The agricultural industry in Germany remained entirely unaffected by the crisis, in fact, the country was once in a way able to draw temporarily on town labour to a small extent. Owing to the increase of the import duties from the first of March 1906, and the almost simultaneous large rise in prices of agricultural products in all markets of the world, the prices realisable in Germany were, during the crisis, higher than they ever were before. This led to a material increase in production, to some extent due to an increase in the cultivated area, but much more to better and more intensive cultivation.

The total harvest in Germany of some of the more important products was, in thousand tons:—

	Rye	Wheat	Oats	Potatoes
In 1895 . .	6598	2808	5253	31,787
In 1907 . .	9758	3479	9149	45,538

The outturn per hectare [1] was, in tons—

In 1895 . .	1·12	1·45	1·30	10·42
In 1907 . .	1·61	1·99	2·09	13·81

Agriculture in Germany was never more prosperous, but nevertheless the proportion of the agricultural population to the

[1] Hectare = $2\frac{1}{2}$ acres.

total population decreased from 42 per cent. in 1882 to only 29 per cent. in 1907. The small actual increase in the number of persons employed in agriculture, either as their only profession or in addition to other occupations, is to a great extent accounted for by women. The young men go to the towns.

Forestry.—The demand for forest produce, on the part of the agricultural and general population, is a steady one, and prices do not fluctuate, though, with a growing population, a tendency exists to a gradual and slow increase in demand and in prices. Sudden variations in timber prices are only effected by the ups and downs of industrial demands.

In 1882, 91,600 persons in the German Empire were exclusively employed on forest work, and 26,200 in addition to other occupations; in 1907, 126,000 persons were wholly occupied in forestry, and 65,400 only partially; 81 per cent. of these were agricultural labourers, which is a matter of considerable importance in forest management.

The Prussian State forests contain at present 6,593,800 acres, of which 5,889,800 acres are under timber; the remaining 704,000 acres are arable land, uncultivated waste, etc. The increase since 1870 is as follows:—

	Forest Land.	Other Lands.	
1870-80	56,600	140,600	
1880-90	79,800		
1890-1900	107,800		
1900-10	347,600	65,500	
	591,800	206,100	Total, 797,900

The increase is almost entirely due to the purchase of waste lands, neglected forests, and impoverished estates, chiefly in the east of the kingdom. Till the end of last century Prussia had still to pay off the debts incurred during the Napoleonic wars, and means were scanty; but since then forest estates near large towns became available, and were sold at high prices, for building sites, etc. In 1908 upwards of £520,000 were thus obtained. As means became more plentiful, the budgets were increased, not merely for the purchase of lands but for silvicultural operations as well.

The budget of 1907 provided for this purpose about £265,000, which was increased to £342,000 in 1908, and again to £392,000 in 1909; in the present year £430,000 is available.

These provisions may be regarded as sufficient and satisfactory, but a grave danger threatens the efficient re-afforestation of private forests, especially in Prussia, where Stein's Reform Bill, passed in the height of enthusiasm immediately after the close of the Napoleonic wars, left almost entire freedom of action in this respect to private proprietors.

It is now an everyday occurrence that the purchase of estates is engineered by timber-trading firms, who enter the property simultaneously with the new owner and clear the land of all saleable wood; then, means being scarce, the disforested areas are frequently left for years, without adequate recultivation, at the mercy of sun and wind. Another and perhaps even more serious danger is brought about by the breaking up of estates for the formation of small holdings. The problem as to what is to be the fate of the forest area under such schemes, which otherwise meet with general approval, is a most serious one Their division with the rest of the land would be a continuation of the mistake made in the case of former communal settlements and partitions, and would again lead to the creation of entirely unmanageable bits or strips of forest land. Any direct State interference is, in the face of Stein's reform laws, out of the question. This being recognised, a beginning has been made of late years with the formation of associations, or, as it were, private trusts, composed of the landed proprietors themselves, with the addition of professional foresters, in order to influence the regulation and management of private forest property.

In the provinces of Pomerania, Brandenburg, and Posen considerable progress has been made in this direction, and regular working-plans have been framed and settled for 342,000 acres. The scheme has not as yet made much progress in other provinces, because the peasant proprietors argue that, as a rule, they follow, in respect of their communal forests, the regulations periodically framed in consultation with the local forest officers, and they object to any additional interference. A distinct movement exists and is growing, favouring the reconstitution of communal forests, which were partitioned under settlements, and this may pave the way towards a sensible solution of the problem of the treatment of forest areas included in estates to be broken up into small holdings.

The great land and forest owners, possessing a considerable part of the private forests of the country, have their own forest

organisations, and are therefore not interested in any outside schemes. The peasantry of Prussia still own, in spite of the continuous purchases and re-afforestation of waste lands by the Government, upwards of 1,000,000 acres of such land, including rough pastures, which, in their present state, give practically no return, but they are mostly so scattered as to render their afforestation impracticable by any other but local efforts. Numerous small afforestation societies have been formed, and the Government assists with advice, tools, seed, plants, and money; but though progress has been made, the areas taken in hand are as yet disappointingly small in comparison with the vastness of the problem.

The year was not favourable for the development of silvicultural operations; the dry autumn of 1909 reduced the moisture in the soil considerably, and was unfortunately followed by a severe frost before any snow fell, rendering the surface of the ground impermeable. The subsequent heavy snow-fall, therefore, in no way benefited the soil, and when an early thaw set in most of the moisture ran off the still frozen ground.

As a seed year also 1908-9 had been a bad one for pine and spruce, and even Government had to rely to some extent on importation. The forest administration have long since recognised that a high percentage of germination affects not merely the general but the individual results of the culture, and have, when their own production of seed was insufficient, not hesitated to pay in accordance with their conviction; but for years the desire to buy in the cheapest market has led to an ever-increasing importation of coniferous seed from Hungary and France on the part of private forest owners, especially the smaller ones. The results have been unfavourable and far-reaching.

Recent experiments and observations have proved that a much higher percentage of germination can be secured by extracting the seeds as soon as feasible after the ripening of the cones, and by employing a less degree of heat than had been accepted as necessary. They have also proved that coniferous seed can be maintained in a vigorous state in air-tight receptacles for future use. This is very important, but it will further add to the cost of production, and it takes time before private parties can be convinced that the sparing use of the more expensive seeds, with a germinating power of 85 to 95 per cent., is in the end more

satisfactory than that of the cheaper sorts with a power of only 65 to 75 per cent.

Experiments have shown that each hundred Scots-pine seeds, with a germinating power of 55, 65, 75, 85, and 95 per cent. respectively, produced, when sown in the open, 7, 14, 22, 31, and 44 yearling plants. The annual requirements of pine seed amount, for the Prussian State forests alone, to about £100,000.

In 1906 ravages by pine spinners, the nun-moth, and to some extent the pine geometer, necessitated a large increase of the annual budgets for protection against insect plagues. In ordinary years the amount provided for in the Prussian State forest budget averages some £19,000, but it rose in 1906 to £31,000, in 1907 to £53,500, and was still £32,500 in 1908-09.

The fight is practically ended, but though no permanent damage has been done by either spinners or geometers, the losses caused by the nun have been severe, as no actually effective means are known of combating this moth beyond the felling, barking, and removal of the trees attacked, tar rings having proved entirely ineffective.

Forest fires are decreasing, thanks to a more careful clearing of the railway fire lines.

The Prussian State forests yielded in 1908 about 11,000,000 cubic metres of wood, of which 63 per cent. was timber. The outturn was 799,999 cubic metres in excess of any previous yield, but as timber prices sank considerably during the crisis of 1908, the income from wood fell, nevertheless, by about £100,000 as compared with that of the previous year.

The depression in prices was to a great extent due to an abrupt drop in those of pit timbers, aggravated by "bear" operations on the part of trusts. These failed entirely, and for some firms connected therewith, disastrously, but it would seem doubtful whether the extremely high prices of 1907 will again be realised for years to come. These prices exercise a very great influence on the general average of timber prices, as the present demand for pit timbers in the whole of Germany is equal to about one-third of the total outturn of the Prussian State forests.

Owing to enhanced wages, the cost of exploitation naturally followed that already noticed in connection with silvicultural operations, and rose from about £550,000 in 1906 to £760,000 in 1910. The same proportionate increase applies to all other

forest operations. The amount of daily labour, including that of women and children, required in the working of the Prussian State forests, is estimated at two work days for each acre, or a total of nearly twelve million days. This includes contract work.

The number of officials, as well as their salaries, has been considerably augmented since 1908; and though the gross income derived from the Prussian State forests has already recovered, and will doubtless grow, the net revenue has fallen, and it is more than questionable whether the same net income per acre will ever again be realised unless new sources of revenue are opened out.

The complete Prussian State forest budget for 1910, which has just come to hand, indicates that this has been effected, in various ways, chiefly by leasing out agricultural lands and shootings formerly in the hands of forest officials. The budget exhibits the following figures:—

Ordinary Income .	£6,415,000	Ordinary Expenditure .	£2,957,000
Extraordinary Income .	375,000	Extraordinary Expenditure	511,000
Total Income,	£6,790,000	Total Expenditure,	£3,468,000

leaving a net surplus of £3,322,000, or £442,000 more than in the preceding year.

The absorption of the administration of all State lands into a joint administration is under serious consideration.

This project, if carried, would doubtlessly effect a considerable saving in the cost of the present dual administration; and, as pointed out, the Prussian forest officers of the day are as competent to undertake the management of State lands, other than forests, as the present staff of purely legally trained officers, if not more so.

Apart from persons engaged in the timber trade, or in the transport of forest produce by rail, road, sea, or rivers of whom no statistics are available to us, the wood-using industries give, in accordance with the last enumeration, employment to upwards of twelve million persons.

The Labour Crisis.

The situation, in regard to the scarcity of agricultural and forest labour, is one of economic, social, moral, and political importance of the first magnitude. The productive power of the land has so far increased—but how? To a great extent

it is, doubtless, due to improvements in agricultural implements, the use of artificial manures, a better knowledge of the requirements in each case, the temporary importation of foreign labour, etc.; but the one outstanding fact cannot be gainsaid, that the women of the country are replacing, to an ever-increasing extent, in agricultural work, the men who leave the land. This is not a healthy state of things. It is possible, even probable, that, with an extension of the policy of small holdings, many men may return to the land in the hope of eventually acquiring a small freehold property, or they may not leave it to the same extent; but, however satisfactory this may be from a general political point of view, it will not materially aid the Forest Department, nor the larger proprietors of land, in obtaining the necessary manual labour.

The question of the labour scarcity in the open country naturally excites the most vital and general interest. The main reason of the emigration of labour from the land, doubtless, is that labour in the country is, with few exceptions, not so continuous throughout the year as it is in towns, but numerous other more or less tenable reasons are brought forward.

The Forest Department more especially, it is argued, neglect their duties in not insuring their workmen against illness and accidents, in not providing sufficient shelter near the works, nor the most improved implements for contract work. To some extent this may be true, but the gradual disappearance and present scarcity of labourers' cottages within reasonable distance of the work, plays a much more important part in the labour question, and one which cannot be obviated by a mere rise in the scale of wages.

It is now generally agreed that, if not the only, certainly the most feasible, remedy must be found in the formation of labour colonies, with due consideration of local conditions.

The country labourers, even those who can still find shelter in the vicinity of forest or other suitable work, require, nevertheless, a modicum of cultivable land to enable them to eke out, with the assistance of their families, the income derived from intermittent wages. Formerly such lands could be rented by the labourers at rates which enabled them to exist; but of late years the rents have risen to an extent which has rendered their profitable cultivation impossible by men of the labouring

class, who have no draught cattle and therefore have to pay their better placed neighbours for the hire for ploughing, etc., either in money or by labour. They can no longer pay the high rent and live in the country; they are forced to emigrate. The Forest Department, on verifying these facts, decided in 1889 to lease to each forest labourer about two acres of cultivable land, within the forest boundaries, at reduced rates, averaging 50 per cent. of those obtainable in the open market, and to grant further concessions in respect of pasture, minor forest products, etc., so long as the participants in these favours were willing to work in the forest during the periods of felling and of cultivation, on the payment of full rates. Most satisfactory success has been obtained under this plan, at a reasonable cost, and in 1907-8, 15,919 workmen had already been secured. The contracts, which are not limited to the mere labourers, but extend to small proprietors who are willing to work in the forest either themselves or with their horses, run for six or twelve years, but there is no question that they will ever be repudiated by the employer. The scheme is still growing, but is naturally limited by the number of domiciles available in villages near enough to cultivable land within the forest areas, and not too far from forest work, for even now, in the eastern provinces, labourers have frequently to be driven to their work.

Many, many years ago, when regular forest management was first introduced into sparsely populated districts, the authorities were forced to build habitations, which were let to forest labourers at a nominal rent; but a time arrived when the population in the country increased, in excess of agricultural requirements, and labour became plentiful and cheap. The Forest Department then abandoned the policy of providing houseroom, and most of the cottages were pulled down. Thereafter a period set in when industries began to indent on agricultural labour. The movement towards manufacturing centres was in the beginning slow, and attracted no serious attention, but it grew with the force and rapidity of an avalanche, till now it threatens to sweep away the very vitality of the open country. The seriousness of the case, as affecting forest administration, was first recognised in 1873; but beyond stopping any further demolishment of workmen's huts, nothing was done for years. The number of such cottages amounted

to only 470 for the entire State forests, and though a certain number were newly built, and others acquired in the purchase of estates, only 1232 domiciles existed at the end of 1908.

The funds for new buildings were very limited, permitting only the cheapest possible construction, and at the outset houses were built containing two and four habitations under the same roof, costing between £125 and £150 for each domicile. The rents were fixed at from £1, 5s. to £2 per annum, but even on these terms only Poles and Kassubians, neither of whom, for political reasons, it is desirable to encourage as a permanency in the eastern provinces, were ready to take the houses; the German labourers, having grown more exacting with time, and feeling themselves to a certain extent masters of the position, were not satisfied with the housing offered. More substantial houses were built, costing £225 for each domicile, for which a rent was fixed at £3, 10s. It is estimated that, taking everything into consideration, the State will lose annually about £10 on each workman. This great sacrifice naturally limits the extension of such building operations to the housing of persons in permanent employ; moreover, it becomes increasingly difficult to fill even these houses permanently with the highest class of labourers, for the best men are the most ambitious to found a real permanent home on a property of their own, and this is incompatible with the construction of expensive Government quarters.

The formation of labour colonies would seem to be the only possible way of meeting both the desire of acquiring property and, at the same time, of securing a permanent labour supply, but so far experiments with these two objects in view have not been very encouraging.

The first plan tried was initiated by the Agricultural Department in conjunction with the Forest Department, both setting apart considerable areas of arable land. These were let on long leases, at rates considerably below the market value, to settlers of the labouring class. A mistake was made in awarding too much land to each settler, and this, in the first instance, led to the emigration of a certain number of small men, who were deprived of areas formerly rented by them. The colonists who remained in possession have done well for themselves; they keep horses, cattle, and a large number of pigs, in fact they have become well-to-do peasants, pork producers, and carriers. They

do not any longer seek forest or any other outside work, and to this extent the experiment has proved a failure.

The next scheme managed by the Forest Department contemplated the grant of long leases, at reasonable rates, of good arable lands, included within forest boundaries, to persons of the labouring class, coupled with the obligation on the part of the settlers to construct the necessary buildings. For this purpose it was decided to grant a premium in each case of £25 free of interest, and loans up to £125 at 3 per cent.; the property to become freehold on the repayment of the whole capital, within fifty years, but in the meantime all buildings had to be insured against fire. Profiting by experience, it was decided to make the individual holdings of moderate size, and only in exceptional cases to exceed the limit, which was fixed at about four acres for the best land. The settlements were to be located within reasonable distance of school and church, and, if possible, within reach of other outside work; but, in spite of this, no obligations in regard to forest work were to be entered in the leases, as it was considered that this was sufficiently safeguarded by the position of the location, by the moderate size of each holding, and by the power the Forest Department has of making additional concessions in the way of pasture and minor forest produce.

Progress under this plan has been exceedingly slow, though, where such settlements have been effected, thanks to the individual influence of local forest officers, they generally show sufficient vitality, and the men are satisfied.

The scheme has better chances of success in the eastern provinces, but even there only 129 householders had been placed by the end of 1908.

More Voices Against Pure Pine Forests.

"Up to quite recent times," Forstmeister Krause of Zerrin writes, "but few had the hardihood to recommend the creation of mixed forests, or even to insist upon their maintenance, where the Scots pine would grow." The answer was invariably the same: "Pine cultivation brings the most money, the rest is luxury."

Extensive areas doubtless exist, especially in the eastern provinces of Prussia, where the condition of the soil, consisting of pure sand, permits no other choice but the growth of pure

pine forests; but the same method of cultivation was, for many years, applied to areas capable of producing good mixed forest growth, and was, moreover, not limited to cases where new forests had to be created, but was, in the desire for larger and earlier profits, extended to areas already under a mixed forest cover. The increased profits expected were but rarely realised; the productive power of the soil was frequently reduced under pure pine cover, and in some cases it was impaired to such an extent as to necessitate considerable effort and outlay to restore it to its original vigour, which might have been retained by a more rational treatment.

The Zerrin forests are given as an example of the incalculable harm that has been done by the most well-intentioned, but misdirected, efforts. These forests had been maltreated for centuries, and were subject to the most intolerable servitudes till about 1830. When at last it became possible to bring them under regular management, they were, to all appearance, in an utterly ruined condition. The forest officers of the time evidently did not believe in the possibility of their recovery, or were too impatient; under any circumstances, whatever may have been their reasons, they introduced clear fellings and cultivation with pure Scots pine, in which, at that time, everybody in the forest world had an unbounded belief. Every effort was made to eradicate the deciduous trees from the ground, and even temporary cultivation of field crops was resorted to with this in view.

When judged by the present state of the forest growth, the result of these operations, which, unfortunately, went on for years, is utterly disappointing, for in all cases where nature has been allowed to do her work, a well-grown mixed forest of beech, oak, and pine, from 90 to 140 years old, covers the ground; whereas in all areas where the extermination of the broad leaved species succeeded, a badly-grown open pine forest exists. Where the eradication of the deciduous species was either incomplete, or where these trees re-established themselves from the adjacent forests, a healthy mixture has grown up, with every prospect that it will grow into mature forest equal to those left untouched. The loss of time and money is, in these cases, the only matter to be regretted.

As a guide for the future, these observations by Forstmeister Krause are invaluable, and doubtless similar treasures of

experience are hidden away in the records of many old forest divisions in Germany, waiting to be lifted by the magic touch of intelligent inquiry.

Dr Graebner concludes a most convincing article on root formation in pure spruce and pine forests, in the plains of Northern Germany, with a most powerful indictment.

The degeneration of the soil, observed in numerous areas in the heather tracts of Northern Germany, wherever they are covered with pure pine and spruce forest, DEMANDS the rehabilitation of the *natural* original vegetation; that is, a forest mixed with deciduous species, and the removal of the (under existing conditions of climate and soil) *unnatural* pure coniferous forests, even in cases where no present outturn or income can be expected from the intermixture of broad-leaved species.

Future generations, he points out, will benefit by a wise return to the laws of nature, just as the present one has to suffer by a departure therefrom on the part of their predecessors. Dr Graebner is thus another powerful advocate of a radical change in a policy, which, dictated by greed, ended in national loss.

It may be accepted, without prejudice, that both spruce and pine were original inhabitants of all the German heather tracts, but that neither of them ever formed pure natural forests within these districts. This is quite in accordance with Zimmermann's observations, discussed by us in previous notes.

It would absorb more space than is available for these notes, were we to follow in detail Graebner's careful and most interesting observations, made almost invariably in the presence of competent witnesses; and it must suffice to state that he has proved that the root-systems of spruce and pine rise, year by year, nearer to the surface by a more pronounced development of the far-spreading upper side roots, and the gradual death of the lower ones, in proportion to the exclusion of air caused by the annual fall of the needles, which, as they decompose, form a more or less airtight covering of pine humus. The observations have shown that the struggle against gradual asphixiation cannot be permanently maintained; the far-spreading roots near the surface interfere and interlace with those of the neighbouring trees, nourishment for each becomes scarcer, and the forests lose their vitality; and as the flat spreading roots can draw moisture only from the surface layer

of the soil, a severe and prolonged drought has often signalised the beginning of the end.

A liberal intermixture with deciduous species, or even with *Abies alba* or Douglas, has always proved to be a most effective preventive or remedy against the asphixiation of spruce or spruce mixed with pine. As a proof of this a case is recorded where a mixed forest is divided from a pure spruce forest by nothing but a straight road. Every spruce, young and old, in the pure forest was diseased, whereas not a single diseased tree was to be found in the mixed forest.

It is not stated whether the Scots pine if unaccompanied by spruce is, on these heather lands, liable to self-asphixiation; but as they are, failing this, doomed to extermination by root diseases, fungi, or other causes, it is a matter of no vital importance whether asphixiation plays a part in their death.

The one fact stands out that a mixed forest is a safeguard against every one of the dangers which threaten the pure pine or pure spruce, or spruce and pine plantations, on heather lands, waste lands, or old fields.

31. Indian State Forestry.[1]

By Saint-Hill Eardley-Wilmot, C.I.E.
(Late Inspector-General of Forests.)

The last twenty years have formed, as is well known, a period of great progress in India. In spite of frequent set-backs, due to famine and pestilence, the population has largely increased, and perhaps still more marked has been the extension of railways and of the feeder roads that are necessary to their working. I select these two items because they have the most important bearing on State forestry, and because to them is largely due the corresponding progress in the successful practice of this science. It is admitted that to make the practice of forestry remunerative, it is necessary everywhere, but especially in India, that there should exist a good demand for forest products and sure means of transport. This demand exists in India, but difficulties of transport make it impossible to satisfy it in many parts of the country. The importance of the Indian forests may be realised from the fact that the area of 240,000

[1] Abstract of a paper read before the Indian Section of the Royal Society of Arts, on 10th March 1910.

square miles now under the control of the Forest Department represents about the fifth part of British India, and that if the forest areas of Native States, which are managed chiefly on plans compiled by British officers, and are not infrequently administered by them, be added thereto, the total amounts to about a fourth of the whole of India.

The comparative importance of the large forest area of India is of course not so great as the same proportion would imply in Western countries; for instance, the value of the outturn is not at present, area for area, to be compared with that of Western forests. In the first place, the Indian forests stand to a great extent, and especially in the more settled areas, on soil unsuitable for growing good field crops. And, moreover, they were taken over in a ruined condition, having been devastated by men, by cattle, and by fire. Such damage may be observed in every province of the Empire, though it is perhaps more apparent in the deciduous forests of Central India than elsewhere. The long continued ill-treatment of the forests cannot be made good in one or even two generations of man; but it is satisfactory to know that the efforts of the last forty-five years are having an effect in improving the soil and also the growth, as regards both quantity and quality. We may feel convinced also that this improvement will keep pace with the increasing demand of the future; and this leads to a definition of one of the chief duties of the Indian forester, which is so to improve the area in his charge as to bring it into a condition to meet the legitimate demands of a population ever increasing both in numbers and power of consumption.

In a country which extends roughly from the 8th to the 36th degree of north latitude and across 32 degrees of longitude; whose forests stand at altitudes varying from sea-level to 14,000 feet above it; whose rainfall, always a vital factor in the distribution of forest-growth, varies from five hundred or more inches in the year to an amount almost imperceptible to recording instruments, it would take more than an ordinary lifetime to become acquainted in practice with all the varying types of forest, and the conditions under which they and their inhabitants exist.

The influence of the forest begins immediately below the line of perpetual snow, at about 16,000 feet elevation. First come the upland meadows, carpeted in the spring with wild

flowers; next the shrubby growth of juniper and alpine rose, and below these the birch and firs.

Lower down appear the forests of oak and rhododendron, which flourish up to an elevation of about 8000 feet; and this area is marked by a heavy rainfall that is capable of causing serious damage by washing away the surface soil, wherever the forests are not maintained so as to afford adequate protection to the precipitous slopes.

The forests of cedar and pine also grow at about this elevation; the cedar is the *Deodara*, or "Tree of God," and is practically identical with the cedar of Lebanon. It assumes the form we are familiar with in English lawns whenever lateral extension is possible; but when this is not the case, it makes good timber by a rapid vertical growth. The pine is the blue pine, which grows like any weed if the attention of man is happily diverted from it for a time; but it affords good timber and charcoal, and its leaves are used for stable litter, so that it has many enemies.

Further down, the forests of the long-leaved pine yield good timber and much rosin; they grow on steep and rocky slopes that are often even hotter than the plains below.

At still lower elevations, the alder groves stand with their feet in the water and their roots holding up the shallow banks against the swift currents.

In the submontane forests, where the soil is composed of beds of boulders, gravel and sand, the "shisham" and the "khair" forests flourish on the banks and islands of the perennial streams, while cotton and other soft-wooded trees occupy the more stable positions. Below the submontane forests, the Tarai is entered, where water is close to the surface, and heavy grass growth is characteristic of the country; and from here commence the deciduous forests which extend throughout the length and breadth of the peninsula, and are found in Burma, flourishing wherever the rainfall is suitable to their growth. They furnish the most valuable timber, such as "sál," teak, ironwood, sandal, rosewood, red sanders, and ebony.

Towards the coast, as well as inland, in the north-east of India, are found the evergreen forests, where the trees grow to an enormous size, standing over an almost impenetrable undergrowth. Then come the tidal forests, where the mangrove and "sundri" are at home, and which are inundated twice daily by

the tides. The flowing tides hold up the fresh water from the rivers, and so enable it to deposit its silt, and thus by degrees the ground level is raised, and in consequence the characteristic tidal vegetation is after a time replaced by trees of the evergreen or deciduous forests. Lastly, across the Bay of Bengal, there are the primeval forests of the Andamans and Nicobars, with the species of "padauk" that is not found on the mainland, and where ocean currents have brought the seeds of exotic trees to flourish on the island shores.

We have now indicated the general sequence of forest vegetation from the snow-line to the sea, and may next consider the effects of this vegetation in regulating the water-supply to the plains below. On the upland meadows, on the junipers, and on the birch and fir woods the greater portion of the annual precipitation falls in the form of snow. The summer is short at these elevations, but the snow melts quickly under the direct rays of the sun. The resulting moisture is readily absorbed by the porous turf, by the mosses, and by the rich vegetable soil, yet there is always the danger of vast accumulations of melting snow sliding down the steep slopes and carrying everything before them, unless barriers are erected to prevent these mishaps. The forest-trees provide such barriers, formed of living piles, which sustain the weight of the snow till it gently melts away; the birch trees are bent with the weight they have to sustain, and the firs are scored with wounds from many a boulder that might, without such hindrance, have provided the commencement of a disastrous avalanche.

On the lower hills the rainfall is more to be dreaded than the snow, which occurs less frequently. Here the protection of the forest is required to prevent the slopes from being scored by the action of intermittent torrents, which are powerful enough not only to remove the surface soil but to cut deep ravines into the hillsides. Fire and excessive grazing soon destroy all protective vegetation, and the next stage brings discomfort to the resident in the plains below. It has been truly said that the forester does not object to seeing cattle upon a thousand hills; it is the thousand cattle on one hill that embitter his life by making his work ineffective.

But not only does erosion of the unprotected mountain side bring distress to the population of the plains by drying up the permanent water-supply, by covering the fields with sand and

gravel, and by endangering life by floods and avalanches, but the hill-folk themselves soon learn to regret the want of foresight shown in wasteful utilisation of the benefits the forest affords. For instance, the southern slopes of the Simla Hills are bare of forest, and wood fuel sells amongst a population of 40,000 souls at over £1 per ton, delivery not included. If these slopes were wooded, as they certainly were in the past, their owners would now be wealthy, the stability of the slopes would be better than at present, and the seats and rails along the public roads would not be so liable to be stolen for fuel.

The objects of State forestry are then, as I understand them, to secure to an agricultural population those direct and indirect benefits which forests confer, and to further the industrial development of the country.

The chief factors leading to success in Indian forestry are familiar to us all; they have been adopted wherever Britons have been called upon to administer their possessions in the East, and they consist in personal influence and in education.

The part played by the Indian forest officer has been in the past, and, on the borderlands of our less settled provinces still is, that of a pioneer; and he soon learns the lesson that there is in his calling—perhaps more markedly so than in others—no success without the good-will of his neighbours, and that he cannot overcome their distrust, save by kindly tact, or be able to command their aid, until he first possesses their confidence.

The life of the forest officer is passed in intimate connection with the people, and it is of great importance that he should be well equipped. The Service may be divided into Imperial, Provincial, and Subordinate, the first being recruited by the Secretary of State for India, the other two by those Local Governments who entertain them. The Imperial officer, to be a useful servant to the State, must have not only a good professional training but also a knowledge of many other things besides forestry. He must be a competent surveyor, a practical engineer, and an efficient timber merchant; he occupies the position of land agent for an estate that may have an area of 1000 or more square miles, and he must be physically strong. If to all these qualifications he can add a special knowledge of botany, of chemistry, of zoology and geology, with an intimate acquaintance with modern languages, so that he may read of the doings of foresters in other countries, there should be little

anxiety that he will not do well in the service. The standard, it will be admitted, is somewhat high. Forty-five years ago forestry as a science was unknown in England, and we are indebted to Germany for its inauguration in India. The name of the late Sir Dietrich Brandis will always be remembered as the founder of Indian forestry, and his successors, Sir William Schlich and Dr Ribbentrop, worthily continued his labours. Between 1869 and 1881 the officers of the Imperial Service studied their profession in France and Germany; up to 1905 they were educated at Coopers Hill College, and since then the University of Oxford has been entrusted with their probationary training. It is still found advisable, owing to the paucity of areas managed on silvicultural lines in England, to make these probationers acquainted with such areas on the Continent, and thus they come to India with a good knowledge of what a well-tended forest of European species should be, and ready to apply this knowledge, as far as it is possible, to the varied conditions of vegetation and population in the East. The advantages following the study of the science in the country where it is to be practised are, however, not yet within the reach of the Indian probationer, and his application of the theories and practice of European forestry (as well as of any theories of Indian forestry that may have been imparted to him) to Indian conditions depends, perhaps, to too great an extent on his subsequent efforts, made for the love of his profession.

It is probably the opinion of the majority in the present day that education must, to be up to date, be accompanied by research. The Forest Research Institute was created in 1906, and its labours in the way of zoology (chiefly insect damage, to which the Indian forests are most liable), and of applied botany and chemistry, most important in the discovery and investigation of forest products and of forest economics, with a view to bringing valuable products to the notice of consumers, have already proved its value. There is also in this Institute a special branch for silviculture and forest working-plans, and there can be no doubt that a beginning has been made from which important results may be expected.

The Government of India have proved of late years, in the most practical manner, their belief in the importance of State forestry and of its increasing value, by raising the standard of

education and by extending the opportunities to profit by it, by encouraging research, and by the erection of suitable public buildings.

The Department has been singularly fortunate in the type of officer that has joined its ranks, whether selected, as at first, from the Indian Staff Corps and elsewhere, or trained on the Continent or at Coopers Hill College. Perhaps the loneliness, hardships, and unhealthiness of the life in the past deterred those who did not possess an innate love of the jungle from joining the profession; at any rate we have had no lack of men who have lived amongst the people and influenced them for good, whose names are still household words in the remote villages of the hills and plains, and who have laid the sure foundations for the establishment and progress of State forestry in India.

32. The Importance of Forests in Military Defence.

By Lieut.-Colonel Martin Martin (Retired).

The members of our own Society require no further argument to heighten their appreciation of the national value of forests, and of their establishment on a sufficient scale in the immediate future, and a large body of the general public is becoming impressed with the same views. But it cannot be said that the Government has been sufficiently stimulated to place the project in the prominent position which its importance necessitates and urgently calls for.

In party conflict it must be so; Tories and Liberals cannot afford to "throw away points" in the struggle, by devoting their energies to non-contentious business. Moreover, when the balance between the parties is as narrow as it is at present, it is votes that count, and no attention can be expected by those whose interests are mainly outside the chief issues of debate. Hence the rural, the agricultural and the silvicultural community need expect little attention. They are composed in almost equal numbers of adherents of the two parties, and hence their main interests are necessarily indifferent to both. Any argument, therefore, which can force practical forestry to the front, by insistence on any of its diverse claims to attention, may be of present advantage.

In the matter of military defence against invasion, it may

safely be stated that a densely wooded country is far more easily held against all comers than any other. Waterless deserts have their advantages, but Britain is not of these.

There is a remarkable instance in the world of to-day of a country rendered impregnable and unassailable by a dense thorny scrub clothing its rugged mountains. I refer to the island of Hayti with San Domingo, the Hispaniola of Columbus and Cortes. Probably there are few spots so rich in mineral wealth and agricultural possibilities, and yet the island is abandoned to a small population of imported negroes, degenerate, debased, and unprogressive. Spain has spent millions of money and rivers of blood in the endeavour to refix her hold on San Domingo. At one time the great Napoleon seriously contemplated the recovery of Hayti for France, but when he came to consider the details of a campaign in the dense tangled mountains, his own good sense and his remembrances of youth in Corsica caused him to dismiss the project as impracticable.

In the neighbouring island of Jamaica, I had a small experience of the difficulty of penetrating the same thorny growth, called by the Spanish "chaparal." It was necessary to connect two forts three miles apart by a narrow bridle-path, and a company of native sappers, commanded by Captain Friend (now a General in Edinburgh), faced the task but found it insuperable. Nor was it till we unearthed a certain negro family, skilled in the use of the Spanish knife called the "machete," that any progress could be made. This apparently trifling task occupied many weeks.

Of course such conditions could not be created, nor would they be desirable, in Great Britain. They are mentioned as extreme cases causing extreme difficulties to military or indeed any human progress. In their measure, however, all forests present obstacles to the advance of armies. More especially do they do so when disposed in belts across or astride of the main roads of advance, confining such advance to the roads themselves and so narrowing the front of advance. The defiles of a forest can of course be easily blocked by "abattis" of felled trees. Further, the dispositions of a defensive force within a forest are not readily observed, even by balloons or modern aeroplanes.

Further, also, a defensive force, despatched to bivouac in the field, is largely protected against the inclemency of the weather

by woodlands, which again furnish the materials for erecting huts and shelters. In considering the defensibility of forests, it must be remembered that land fortifications are now rendered of little estimation by modern conditions. Forts are easily located, and can then be searched and destroyed by modern shell fire, even from positions invisible from the fort itself. In an age when the track of comets through space can be calculated to a nicety, the path of artillery shells to their object becomes a very simple matter, while high explosives have vastly multiplied their destructive effect. Forts that are up-to-date to-day become obsolete to-morrow, through the increase of artillery range, and they require periodical re-armament. Millions of money have been sunk in these constructions to provide a security which is effective only until the next advance in military invention.

Not so with forests. These form screens within a few years after planting, and increase in obstructive value with the years, being always, and for permanent reasons, obstructions to the advance of hostile armies.

Hitherto, in this article, forests have been considered only as passive obstructions, inactive obstacles; but such obstacles, while they have always delayed, have seldom defeated active energy when the prize has seemed worthy of the effort. To this the North Pole is the witness and the summit of Mount Everest the exception. Forests, however, demand foresters, and lead on to an investigation of higher interest and importance, military as well as industrial.

Those who have visited Continental forests are unanimous in declaring, that the semi-military organisation there employed in regulating the woodland employés is of the greatest value in regularising the ceaseless method necessary to the growth of forests, and to their control in all stages of youth, maturity and decay. This point then need not be laboured, it is acknowledged; and the fact that it continues to be foreign to our insular habits explains many of the difficulties which we experience in all systems where administration counts for much, and where our own strong point, individual energy and independence, is less in evidence. A combination of both these opposite characteristics would of course be an approach to perfection in all industries.

In establishing State controlled and assisted forests throughout Great Britain and Ireland (not necessarily wholly State-

owned), it might be possible to maintain a forest-corps in each of the counties suitable to reboisement. In these corps (say) conservators would be colonels; deputy conservators – majors; assistant conservators – captains; sub-assistant conservators—lieutenants; head foresters—sergeants and sergeants major; foresters—corporals; and woodmen or labourers—privates. Military pay would be confined to a small retaining fee, and possibly some extra advantages as to old age pension, while rewards would be issued to all ranks for proficiency in rifle shooting, signalling, scouting, and other forms of military proficiency. There should, of course, be a distinctive uniform, as in the police or postal departments, one suitable for a daily working dress, possibly including the kilt in the Highlands, and the broad blue bonnet throughout Scotland, in accordance with the modern national aspirations espoused by so many patriotic societies.

Such corps would possess the strongest *esprit de corps*, not only from daily association in a common employment, but because such association, involving regulation by civil superiors, would in war time render military command by these civil superiors an easy and really effective discipline, such as hardly exists among territorial auxiliaries only very occasionally embodied. There could also be no doubt as to the genuine "territorialism" of such forest corps; they would be actually employed daily in open-air life in their own county, whose features they would know intimately. They would be hardy, healthy, active and sturdy,—no mean advantages to soldier or civilian.

Readers will doubtless observe many points and details omitted in these short notes, which are put forward merely as rough and early suggestions.

33. The Protection of Timber against White Ants.

Various methods have been suggested at different times to protect timber against the attack of white ants (termites). We note the following as apparently efficacious:—

1. Blue Oil.

According to the *Royal Engineer Journal*, it has been found that a treatment with "blue oil" protects wood against the attack of white ants besides acting as a preservative generally. The specification governing the supply of "blue oil" to the War Department contains the following provisions:—

(*a*) The oil to be a shale product.

(*b*) Its specific gravity (at 60° F.) to be 0·873 to 0·883.

(*c*) Its flashing temperature to be not lower than 275° F. (close test).

An extract from the report of a trial of the "blue oil" treatment of wood as a protective measure against the white ant is appended hereto.

"The boxes treated with blue oil have been placed during the wet season in various positions in the open, and there is no sign of their having been attacked by white ants, although a quantity of timber in close proximity to them was considerably damaged by these insects. The blue oil has also acted as a preservative to the wood, which shows no signs of rotting from the extreme damp to which it has been exposed. One of the ammunition boxes was lent to the O.C. West African Frontier Force, for trial in his magazine, which is infested with white ants. On returning the box, he stated—

"'Herewith ammunition box and a piece of wood. Both have been lying in the same place ever since you lent me the box. When I placed the box in my magazine, this wood and the ground in close proximity were swarming with white ants. I placed the box under the wood, between it and the ground. Since then the ants have disappeared from the wood and the ground referred to; the box is not touched.'"

2. The Powell Process.

The *Indian Forester* announces the discovery of another means of protecting timber from these pests. An experiment with this new preservative was made by Mr H. N. Ridley, curator of the Government Botanical Gardens, Singapore, who placed two pieces of ordinary yellow deal in a position where

termites abounded. One of the pieces had been treated in London by the Powell wood-process with a termite-resisting solution, while the other was left in its natural condition. The latter piece, after a period of some months, was found to be almost consumed by the termites, while the other piece was untouched. The process is stated to improve the appearance of the wood, and to protect it against dry rot and similar growths, as well as against the termites. The solution is stated to be odourless, and innocuous except to insects, and the cost of the process is low. Plant on an experimental scale has been working at Bombay for some time past; and the value of the process has been recognised in Australia, where extensive works have been erected by the Local Governments. Particulars can be obtained from the Secretary, Powell Wood-Process Co., Ltd., 28 Fleet Street, London, E.C.

3. A White Ant Exterminator.

In the *Natal Agricultural Journal* for July 1906, according to the *Indian Forester*, Mr Claude Fuller, Government Entomologist, illustrates and describes a machine for the destruction of white ants, placed on the market in South Africa by Messrs P. Henwood, Soutter & Co., agents for the sale thereof.

This contrivance consists of an air-pump, connected by a short length of rubber hose to a furnace. By working the pump a continuous blast of air is driven into the furnace, entering beneath and escaping through a pipe near the top. A charcoal or cow-dung fire is first started in the furnace, and got thoroughly alight by pumping. A powder is then sprinkled over the fire and the lid is closed. By continuing the pumping a very hot cloud of poisonous smoke is driven out through a flexible hose. In use, the hose is inserted into a gallery of an ant's nest and the smoke is pumped in.

Wherever a gallery, sufficiently large to admit the nozzle of the hose (about half an inch in diameter) can be obtained, the machine can be used with the most satisfactory results; not only are the insects killed, but the gallery is thoroughly poisoned for an indefinite period.

The powder spoken of is sold with the pumps. A cheaper and equally effective powder can be obtained by farmers at the Department of Agriculture, Maritzburg, at 8d. per lb.

NOTES AND QUERIES.

Forestry Operations Under The Irish Department of Agriculture in 1909.

By the grant of £6000 to the Department of Agriculture in the financial year 1909-10, State forestry may be said to have been established in Ireland on a satisfactory basis. This grant is intended to enable the Department to acquire existing woods and lands from the Estate Commissioners under the Land Purchase Acts of 1903 and 1909, and to work them on a commercial system. In most sales to tenants under the Land Acts, the landlord reserves and retains all woods and untenanted lands, together with the demesne, and the woods are managed in exactly the same way as before the sale, by the owner's woodmen and forester. In other cases, again, the owner prefers to sell the entire estate to the Commissioners, who transfer the tenanted land to those in occupation, create new, or enlarge existing holdings from the demesne and untenanted land, and under the arrangement now made, transfer the woods and any lands unsuitable for agriculture to the Department of Agriculture as purchasing tenants.

So far, three areas of woodland have been acquired under this grant — Dundrum in Tipperary, Aghrane in Galway, and Camolin in Wexford. Dundrum contains 1200 acres, consisting chiefly of oak, spruce, Scots pine, and beech, from 60 to 100 years of age, with a little young larch of from 20 to 30 years. A plan has been drawn up for the clearing and replanting of these woods within a period of forty years, and to facilitate the disposal of the rougher timber a sawmill has been erected adjoining the railway station, which here lies in the centre of the woods. At this centre the first year's course of the forestry students is spent, before they proceed to Avondale for the more theoretical part of their training.

At Aghrane, near Roscommon, 1300 acres of woods,

demesne land and bogs, have been acquired within the last six months. The woods are well stocked with mature Scots pine and spruce, and some very fine larch exists in places. Large areas of bog were planted by the owner of this estate about twenty-five years ago, but practically all the trees died out except near the margins. These woods will be gradually cleared and replanted after the existing bare ground has been planted up, which will occupy several years.

Camolin, in Co. Wexford, occupies 630 acres and contains some very good timber, chiefly oak, Scots pine, silver fir, and larch of clean growth. It is intended to clear these woods very gradually, so that they may eventually form a Demonstration area representing a properly organised forest with a complete series of age-classes. The soil being particularly good and the situation sheltered, many of the more valuable species will be introduced in replanting, and 50 acres of bare ground have already been planted with Douglas fir.

In addition to the above areas, negotiations are proceeding for the acquisition of about 3000 acres of woods in various centres, and it is expected that these will be taken over within the next few months.

At Avondale and elsewhere twenty students are undergoing training in various ways as practical foresters. A forestry museum has been provided, for which specimens of Irish timber and other objects are being collected, while the species of trees at this station now number over 150, a large proportion of which are in sample plots of from one-tenth of an acre to one acre in extent. A. C. F.

Larch Disease Fungus.

Information is invited as to the length of time during which the fungus remains active on diseased larch poles which have been felled and left lying on the ground.

Do partially developed fructifications on them attain maturity? Do fresh fructifications appear and attain maturity? And if so, for how long a time after felling?

Have the size of the poles, the degrees of soil-moisture and of shade, the aspect, the presence of tall and dense weeds, or other local conditions, any influence in the matter? F. B.

Mr Langhammer's Visit.

Mr Langhammer, a Norwegian gentleman, who came to Scotland in 1908 in order to study the raising of Scots pine woods, has published a report of his visit. He gratefully acknowledges the assistance afforded to him by the Secretary of the Society in arranging his tour through the woods of Scone, Murthly, Dunkeld, Grantown, Beauly, Novar, and Balmoral; and he records his thanks to the owners and managers of those estates.

Seeds of North American Conifers.

Cameron of Lochiel permits us to intimate that Mr Angus Cameron, Diboll, Texas, U.S.A., has, through him, most generously offered to send small packets of the seeds of *Thuya gigantea*, the Red cedar of the North Pacific Coast, *Chamæcyparis Lawsoniana*, the White cedar of Southern Oregon, and other North American conifers, to any Scottish proprietor who may apply to him for them. He desires to do all in his power to assist in the re-timbering of the Scottish mountains and glens, knowing full well the benefit this would confer on coming generations of his countrymen.

In regard to the two above-mentioned species, Mr Cameron says that they produce timber which equals that of larch in durability, while it is more easily worked, and does not warp during seasoning. He thinks they will prove to be rapid growers anywhere in Scotland, but especially on the West coast, where, however, they will need shelter from the western gales. Of the seeds sent to Lochiel, those of the Red cedar were collected for Mr Cameron in the Stanley Park, Vancouver, B.C., where the trees attain a diameter of 14 feet,[1] and those of the White cedar were collected on the Port Oxford river, Oregon, where he has seen trees of 16 feet in diameter.

The Development and Road Improvement Funds Act, 1909.

Mr W. L. Haldane, a member of the Society's Council, and Mr Eardley-Wilmot, C.I.E., formerly Inspector General of Forests in India, have been appointed two of the Commissioners for the

[1] I have measured a Red cedar there which had a diameter of 18 feet.—F. B.

purpose of carrying out the provisions of the Development and Road Improvement Act.

Appointment.

Mr E. P. Stebbing, of the Indian Forest Service, has been appointed to the vacant Lectureship in Forestry at the University of Edinburgh.

Bordeaux Mixture.

The *Journal of the Board of Agriculture* for May 1910, contains an article warning fruit-growers to exercise caution in the use of Bordeaux Mixture for spraying their trees. An article on the making and application of this mixture appeared in the *Journal* for January 1910.

Tree-Felling by Machinery.

The operation of felling trees by machinery is now in successful operation in a tract of forest land within about a mile of the village of Tarbert, on Loch Fyne. This is the first successful attempt to fell trees by machinery made in the United Kingdom. The plant, which consists of a steam saw, a small boiler, and a considerable length of flexible steam hose, requires four men to work it. One man works the machine, another drives the wedges into the cut so as to fell the tree in the required direction, another stokes the boiler, collecting and chopping the brushwood with which it is fired, while the fourth man levels a space by the side of the tree next to be cut, on which he beds a light wooden frame to form a cradle for the machine. The machine itself, the weight of which does not exceed 4 cwt., is easily carried from tree to tree by the four men, and it will fell from ten to twelve trees, averaging 30 inches diameter at the ground level, in an hour, sawing them off close to the ground and thus saving a considerable portion of the best part of the tree, which would be cut into chips if felled with the axe.

The machine consists of a steam cylinder 5 inches in diameter, having a long stroke and attached to a light wrought-iron frame, upon which it is arranged to pivot on its centre, the pivoting motion being worked by a hand-wheel turning a worm which

gears into a quadrant cast on the back of the cylinder. The saw is fixed direct to the end of the piston rod, and the teeth are so shaped as to cut only during the inward stroke. By this device saws as long as 9 feet or 10 feet can be worked without any straining apparatus or guide, as the cut made by the saw is sufficient to guide it in a straight line through the tree, and as the teeth offer no resistance on the outward stroke all possibility of the saw buckling is avoided. The machine is supplied with steam at high pressure from a small portable boiler through a flexible steam pipe, which is of sufficient length to enable the machine to fell trees extending over a full acre of ground without moving the boiler.—*Dispatch, 31st May* 1910.

Wood-Pulp.

The demand for wood-pulp for paper making is now so great all the world over that there is difficulty in meeting it at reasonable prices. So far India has not come into the circle of supply, but in her vast forests she may have a reserve of material upon which paper manufacturers will draw in the future. From a paper by Mr A. J. Gibson, Imperial Forest Economist, it appears that the possibility of making wood-pulp from the Himalayan silver fir and spruce has been under investigation. During the past year Mr Sindall, a paper expert sent out from England, was able experimentally to manufacture excellent pulp from the trees above-mentioned. It is stated that the question is receiving attention in the United Provinces and the Punjab, and it is hoped that an experimental plant will be erected in one of these provinces to test the commercial prospects in India of chemical pulp, and possibly of mechanical pulp also. As prices for wood-pulp are steadily rising, it would seem that the time is most opportune for these experiments.

The Timber Resources of New Zealand.

From the last official report on the forests of the colony it appears that, in the opinion of the Government, the existing stock of growing timber will not suffice to meet the demands of the saw-millers for more than about thirty-five years, after which time New Zealand must expect to have to obtain its supply of pine timber from Canada or from Manchuria.

Preserving Sleepers from Decay.

The Atchison, Topeka, and Santa Fé Railroad has recently put into operation at Somerville, Texas, a large plant for treating railway sleepers. The process used is that known as the Rueping. The seasoned timber is first subjected to an air pressure of 60 lbs. to 75 lbs. per square inch, after which creosote is forced into the pores of the wood at a pressure of from 150 lbs. to 250 lbs. per square inch, according to the nature of the wood, until the fluid has penetrated all the cells. The pressure being then withdrawn, the air contained under pressure in the cells forces out all superfluous fluid. There is thus required only so much of the impregnating fluid as is sufficient to coat the cells.

The impregnation cylinders, of which five are now installed with provision for a sixth, are 132 feet long by 74 inches in diameter, and are adapted to withstand a working-pressure of 250 lbs. The end doors are hinged to heavy cast steel flanges, and a part of their weight, which amounts to 4 tons, is carried by a wheel running on a T-rail as the doors are opened or closed. The doors are also secured to the flanges by 36 hinged bolts which enter slots in the edges of the door, and may be released and thrown out of the slots after a few turns of the nuts. The pressure on the door when working at the *maximum* is 537 tons. Rails run the entire interior length of each cylinder, and between the rails are steam coils for heating the oil to about 180° F. The cylinders rest upon 16 cast-iron saddles, to one of which they are secured. On the other saddles are rollers to provide for movement under expansion and contraction. Each cylinder will hold 16 cars loaded with 37 sleepers each, making a total charge of 592 sleepers for each cylinder. The capacity of the plant is from 10,000 to 15,000 sleepers in twenty-four hours.

There are now installed two pressure cylinders with provision for a third, the intention being that one pressure cylinder shall supply oil to two impregnating cylinders. These are 6 feet in diameter and 106 feet long, each having a capacity of 22,500 gallons. They are adapted to a working-pressure of 100 lbs. per square inch, and are fitted with steam coils, providing about 800 square feet of heating surface.

Pressure for the impregnating cylinders is obtained by four plunger pumps with pot valves, which are required to work at a

maximum of 250 lbs. per square inch. There is one 18 × 20 × 24-inch Laidlaw-Dunn-Gordon air compressor, and one 9 × 12 × 10-inch Worthington for auxiliary purposes. Near the ground tanks are two 8 × 8½ × 12-inch Fairbanks Morse and Co. pumps for raising oil to the storage tanks.

The buildings are constructed of reinforced concrete. The main building is 155 feet long and 101 feet wide, and is divided into two sections, one for the cylinders and the other for pumps, etc.

An interesting feature is the experimental plant, which is so fitted up that experiments may be carried on in a small way under precisely the same conditions as the work on a large scale in the body of the plant. The experimental cylinder is 48 inches in diameter and 12 feet long, and is adapted to withstand a working-pressure up to 400 lbs. Other equipment consists of a pressure cylinder 5 feet in diameter by 8 feet long, oil pressure pumps, vacuum pumps, condensers, etc. This plant is located in a separate building.

REVIEWS AND NOTICES OF BOOKS.

Illustrations of Conifers. Vol. II. By H. Clinton Baker. Printed privately by Simson, Hertford, 1910. 72 pp., Quarto, with 89 full-page illustrations.

Mr Clinton Baker's second volume is of as great, if not greater, value than the first (see vol. xxii. p. 239), to all those who themselves collect conifers or take pleasure in seeing and identifying the collections of others. The volume contains the important genera *Abies*, *Picea*, and *Larix*, as well as the majority of the smaller groups, such as *Sequoia*, *Araucaria*, etc. All the most recent botanical information is embodied in the short descriptions of the species, and cone-bearing branches have been chosen and photographs of them prepared with the greatest possible care.

It would be well that all nurserymen who sell young trees should revise their lists after a close study of Mr Clinton Baker's book. Some of the Western America silver firs are consistently misdescribed by nearly all British nurserymen; the writer's experience being that *Abies lasiocarpa* is practically unobtainable in this country, and that it is *Abies Lowiana* which is usually

so described in the catalogues. Even in the Kew Handbook the two species of Himalayan silver firs, *Abies Webbiana* and *Abies Pindrow* are wrongly described as varieties of the same species. Two of the Japanese *Piceas*, *P. Alcockiana* and *P. ajanensis* have hitherto been hopelessly confused by collectors; but it may be hoped that Mr Clinton Baker's volumes will go far to set things right. The keys to the different descriptions are most clear and precise. F. R. S. BALFOUR.

The Soil: An Introduction to the Scientific Study of the Growth of Crops, vii + 311 pp. and Index, 17 Illustrations and numerous Tables. *Fertilisers and Manures*, xv + 384 pp. and Index, 9 Illustrations and numerous Tables. Both by A. D. HALL, M.A., F.R.S., Director of the Rothamstead Experimental Station. London: John Murray. 5s. net each.

Students of forestry and practical foresters will find much that is both valuable and suggestive in the new edition of Mr Hall's well-known work *The Soil*, the first edition of which was published in 1902. The present edition follows the same general plan as the first, but has been considerably extended, some chapters having been entirely rewritten.

As we should expect, the changes are most marked in the sections dealing with the living organisms of the soil, and a comparison of the two editions shows the great progress which has been made in recent years in the investigation of the many complex reactions brought about by the action of bacteria and fungi in the soil. A problem of particular interest to the forester is the method by which the accumulation of nitrogenous compounds takes place in pasture lands and forest soils, and in chapter vii. we have an admirable summary of the present state of knowledge of this most important subject. In subsequent chapters the absorption of salts by the soil, the causes of fertility and sterility, and the usefulness of soil surveys are considered in detail. The work concludes with a useful Bibliography.

In *Fertilisers and Manures*, Mr Hall deals with the composition and properties of manures and fertilisers, and the general principles of manuring. There is a useful chapter on the valuation of manures, and the work concludes with a highly

suggestive discussion on the conduct of experiments with fertilisers.

It is hardly necessary to add that both books are written in Mr Hall's lucid and attractive style. A. L.

Les Sols Forestiers. Par E. HENRY, Professeur à l'École Nationale des Eaux et Forêts. 492 pp., including Table of Contents, with 3 diagrams, 5 plates and 2 maps.

Les Sols Forestiers, by Professor Henry of the French School of Forestry, Nancy, is a welcome addition to the literature on this subject. Its appearance at the present time is rendered the more acceptable, since general interest in all matters pertaining to silviculture, is now being actively, and it is hoped permanently, revived in this country. There are, however, other reasons which make us welcome treatises on soils; for, like most studies in natural science, considerable progress has been made within the last few decades. Hitherto, soil investigations have been mostly directed towards a better understanding of their chemical and physical properties, and in this respect very different views and hypotheses to those originally held are now put forward. It is however, in connection with soil bacteriology that the greatest advances have been made. Since Warington published his brilliant researches on nitrification, and Hellriegel and Wilfarth their important work on nodule-forming bacteria—not to mention the work of numerous other contributors—increasing attention has been devoted to soil biology, with the result that its study now forms the most fruitful and fascinating line of work in soil investigation. An admirable survey of modern ideas on soil problems is supplied in the second edition of Mr Hall's book on agricultural soils, and there exist many valuable treatises by other well-known authorities; but if we turn to forest soils, we cannot but admit that there is a lamentable absence of recent British work dealing specifically with this subject. For this reason Professor Henry's book should form a most valuable help and guide to the student of forestry. The subject matter of the book is contained in 18 chapters, occupying 492 pages, and embodies the results of a large number of French, German, Russian and other investigations. Its compilation must have entailed a great deal of labour, for it is amply supplied with explanatory tables, and wherever necessary, references to the source of the

information quoted are given. There is, however, no index of contents and authors, and only, at the end of the book, a very inadequate summary of each chapter. This is a pity, since with a good index a book is made so much more accessible. It is, of course, out of the question to attempt, in a brief space, to give more than a general impression of a book of this size, or even to draw attention to parts, here and there, which seem deserving of special notice. The introductory chapter, commencing with a general statement on the formation and constitution of forest soils, is mainly taken up with an interesting comparison of the properties and functions of forest soils and agricultural soils. In this comparison it is at once made clear, in dealing with such questions as the supply and importance of humus, the composition of soil-water and air, the improvement of soils, their rate of exhaustion and manner of nutrition, etc., that fundamental differences exist between the two categories of soils. These differences are dealt with in subsequent chapters.

One aspect of afforestation, given on page 6, and expressed in the following sentence, seems worth quoting:—"Le boisement est le seul procédé que l'homme ait à sa disposition pour améliorer sans aucuns frais—mais avec le concours du temps—les sols de mauvaise qualité et les rendre aptes à la culture." Further on in the book comes the terse statement, "C'est le sol qui fait la forêt." Certainly this emphasis on the soil is largely justified in agriculture, but one is almost led to believe, from earlier chapters, that moisture, warmth, elevation, sunlight, etc., are the really dominating factors in forest growth, so that the expression must not be taken too literally.

It is of cardinal importance in afforestation to encourage the production of humus of the right kind and thickness, for upon this factor the supply and preservation of water and nitrogen, the soil texture, and the supply of available mineral food materially depend. It is then not surprising that the next nine chapters are devoted to an elaborate treatment of the *couverte morte* or dead covering in all its varying aspects. Though humus is an essential ingredient of agricultural soils, it is manifestly of greater importance in the soils of the forest. Perhaps chapter ix., which deals with the decomposition of the *couverte morte* by eremacausis, is the most interesting. Mention is here made of the work of Pasteur, Berthelot, Schloesing, Müntz, De Saussure, Warington, Winogradsky,

Beyerenick, and others on soil biology. Speaking of the gain of nitrogen in forest soils, due consideration is given to, among other agencies, the part which the recently discovered organism *Azotobacter chroococcum* plays in this process.

Prominence is also given to the absence of nitrifying bacteria, through conditions inimical to their growth, and to the presence of ammonia-forming bacteria, which are abundantly present in forest soils. One is left, however, with an impression that much more investigation into the sources of assimilable nitrogen by forest trees is needed. Useful tables on the composition of leaves at different ages, and of different varieties of trees, are given. Chapter xi. deals with the chemical composition of forest soils. The elementary requirements of forest growth in essential mineral constituents are, of course, the same as those of other plants, and they are dealt with here. The section on chalk and nitrogen is most instructive. In connection with the latter, the likely gains and losses under different circumstances are enumerated, and reference is made to the work of Hellriegel, Wilfarth, Grandeau, Lawes and Gilbert, Mazé, Nobbe, Hiltner and others, along with a criticism of Jameson's hypothesis.

The next forty pages are devoted to the exhaustion of the soil by forest vegetation. Numerous tables are given, and frequent reference is made to the work of Ebermayer, Schroder and Waber on this subject. The exhaustion of the soil under silviculture, with its periodic harvests, is almost insignificant compared with that of soils under agriculture with its annual harvests (see Table H., p. 250). In horticulture, the soil frequently requires recuperation by means of manure. The physical properties of soils, and the importance of water in forest growth, are considered in chapters xiii. and xiv. In forestry, the texture of the soil is relatively far more important than the chemical composition, and this question is adequately dealt with here. Rainfall in connection with forest distribution makes several pages of very instructive reading, and an interesting discussion follows on the amount of water required per gram of dry matter formed. Trees are great consumers of water, and this fact is well illustrated in chapter xv., where, by means of graphs, it is shown that the water-level is permanently lower when supporting than when not supporting forest growth.

The classification of forest soils, according to their geological origin, and the distribution of the forests in France, along with a detailed study of several typical soils and forests, occupy the

next hundred pages. Chemical analyses of the fine earth of a large number of forest soils are given in the Appendix.

Two maps showing the distribution of soils and forests, along with some good photographs of typical forests, are given. The question of the relative importance of soil surveys need not be discussed here; at the same time, in connection with the soil of our own country, one naturally asks if it would not be advisable—even necessary — especially in view of extensive schemes of afforestation likely to be put forward in the near future, to first make a systematic survey of the land available and suitable. Data showing elevation, rainfall, aspect, and the principal physical and chemical characters of the land would undoubtedly be very helpful, and much remains to be done in increasing our knowledge in this direction. The following is taken from page 332, "Il faut consacrer à la production des bois toutes les terres trop ingrates pour celle des céréales." One is thus led to conclude that a soil survey of both forest and agricultural land would be beneficial.

The last chapter is taken up with the improvement of forest soils and is well worth reading. Speaking of the use of manures, the author points out that, except in horticulture, very little reliable data are available.

If only for the sake of the tables, and references in the foot-notes to the work of other authors, the book can be strongly recommended, and besides it contains statements of general principles which alone would make it acceptable to all interested in the subject.

R. A. Berry.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON

HIS MOST EXCELLENT MAJESTY THE KING.

PROCEEDINGS IN 1909—*Continued.*

THE GENERAL MEETING.

The General Meeting of the Royal Scottish Arboricultural Society was held in the Highland and Agricultural Society's Showyard at Stirling, on Thursday, 22nd July 1909, at 2.30 P.M. Sir KENNETH MACKENZIE, Bart., President, in the Chair. There was a large attendance of Members.

MINUTES.

The Minutes of the Annual Meeting, which was held in Edinburgh on 5th February last, were held as read and adopted.

APOLOGIES.

Apologies for absence were intimated from the Right Hon. the Earl of Mansfield, Mr Munro Ferguson, M.P., *Honorary Secretary*, Sir Arthur Mackenzie, Sir David Stewart, Dr Nisbet, Messrs John Black, Cortachy, A. T. Gillanders, Alnwick, J. F. Annand, Armstrong College, John D. Crozier, Durris, G. U. Macdonald, Haystoun, and others.

Chairman's Remarks.

The Chairman mentioned that since the Annual Meeting a Deputation had been appointed to wait upon the Chancellor of the Exchequer on the subject of afforestation. This they had been compelled to do, because of the report of the Commission, with which they did not wholly agree. He had not, unfortunately, been able to attend with the Deputation, which, however, had been most courteously received by the Chancellor of the Exchequer, who asked a great many pertinent questions, and the Deputation had come away convinced that the Chancellor intended to draw up some scheme for the promotion of forestry in this country. A Petition bearing on the subject had been forwarded to the Chancellor of the Exchequer since that time. The Council had reported that something should be done with regard to death duties, as they felt that, with the added taxation on land, there was great probability of people who had to meet death duties being tempted to cut immature timber, and accordingly it was thought advisable to draw up some suggestions for the Chancellor's consideration, with the view of obtaining some modification of his proposals as regards woodlands.

Judges' Report on Essays.

Colonel Bailey, Convener of the Judges, gave in their awards as follows, namely :—

Class I.

1. An account of the Broad-leaved and Coniferous Trees, especially of the more recently introduced Species, which the writer has found from experience to be most suitable as Forest Crops on High and Exposed Situations. By William Forbes, Beechwood, Blairgowrie. Award—No. 2 Silver Medal.

2. Suitability of any Exotic Conifer for cultivation as a Forest Crop, and nature of the Locality found in the experience of the writer to be most suitable for it. By William Forbes, Beechwood, Blairgowrie. Award—Bronze Medal.

3. The Sitka Spruce as a Tree for Hill Planting and General Afforestation. By J. D. Crozier, Durris. Award—No. 1 Silver Medal.

4. The relative Powers to bear Shade of some or all of the following Species:—Douglas Fir, Menzies Spruce, White American Spruce, etc. By WILLIAM FORBES, Beechwood, Blairgowrie. Award — No. 2 Silver Medal.

5. Report on the Woods of Gregynog Estate, North Wales. By W. H. WHELLENS, Gregynog. Award—No. 2 Silver Medal.

6. Report on the Woods of the Ainsty Estate. By WILLIAM HALL, Church Cottages, Bilton, near York. Award—Bronze Medal.

7. The Best Method of Planting at High Altitudes and in Exposed Situations, together with the Best Species of Trees to Plant there for securing—(*a*) Shelter for Stock, and (*b*) Profitable Timber Crop. By THOMAS HALL, Moore Abbey, Monasterevan, Co. Kildare. Award—Bronze Medal.

CLASS II.

1. A Weevil (*Hylobius abietis*) Infestation, 1908. By DONALD MACDONALD, Bowmont Forest, Roxburgh. Award—Bronze Medal.

2. The Formation of Larch Woods and their Protection from the Ravages of the Larch Canker. By DAVID STEWART, Assistant Forester, Royal Botanic Garden. Award—Bronze Medal.

3. Seaboard Plantations for Protection and Profit. By JOHN M'EWEN, Royal Botanic Garden. Award—Bronze Medal.

4. The Formation of a Nursery and its After Management. By "APPIN." No Award.

5. Five Notes of Silvicultural Interest. By "UNITED EFFORT." No Award.

6. Five Notes of Silvicultural Interest. By DAVID STEWART, Assistant Forester, Royal Botanic Garden. Award—Bronze Medal.

The Judges' Report was approved of, and they were thanked for their services.

Forestry Exhibition at Stirling.

Judges' Awards and Report.

Competition No. I.

Specimens of Timber of Scots pine (*Pinus sylvestris*), Larch (*Larix europæa*), and Norway Spruce (*Picea excelsa*).

Open Section.

1st Prize, £2, 10s., J. A. Stirling of Kippendavie.
2nd ,, £1, 10s., Captain Stirling of Keir.
3rd ,, £1, Duke of Montrose.

Local Section.

2nd Prize, 15s., J. Ernest Kerr of Harviestoun (2nd Prize only awarded).

Competition No. III.

Open Section.

Specimens of Timber of Ash (*Fraxinus excelsior*), Oak (*Quercus robur*), and Elm (*Ulmus montana*).

1st Prize, £2, 10s., Captain Stirling of Keir.
2nd ,, £1, 10s., J. A. Stirling of Kippendavie.
3rd ,, £1, Duke of Montrose.

Competition No. IV.

Open Section.

Specimens of Timber of any Three Broad-Leaved Trees other than the above.

1st Prize, £2, 10s., J. A. Stirling of Kippendavie.

Competition No. VII.

Gate for Farm Use manufactured from Home-Grown Timber.

1. James Younger of Mount Melville, ... } No. 2 Silver Medal.
2. Duke of Montrose, . . £1 award.
3. Captain Stirling of Keir, . { Special Prize, No. 2 Silver Medal.

Competition No. VIII.

Self-closing Wicket-Gate manufactured from Home-grown Timber.

1. Duke of Roxburghe, . . No. 2 Silver Medal.
2. J. A. Stirling of Kippendavie, Bronze Medal.

Competition No. X.

Full-sized Section of Rustic Fence, made from Larch or other Thinnings.

J. A. Stirling of Kippendavie, . No. 2 Silver Medal.

Competition No. XV.

Collection of Fungi injurious to Forest Trees and Shrubs.

1. Hugh R. Munro, Murthly, . No. 2 Silver Medal.
2. Alan Burns of Cumbernauld, . Bronze Medal.

Competition No. XVI.

Examples of damage by Squirrels, Voles, etc.

Duke of Roxburghe, . . . Bronze Medal

Competition No. XVII.

A Useful Invention or Marked Improvement on any of the Implements or Instruments used in Forestry.

Duke of Roxburghe, . . No. 2 Silver Medal, for a Working Scale Model of Portable Boiling Creosoting Plant, etc.

Competition No. XVIII.

For any approved Article either wholly or mainly made of Wood.

Thomas Strachan, Keir, . No. 2 Silver Medal, for Card Table Top.

Alexander Pollock, Tarbolton, Bronze Medal, for Rustic Oak Seat.

Captain Stirling of Keir, . Bronze Medal, for Model of Field-Gate.

In addition to the Prizes awarded in the Competitive Section, the Judges also recommended, and the Meeting approved of, the following Awards in the Section for Articles for Exhibition only:—

Duke of Roxburghe, . . No. 2 Silver Medal, for a Collection of Seeds, Photographs, etc.

John D. Sutherland, Oban, . No. 2 Silver Medal, for Hand Specimens of Timbers.

Alex. Gow, Murthly, . . Bronze Medal, or 10s., for Collection of Cones, etc.

John D. Crozier, Durris, . No. 1 Silver Medal, for Specimens of Exotic Timbers.

The Judges have pleasure in submitting the foregoing List of Awards, and the following Report on the Forestry Exhibition, held in connection with the Highland and Agricultural Society's Show at Stirling, on 20th to 24th July 1909.

The Exhibits were of a high standard, and of both professional and general interest, but were not so numerous as could have been wished. Apart from the professional interest of this Annual Exhibition, it affords an excellent opportunity of popularising the subject, and forest-owners and foresters could do a great deal in stimulating public interest by forwarding Exhibits of an educative nature.

With regard to the Exhibits, the timber shown in Sections I. to IV. was of good quality, though in some cases the Scots Pine was defective. The Spruce, from Harviestoun Castle, shown in the Local Section in Competition I., calls for special mention on account of its excellent quality. In Competition III., the First Prize lot from Keir was a really outstanding exhibit, all the three hardwoods being of excellent quality. In Competition VII., several of the gates were far too elaborate and expensive to fulfil the condition, "Gate for Farm Use," and were on that account put out of competition. In the case of the gate from Kippendavie, it was agreed that the build and workmanship were excellent, but the Judges were obliged to pass it solely on account of its not being a gate for "farm use."

The other Sections contained some interesting Exhibits, notably the "Working Model of Portable Creosoting Plant," in Section XVII.; though such exhibits as model gates serve a less useful purpose.

Among the Articles shown for Exhibition only, the exhibits of Mr Crozier, Durris, and of Mr Sutherland, Oban, call for special mention, Mr Crozier's exhibit of exotic timbers being unique of its kind, while Mr Sutherland's exhibit embodies a very useful suggestion in connection with technical instruction in country schools.

The Judges desire to thank the Local Committee, who were assiduous in their attention, and greatly facilitated the work of judging.

George Leven.
Jno. Broom.
Wm. Dawson.

Votes of thanks were awarded to the Highland and Agricultural Society for their generosity in contributing to the Prize Fund, and for the facilities given for the Exhibition, and to the Judges and Exhibition Committee for their services. Special votes of thanks were also awarded to Messrs Wm. Drummond and Sons and to Mr Mungo Chapman for sending plants to decorate the Society's stand.

Excursion to Bavaria.

Mr Buchanan, Convener of the Excursion Committee, mentioned that for the Excursion to Bavaria, which was to leave Edinburgh on 29th July, sixty members' names were on the list, and he was hopeful that they would all be able to make the tour. He mentioned that Professor Mayr, of Munich University, had been appointed official guide by the Bavarian Government, and he expressed the belief that the Excursion would be an extremely interesting and instructive one. He said they were much indebted to Dr Borthwick for the trouble he had taken in drawing up the programme.

Excursion 1910.

With regard to the locality of the Excursion next year, Mr Buchanan mentioned that the Council had agreed to recommend the West of Scotland. He hoped that Members would express their views regarding any other district that they might favour.

Mr Fothringham moved that the West of Scotland be the district, and Mr Macbean seconded. Mr Moon moved that the Border district be selected, and Mr Gammell, to get the feeling of the Meeting, seconded. On the vote being taken, however, a large majority were in favour of the West of Scotland.

A hearty vote of thanks to the Chairman for presiding brought the Meeting to a close.

Royal Scottish Arboricultural Society.

SYLLABUS OF COMPETITIONS—1910.

[*The Judges are empowered to fix the value of the Prizes to be awarded according to the respective merits of the Essays.*

All Essays, Reports, Models, or other Articles intended for Competition must be lodged with the Secretary not later than 14th May 1910. *Each such Essay, Report, Model, or Article must bear a* MOTTO, *and be accompanied by a sealed envelope bearing outside the* SAME MOTTO, *with the Class to which the Competitor belongs, and containing a* CARD *with the* NAME *and* ADDRESS *of the Competitor.*

Essays should be written on one side of the paper only; the left-hand quarter of each page should be left as a blank margin. The lines should not be crowded together.

Manuscripts for which prizes have been awarded, or which have been wholly or partly reproduced in the Transactions, *become the property of the Society and are not returned to their authors.*

Judges cannot compete during their term of office.

Successful Competitors may have either the medals or their converted values, which are as follows:—Gold, £5; No. 1 *Silver,* £3, No. 2 *Silver,* £2; No. 3 *Silver,* £1; *Bronze,* 10s.]

The following subjects are named for competition in 1910:—

CLASS I.—FOR OPEN COMPETITION.

I. An account of one or two of the Broad-leaved and Coniferous Trees, especially of the more recently introduced Species, which the writer has found from experience to be most suitable as Forest Crops on high and exposed situations. The method under which such a Crop has been raised to be fully described. (*Five Guineas* offered by W. H. MASSIE, Esq., of Messrs Dicksons & Co., Nurserymen, Edinburgh.)

II. Suitability of any exotic Conifer for cultivation as a Forest Crop, and nature of the locality found, in the experience of the writer, to be most suitable for it. (*Five Guineas* offered by DAVID W. THOMSON, Esq., Nurseryman, Edinburgh.)

III. The relative powers to bear shade of one or two or all of the following species :—Douglas Fir, Menzies Spruce (*Picea sitchensis*), White American Spruce, *Sequoia Sempervirens*, Lawson's Cypress, *Abies grandis*, Giant Hemlock (*Tsuga Mertensiana*), *Thuya gigantea;* and the order in which the above Species should be placed in a list of shade-bearing trees comprising also Silver Fir, Beech, Spruce, Hornbeam. The Report to be based on personal experience only. (*Five Guineas* offered by JOHN METHVEN, Esq., of Messrs Thomas Methven & Sons, Nurserymen, Edinburgh.)

IV. Successful raising, by the writer, or on the Estate with which he is connected, of a Young Forest Crop by the method of "Direct" Sowing. The conditions of Soil and Soil Covering to be fully stated. (*A Medal.*)

V. Comparative results obtained by various methods of Planting, with various Species and Sizes of Plants, up to the time at which the Young Crops have become thoroughly established. (*A Medal.*)

The Report to be based on actual experience; soil and other local conditions to be fully described

VI. The use, on an Estate with which the writer is, or has been, connected, of Timber of any British-grown exotic Conifer, for House Carpentry and other Estate purposes. (*A Medal.*)

Besides giving information as to the specific uses to which the timber has been put, the writer should give details, such as the age of the trees from which it was taken, the soil on which they were grown, and whether the trees were raised in the open, or in woods of ordinary density. Statistics to be given, as far as available, of the comparative durability of this timber and the timber of British coniferous trees.

VII. Successful raising, by the writer, or on the Estate with which he is connected, of a young Forest Crop in a frosty locality, with details as to Soil Covering, Species, and Measures of Protection adopted. (*A Medal.*)

VIII. An approved Report on the Woods of which the competitor is Forester. Reporter to state the extent of the woods, the species of trees grown, soil, situation, age, management, etc. (*A Medal.*)

IX. Successful Underplanting of Larch or other Light-crowned Species, on an Estate with which the writer is, or has been, connected. (*A Medal.*)

The Report to be based on experience, the cases referred to being cited.

X. Details of Measures successfully practised by the writer to exterminate any important Parasitic Fungus or Insect Pest, or to mitigate the Damage done by it. (*A Medal.*)

XI. Details of Mechanical means employed by the writer, or on the Estate with which he is connected, for moving Timber from the interior of Woods to their margins, or to roads. (*A Medal.*)

XII. The erection and maintenance of a Saw-mill (either temporarily or permanently placed) or of any Wood-working Machinery, used by the writer, or on the Estate with which he is connected, for the Manufacture of Timber, with details of outturn and cost. (*A Medal.*)

XIII. Details of Measures successfully adopted for the natural regeneration of a timber-crop of Scots Pine, Larch, or other species. (*A Medal.*)

XIV. For an approved Essay on the Botanical characteristics of some typical forest tree. The Essay to be accompanied by Illustrations. (*A Medal.*)

XV. For an approved Essay on Soils:—(*a*) preparation prior to planting; (*b*) the advantages of soil-protection accruing from density of crop; (*c*) the improvement to the soil arising from mixing the main crop with various classes of shade-bearing trees. (*A Medal.*)

XVI. For an approved Essay on the best method of Planting at high altitudes and in exposed situations, together with the best Species of Trees to plant there for procuring (*a*) shelter for stock, and (*b*) a profitable timber-crop. (*A Medal.*)

XVII. Report on the comparative Durability and Suitability of various kinds of Timber for Fencing after being creosoted in open tank. (*A Medal.*)

XVIII. An approved collection of short Notes of silvicultural interest based on personal observation. (*A Medal.*)

XIX. An approved Essay or Report on any other subject connected with Forestry. (*A Medal.*)

CLASS II.—FOR ASSISTANT FORESTERS ONLY.

I. Details of the Measures successfully practised by the writer to exterminate any important Insect Pest or Parasitic Fungus, or to mitigate the Damage done by it. (*A Medal.*)

II. An approved collection of Notes of silvicultural interest based on personal observation. (*A Medal.*)

III. An approved Essay or Report, based on personal experience, on any practical work connected with Forestry. (*A Medal.*)

ROBERT GALLOWAY,
Secretary.

19 CASTLE STREET,
EDINBURGH,
November 1909.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON

HIS MOST EXCELLENT MAJESTY THE KING.

PROCEEDINGS IN 1910.

THE ANNUAL MEETING.

The Fifty-seventh Annual General Meeting of the Royal Scottish Arboricultural Society was held in the Goold Hall, 5 St Andrew Square, Edinburgh, on Friday, 11th February 1910, at 2.30 P.M., at which Sir KENNETH J. MACKENZIE, Bart. of Gairloch, President of the Society, presided.

There was a good attendance of Members. Apologies for absence were intimated from Sir John Macpherson Grant, Colonel Bailey, and Messrs James Johnstone, Ayr, W. S. Curr, Ninewar, and John Boyd, Crown Forester, Inverliever.

MINUTES.

The Minutes of the General Meeting, held in the Exhibition at Stirling, on 22nd July last, which had been printed and issued along with the *Transactions*, were approved.

REPORT BY THE COUNCIL.

The SECRETARY read the following Report by the Council:—

Membership.

According to the Council's report to last Annual Meeting the Membership of the Society at that date was 1313. In the course of the past year 96 new Members were elected, but 57 were struck off the roll, either on account of death, resignation, or lapsing, the total Membership at this date being thus

1352. The following amongst others died during the year, viz.:—Lord Kincairney; Sir Donald Currie; Sir Alexander Muir Mackenzie; Sir Robert Dundas; Mr H. T. M. Hamilton-Ogilvy of Biel; Mr Lewis Miller, Crieff; Mr John Smith, Factor, Grantoun; Mr John Brydon, Forester, Rothes; and Mr W. Harrower, Forester, Garth.

Syllabus and Prizes.

The Syllabus for 1909 included 23 subjects for Essays. Thirteen Essays were received and submitted to the Judges, and 11 awards were made, as follows:—One No. 1 Silver Medal, three No. 2 Silver Medals, and seven Bronze Medals. Several of the Essayists, as usual, preferred the converted value of their medals either in books or cash. The Syllabus of Competitions for the current year was issued along with the *Transactions* in January.

Donors.

The Directors of the Highland and Agricultural Society have voted their usual grant of £20 for prizes to be awarded for home-grown timber exhibited in the Forestry Exhibition in their Show-yard at Dumfries, and Messrs W. H. Massie, David W. Thomson, and John Methven have renewed their offer of prizes in the Syllabus of Competitions, to all of whom the hearty thanks of the Society are due.

Transactions.

The *Transactions* continue to appear punctually in the beginning of January and July. It is to be regretted, however, that on each occasion a number of copies have to be kept back owing to Members omitting to forward their subscriptions at the proper time.

Local Branches.

The Annual Reports from the Aberdeen and Northern Branches will be submitted in the course of the Meeting, from which it will be seen that they are maintaining a lively interest in forestry in their districts.

Forestry Exhibition.

The Annual Exhibition of Forestry in the Highland and Agricultural Society's Showyard was held last year at Stirling. The Judges were—Mr W. Dawson, Lecturer on Forestry, Marischal College, Aberdeen; Mr George Leven, Forester, Auchincruive, Ayr; and Mr John Broom, Wood Merchant, Bathgate. Their report has, as usual, been included in the

proceedings of the General Meeting, which was held in Stirling on 22nd July. A report of the Exhibition will be found at page 101 of Vol. XXIII. of the *Transactions*. The Exhibition was rather smaller than usual, and only £12, 10s. of the £20 offered by the Highland and Agricultural Society, and 15s. of the £9 offered by this Society, were awarded for exhibits of timber. In addition to these prizes sixteen Medals were awarded and one money prize. The Medals were as follows:— One No. 1 Silver Medal, nine No. 2 Silver Medals, and six Bronze Medals. The Exhibition is to be held this year at Dumfries, and the revised Schedules have been issued to Members. The competitions and prizes are similar to these of last year.

The General Meeting.

The General Meeting of the Society was held in the Show-yard at Stirling, on the 22nd July, and was well attended. A full report of the proceedings, containing the Prize lists, was printed and bound up with the *Transactions* which were issued in January.

Annual Excursion.

The Excursion last year was held in Bavaria. The party set out from Edinburgh on Thursday, 29th July, and returned on Thursday, 12th August, having been absent for fifteen days. During their stay in Bavaria they visited the State Forest of Partenkirchen, in the Alps, in the course of which they made the ascent of the Schachen (over 6000 feet), also the Ebersberger Forest and the Royal Experimental Forest Garden of Grafrath, near Munich, Neuessinger and Heinheimer forests near Kelheim, the State Forest of Reichswald near Nuremberg, and the Royal Forest of Rothenbuch in the Spessart, near Aschaffenburg. Sixty Members of the Society, including Professor Mayr of Munich University, who is an Honorary Member, took part in the Excursion. Professor Mayr was appointed by the Bavarian Government to act as official guide, and in this capacity he earned the gratitude of the Members for the clearness with which he explained the management of the various forests visited, and the patience with which he listened to and answered questions and explained difficulties raised by the Members. On reaching Nuremberg, the Members presented to Professor Mayr a pair of field-glasses as a memento of the Society's visit. Mr W. F. Soltau, British Vice-Consul in Munich, met the Members on their arrival, and did everything in his power to make their stay in the city and neighbourhood interesting and profitable. After the return of the party, the formal thanks of the Society were conveyed to Professor Mayr and Mr Soltau, and to the Foreign Office and the Bavarian Government. Occasion was also taken, in the course of the tour,

to thank Dr Borthwick for arranging the programme and compiling the guide book, which was handed to Members before setting out. A revised edition of this guide book, with illustrations taken on the course of the tour, and also a report written by Sir Andrew Agnew, will be found in the *Transactions*. A reprint of these papers, with additional notes written by Dr Borthwick, is being prepared for presentation by the Excursion Committee to each Member of the party as a souvenir of the visit. Mr Charles Ritchie has also kindly undertaken to prepare for the Society an album of views taken by the Members, and this will in due time be added to the Society's library.

Dunn Memorial Fund.

This fund consists of £100 3 per cent. redeemable stock of Edinburgh Corporation, and a balance of £21, 9s. in bank made up partly of accumulated revenue. The Council decided some time ago that this balance should be expended in purchasing suitable books for the library, and the matter is under consideration by the *Transactions* Committee.

Photographs of Interesting Trees.

The Council has authorised the Secretary to keep an album of photographs of interesting trees, and contributions to this album will be welcomed.

Proposed Collection of Portraits.

The Council has appointed a small Committee to obtain photographic or other portraits of a limited number of Members of the Society, or others, who have rendered important service to the cause of forestry or to the Society, with the view of having such portraits hung upon the walls of the Society's room. It is proposed that meantime the portraits shall be limited to those of deceased gentlemen. A portrait of Dr Cleghorn has been presented by Colonel Bailey.

Correspondents.

In the course of the year the Council appointed five Correspondents in different parts of the world, whose names will be submitted for confirmation at this Meeting, in terms of the laws.

Consulting Foresters.

The Council has had under consideration a proposal that the Society should keep a list of Consulting Foresters, which might be open to the inspection of proprietors and those in

charge of landed estates who desire advice in connection with the management of woodlands under their control, but has decided not to proceed with the scheme in the meantime.

Deputation to the Chancellor of the Exchequer.

The Resolution passed at last Annual Meeting was duly forwarded to the Chancellor of the Exchequer, and the Deputation then appointed met him at the House of Commons on 22nd March last. A full report of the Meeting was taken by an Official Reporter for the Government, but was not made public. A short report, adjusted by the Government Officials and the Deputation, was afterwards handed to the Press. A copy of this report and of that part of the Chancellor's Budget speech relating to forestry will be found at page 200 of Vol. XXII. of the *Transactions*. As suggested by the Chancellor, a small committee of the Council was appointed to give him any further information he might call for.

The Development Act.

Shortly after the Development Bill was introduced into the House of Commons, the Council had under consideration a suggestion that the Society should ask for a grant out of the Development Fund, to enable a complete survey of all unafforested land in Scotland, situated below the 800 feet contour level, being undertaken by competent judges of its capacity for afforestation, and that the Society might carry out this work. It was pointed out that the Chancellor of the Exchequer had accepted the Society's programme as contained in their Resolutions, and had been informed of the appointment of the Committee to give him any further information he might call for, and it was decided that it would be inexpedient at this stage to make a representation through any other Department. The following Resolution was then passed, and sent to the Prime Minister and the Chancellor of the Exchequer:—

"The Council of the Royal Scottish Arboricultural Society supports the Deputation from the Society which met the Chancellor of the Exchequer, and thanks Mr Lloyd George for his reception of the Deputation, and for the excellent outline of silvicultural policy laid down by him in his Budget speech. The Council urges that the Government should, as soon as possible, give practical effect in Scotland to the intentions expressed by the Chancellor of the Exchequer in his reply to the Society's Deputation and in his Budget speech—(*a*) By creating a Board of Forestry; (*b*) By providing Demonstration Forests and Forest Gardens, and by otherwise assisting the development of University and other Educational enterprise; and (*c*) By carrying out a survey of all areas throughout the country suitable for commercial planting."

The Bill was considerably altered and amended in Committee, and became law on 3rd December 1909.

By the Act as it now stands a Development Fund is created, to which there is to be carried during the present year and the next four years a sum of £500,000 per annum, to be charged on and issued out of the Consolidated Fund, in addition to any other sums that may be specially voted by Parliament. This fund is to be devoted to the economic development of the United Kingdom, and amongst other industries to be benefited are agriculture and forestry. The means by which the latter is to be developed include—(1) The conducting of inquiries, experiments, and research for the purpose of promoting forestry and the teaching of methods of afforestation; (2) the purchase and planting of land found after inquiry to be suitable for afforestation.

The Treasury will only entertain applications recommended by the Development Commissioners, who have not yet been appointed.

The bodies who can obtain grants or loans are—a Government Department, or any of the following applying through a Government Department, viz.:—"A public authority, university, college, school, or institution, or an association of persons or company not trading for profit."

From the foregoing it will be seen that a Society such as this has power to ask for a grant or loan through a Government Department for the purposes mentioned in the Act. No doubt, large claims will be made on behalf of agriculture and other industries, but the Council believe that, in view of the Society's representations to the Government, a fair share of the money available will be devoted to forestry in Scotland. They, however, propose to keep in view their right to apply, through a Government Department, for grants or loans to be used by the Society in promoting forestry in terms of the Act.

By Clause 5 of the Act, where land is required for the purpose of a grant or loan, it can be acquired and held for these purposes, and powers may be obtained, if necessary, to acquire it compulsorily.

Death Duties on Woodlands.

When the Budget was before Parliament, the Council decided to make a representation to the Government on the subject of the new Death Duties as affecting woodlands, and a Committee was appointed to deal with the matter. The Committee prepared a Memorandum of suggestions for registration of forests worked under an approved scheme of management in Scotland, and for relief from Death Duties on them, which was duly forwarded to the Government, and although these suggestions were not altogether adopted, the Committee were able to adjust with the Government Officials the clause as it now stands in the Bill,

which is believed to be as satisfactory a solution of the problem as can be expected at this time.

Consulting Foresters.

Mr W. S. Haldane drew attention to the question of Consulting Foresters, and expressed the opinion that the Society should ask the Council to further consider that question. It was by a very narrow vote that the question had been settled in Council that day in face of a unanimous recommendation by the Committee, to whom the matter had been submitted for consideration. He was speaking particularly in the interests of small proprietors. He knew how useful it would be to small proprietors if they were able to get the advice of expert men, especially if they were in the neighbourhood and available not only to inspect their woods once in a way, but to give continuous advice in regard to them.

Mr Munro Ferguson said he would be sorry if the subject were dropped. He was sure there was a wide field in Scotland for taking and giving advice; advice which varied very much in different circumstances. It was especially needed by small owners of woodlands. It was impossible to discriminate on the governing body of that Society who was fit to be in the various categories of advisers suited for each kind of planting or operation upon which advice was needed; but he did think that to have a list on which they could have the names and qualifications of those who could give their services for that kind of work would be of enormous advantage to silviculture. He regarded the subject as one of first-class importance.

On the motion of Mr Haldane, the subject of Consulting Foresters was remitted back to the Council for further consideration, and with this addendum, the report of the Council was adopted.

Finances.

Mr John Methven, Convener of the Finance Committee, submitted the Accounts for the past year in connection with the Dunn Memorial Fund and the Society (see Appendices A and B). He read the Auditor's docquet on the Accounts, and pointed out that it was proposed to apply the proceeds of the Dunn Memorial Fund in improving the Library. Mr Massie seconded the motion, which was adopted.

In connection with the Excursion Accounts (Appendix C), the SECRETARY explained that these had not yet been closed and audited, but he submitted the details of the expenditure in Bavaria, and moved that the Council be empowered to have the Accounts closed and audited, and appended to the Proceedings of the Meeting in the usual way. Mr BUCHANAN seconded, and the motion was adopted.

ABERDEEN AND NORTHERN BRANCHES.

Reports from the Aberdeen Branch were also read by the Secretary, and on the motion of Mr GAMMELL were adopted. (See Appendices D and E.)

The Secretary explained that the Reports from the Northern Branch had not yet reached him, but on his suggestion it was remitted to the Council to receive the Reports and append them to the Proceedings of the Meeting as formerly. (See Appendices F and G.)

CHAIRMAN'S REMARKS.

Sir KENNETH MACKENZIE, in demitting office, thanked the Council for the support they had always given him during his tenure of office. As his successor, he nominated Sir JOHN STIRLING-MAXWELL, Bart. of Pollok, who, he said, was engaged in carrying out a policy of planting on high ground in poor soil in Scotland. He thought he would make an ideal President. The nomination was seconded by Mr JAMES WHITTON, Glasgow, and agreed to, whereupon Sir John Stirling-Maxwell took the chair, and returned thanks for the honour conferred upon him.

OFFICE-BEARERS.

The following were then elected to fill the other vacancies on the list of Office-Bearers at this time, namely:—Vice-Presidents—Sir KENNETH MACKENZIE, Mr W. S. FOTHRINGHAM of Murthly, and Mr ROBERT FORBES, Kennet Estate Office, Alloa. Councillors—Messrs G. U. MACDONALD, ROBERT ALLAN, ADAM SPIERS, JAMES COOK, ALEXANDER MITCHELL, Sir ANDREW AGNEW, Bart., and FRANK SCOTT. The Hon. Secretary, the Secretary and Treasurer, the Hon. Editor, the Auditor, and the Hon. Consulting Officials and Local Secretaries were re-elected. (For list of Office-Bearers for 1910, see Appendix H.)

Correspondents.

On the motion of the Secretary, the election by the Council of the following Correspondents was confirmed for one year, namely :—

Canada—Robert Bell, I.S.O., M.D., LL.D., D.Sc. (Cantab.), F.R.S. of Ottawa, Chief Geologist to Government of Canada, Ottawa.

India—F. L. C. Cowley Brown, Deputy Conservator of Forests, c/o Inspector-General of Forests, Simla.

British East Africa—Edward Battiscombe, Assistant Conservator of Forests, Nigeri, *via* Naivasha, East Africa Protectorate.

United States of America—Hugh P. Baker, Forester, State College, Pennsylvania.

Cape Colony—W. Nimmo Brown, M'Kenzie's Farm, Mowbray, P.O.

Excursion.

Mr Buchanan, Convener of the Excursion Committee, mentioned that at the General Meeting held at Stirling, it was agreed that the Society should visit the West Highlands in the course of the summer. He suggested that permission might be asked to visit Lochiel and Invergarry, and that the President might be willing to receive the Society at Corrour. He thought it might be necessary to hold the Excursion on an earlier date than usual, and mentioned that the Council had recommended the last week in June as a suitable time. This was agreed to, and the matter was remitted to the Council with powers.

Exhibition at Dumfries.

Mr Adam Spiers mentioned that the usual Forestry Exhibition in the Highland and Agricultural Society's Show would be held this year at Dumfries, and reminded the Members that the Schedules had already been issued to them. He said the Exhibition appeared to be popular with visitors to the Show, and he expressed the hope that proprietors in the South of Scotland and elsewhere would give the Exhibition their cordial support, so as to ensure its success.

Notice of Motions.

Notice was given of the following Motions:—

1. By Mr A. D. Richardson—to alter Law XIV.

   (*a*) To delete the words "one of the retiring Vice-Presidents, and four of the retiring Councillors," in the second clause of the second sentence; and

   (*b*) To insert the following as the third sentence of the Law:—"One of the retiring Vice-Presidents or one of the retiring Councillors may be elected as President, and two or more of the retiring Councillors may be elected as Vice-Presidents; but none of the retiring Vice-Presidents or retiring Councillors shall be eligible for re-election till after the expiry of one year."

2. By Dr Nisbet.

   "Whereas a School for Forest Apprentices has been established for England and Wales in the Forest of Dean (Gloucestershire), and a similar School for Ireland, at Avondale (Co. Wicklow), and whereas Scotland, in the unanimous opinion of the Royal Commissioners, who reported on afforestation in 1909, contains twice as much plantable land as all the rest of the United Kingdom taken together, this Society urges that a School for training Foresters should at once be established in Scotland at some convenient woodland centre, where planting experiments can also be carried on systematically.

   "As Scotland has over $2\frac{3}{4}$ times as many woods and plantations as Ireland, and nearly $2\frac{1}{2}$ times as much mountain and heath land, it is unfair that Scotland should still be without a School for training Forest Apprentices, while Ireland was provided with one on a very liberal scale five years ago. And the Royal Scottish Arboricultural Society considers the present an opportune moment for asking the Government to remove this unfairness, as the Development Act, 1909,

is now about to come into force, under which funds have been specially granted for (along with other objects) providing and improving instruction in Forestry, and for making experiments in planting.

"And it is further resolved that copies of this Resolution be sent to—(1) the Secretary for Scotland, (2) the Scottish Education Board, (3) the President of the Board of Agriculture, and (4) the Chancellor of the Exchequer, and that every Scottish Member of Parliament be asked to use his best influence to obtain the establishment of such a School for Forest Apprentices at the earliest possible date."

In explaining his Motion, Dr Nisbet said his experience was that the collegiate instruction was not suitable for the class of lads they wanted to train as forest apprentices—they should be trained at some central locality. There was no reason why Scotland should continue to be treated unfairly, where the plantable land was twice as much as in all the rest of the United Kingdom put together.

The Motion was referred to the Council to report upon.

Thanks to the Retiring President.

On the Motion of the President, a hearty vote of thanks was recorded to Sir Kenneth Mackenzie for his services to the Society during the last three years.

The President's Address.

Sir John Stirling-Maxwell then gave his Presidential Address, a full report of which will be found in the *Transactions*.

Mr T. A. Nelson of Achnacloich, proposed a vote of thanks to the President for his Address, and, in seconding the Motion, Mr Munro Ferguson referred to the President's experience in planting in the Highlands, and threw out a suggestion that the Society might take in hand to make a survey, of a small area, on the lines the Society expected the Government should adopt, in surveying all the areas throughout the country suitable for commercial planting. He thought the Society should also renew their application to the Government in similar or other suitable terms to those adopted in their recent Resolutions.

APPENDIX A.

ABSTRACT OF ACCOUNTS

IN CONNECTION WITH

THE MALCOLM DUNN MEMORIAL FUND, 1909.

RECEIPTS.

Balance in Bank at close of last Account, . .	£18 12 6
Dividend on £100 3 per cent. Redeemable Stock of Edinburgh Corporation, payable at Whitsunday and Martinmas 1909, £3, *less* Tax 3s. 6d., ...	2 16 6
	£21 9 0

PAYMENTS.

Nil.

Balance carried forward, being sum in National Bank of Scotland on Account Current, ...	£21 9 0

Note.—The Capital belonging to the Fund consists of £100 3 per cent. Redeemable Stock of Edinburgh Corporation.

EDINBURGH, 20*th January* 1910.—Examined and found correct. The Certificate by the Bank of above balance, and Edinburgh Corporation Stock Certificate, have been exhibited.

JOHN T. WATSON,
Auditor.

Less for scarce Parts bought,		0 15 0				
			5 11 0			
6. Income Tax Recovered,			2 12 0			
			£873 8 4			£873 8 4

and French Notes for *Transactions*, £10,		55 0 0			
Secretary and Treasurer,		100 0 0			
Advertising, Insurance, and Premium on Secretary's Bond of Caution,		4 15 3			
Councillors' Railway Fares, £2, 5s. 6d.; and Secretary's Expenses with Deputation in London, £4, 10s.,		6 15 6			
Outlays on Society's Pictures, £6, 12s.; and Shelving for Papers, etc., £1, 8s. 6d.,		8 0 6			
Postages and Miscellaneous Outlays, viz.:					
Postages of Parts I. and II. of Vol. XXII. of *Transactions*,	£31 18 4				
General Postages, Commissions on Cheques, and Petty Outlays,	27 0 6				
		58 18 10			
6. Sum transferred to Capital,				206	6 10
7. Balance of Revenue carried to next year, subject to payment of cost, etc., of January *Transactions*,				213	5 4
Arising thus—					
Balance at credit of Account Current with National Bank of Scotland, Ltd.,		£13 9 4			
Sum on Deposit Receipt with Do.,		200 0 0			
		£213 9 4			
Less Balance due to Treasurer,		0 4 0			
		£213 5 4			

EDINBURGH, 20*th January* 1910.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1909, of which the above is an Abstract, and have found them correct. The Securities, representing the Society's Funds as above, have also been exhibited to me.

JOHN T. WATSON, *Auditor.*

APPENDIX B.—Abstract of Accounts for Year ending 31st December 1909.

I.—CAPITAL.

CHARGE.			DISCHARGE.		
Funds at 31st December 1908,		£1709 18 6	1. Proportion of Life Members' Subscriptions transferred to Revenue,		£115 15 0
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 107½,	£537 10 0		*Purchased* £408 8 4 / 92 7 8 — £117 7 6 less ⅛ of Full Life Subscription, 18 7 6 less ⅛ of Commuted Subscriptions,		
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 114½,	572 10 0		2. Price of £400 North British Railway Company, No. 1, 4% Preference Stock, at 109,	£436 0 0	
£400 North British Railway Company 3 per cent. Debenture Stock, at 85½,	344 0 0		3. Expenses in connection with above purchase,		4 12 3
	£1453 0 0		4. Decrease in value of Railway Stocks at 31st December 1909,	£11 0 6	
Furniture, etc., in Society's Room,	10 14 1		And depreciation on Office Furniture, say	0 14 1	
Balance of Capital in Bank,	231 4 5				44 14 1
			5. Funds, etc., at 31st December 1909—		
2. Life Members' Subscriptions in 1909,		156 16 0	£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 105,	£527 10 0	
New Members,	£196 16 0		£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 112,	560 0 0	
Ordinary Members by commutation,	20 0 0		£400 North British Railway Company 3 per cent. Debenture Stock, at 83½,	335 10 0	
			£400 North British Railway Company, No. 1, 4% Preference Stock, at 105¾,	422 0 0	
3. Sum transferred from Revenue,		206 0 10		£1845 0 0	
			Furniture, etc., in Society's Room, cost £60 0 0,		
			Less for depreciation, say	40 0 0	
					1805 0 0
	£2070 1 4				£2070 1 4

II.—REVENUE.

CHARGE.			DISCHARGE.		
1. Balance in hand at 31st December 1908,		£264 0 3	1. Printing, Stationery, etc.,		£161 8 4
2. Ordinary Members' Subscriptions,		404 10 6	Vol. XXII, Part I, *Transactions*, £74 9 6		
Arrears at 31st December 1908, £12 19 6			Authors' Reprints, 3 4 0		
Add Arrears written off but since recovered, 0 15 0				£77 13 6	
	£13 17 6		Vol. XXII, Part II of *Transactions*,	£4 16 0	
Subscriptions for 1909, £425 4 0				£82 9 6	
Less Received in 1908, 7 8 6			General Printing and Stationery,	4 0 0	
	417 15 6		Forestry Periodicals, Binding, etc.,	6 —	
Subscriptions for 1910 received in 1909,	4 10 0			£86 9 6	
	£436 3 6		*Less* Receipts for Advts. in *Trans.*,	4 16 2	
Deduct—				£81 13 4	
Cancelled or written off as irrecoverable at 31st December 1909, £7 10 6			2. Prizes (Money, £36, 5s.; Medals, £7, 13s.; Books, £5, 1s.),	£49 8 0	
Arrears at 31st December 1909, 24 3 0			*Less* Donation from the Highland and Agricultural Society, for Prizes awarded for Horse-drawn Timber exhibited at Stirling, £12, 10s.; and from Prize Winners in exchange for Medals and Books, £4, 1s.,	16 11 0	
	31 13 6				32 17 0
	£404 10 0		3. Forestry Exhibition at the Highland and Agricultural Society's Show at Stirling—		
7. Proportion of Life Members' Subscriptions transferred from Capital,		135 15 0	Printing,	£9 17 6	
4. Dividends and Interest,		61 0 1	Advertising,	0 15 0	
7. *Transactions*, etc., sold,	£6 6 0		Extra Tabling, Racks, Etc.,	2 1 9	
Less for scarce Parts bought,	0 15 0		Wages, etc.,	3 2 3	
	5 11 0		New Flag, and painting old one,	3 1 0	
6. Income Tax Recovered,		2 12 9	Incidental expenses,	1 14 3	
				20 11 9	
			4. Contribution to Aberdeen and Northern Branches, £5 each,	10 0 0	
			5. Expenses of Management,		237 8 1
			Rent of Room, and Hall for Annual Meeting,	£20 15 0	
			Auditor,	3 3 3	
			Hon. Editor for Assistant, £25; for German and French Notes for *Transactions*, £10,	35 0 0	
			Secretary and Treasurer,	100 0 0	
			Advertising, Insurance, and Premium on Secretary's Bond of Caution,	4 15 3	
			Councillors' Railway Fares, £2, 5s. 6d.; and Secretary's Expenses with Deputation in London, £4, 10s.,	6 15 6	
			Outlays on Society's Properties, £6, 12s.; and Shelving for Papers, etc., £1, 8s. 6d.,	8 0 6	
			Postages and Miscellaneous Outlays, viz.—		
			Postages of Parts I. and II. of Vol. XXII. of *Transactions*, £31 18 4		
			General Postages, Commissions on Cheques, and Petty Outlays, 27 0 6		
				58 18 10	
			6. Sum transferred to Capital,		206 6 10
			7. Balance of Revenue carried to next year, subject to payment of cost, etc., of January *Transactions*,		213 5 4
			Arising thus—		
			Balance at credit of Account Current with National Bank of Scotland, Ltd.,	£13 9 4	
			Sum on Deposit Receipt with Do.,	200 0 0	
				£213 9 4	
			Less Balance due to Treasurer,	0 4 0	
				£213 5 4	
	£873 8 4				£873 8 4

EDINBURGH, *20th January* 1910.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1909, of which the above is an Abstract, and have found them correct. The securities, representing the Society's Funds as above, have also been exhibited to me.

JOHN T. WATSON, *Auditor.*

APPENDIX C.

Excursion Account.

Abstract of Accounts—Year 1909.

Balance brought from last Year, ...				£35 18 1
Deduct—Auditor's Fee for 1908, . .		£2 2 0		
Payments for Photographs	£9 12 0			
Less Received . .	8 0 0			
		1 12 0		
Printing Circulars,		0 12 0		
			4 6 0	
				£31 12 11

Excursion to Bavaria.

RECEIPTS.

Contributions to Common Purse, . . .		£714 9 6	
Collected for 1st Class on Steamer, . .		16 10 0	
Do. Edinbugh to London Railway Tickets,		49 4 0	
		£780 3 6	

PAYMENTS.

57 Continental Tickets at £6, 11s. 9d., *less* abatement, ...		£373 18 9		
In Bavaria—				
Hotels, Lunches, etc.,	£261 12 6			
Local Railways, . .	11 12 6			
Driving . . .	18 9 0			
Incidental, . .	11 16 0			
Field Glasses presented to Professor Mayr, .	5 18 6			
		309 8 6		
Extras for 1st Class on Steamer,		16 10 0		
Edinburgh to London Tickets, .		49 4 0		
Printing Circulars, etc., . .		4 16 0		
Blocks of Photos for Excursion Reports, ...		4 10 0		
Proportion of Printing these and Reports in *Transactions*, etc., .		6 18 6		
Presentation Pamphlet, . .		4 17 6		
Miscellaneous Outlay, . .		4 2 2		
			774 5 5	
				5 18 1
Balance carried forward to next Account, being sum in National Bank of Scotland on Account Current,				£37 11 0

Edinburgh, 13*th June* 1910.—Examined with Vouchers and Memorandum Book and found correct. Bank Certificate of above balance of £32, 11s. also exhibited.

John T. Watson,
Auditor.

APPENDIX D.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY (ABERDEEN BRANCH).

REPORT 1909.

The Committee beg to submit the Fourth Annual Report of the Branch.

The affairs of the Branch have been conducted on similar lines to those of the preceding year. During the year, four meetings of the Branch have been held, on 12th December 1908, 22nd May, 4th September, and 16th October, 1909. Papers were read—by Mr Gammell at the Annual General Meeting in December last, on "An estimate of the possible cubic production of average woodland from portions of Deeside and Kincardineshire"; by Mr Crozier on, "The Forestry Problem in Britain," on 22nd May 1909; and by Professor Trail on "The Origin and Growth of the Woody Stem," on 16th October 1909; and an Excursion was made to Fasque on 4th September 1909. The Branch approached the Governors of the Aberdeen and North of Scotland Agricultural College on the subject of popular lectures in the city during the winter months, with the result that a short course of lectures by Mr Dawson has been arranged for Wednesday evenings, during the months of November and December. A motion by Mr France in support of the proposal to form a demonstration area for the North and East of Scotland was passed at the meeting held on 22nd May 1909, and transmitted to the Governors of the Agricultural College. It has now been arranged that lectures, held under the auspices of the Branch, which are of general interest and likely to attract people outside the Society, will be advertised at the expense of the Branch. On the recommendation of the Committee a circular has been issued to those Members of the Society, who are not members of the Branch, inviting them to join as soon as possible.

The Committee have again to record their thanks to Professor Trail, and the University Authorities, for being allowed to use the Botanical class-room for the meetings of the Branch.

APPENDIX E.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY—ABERDEEN BRANCH.

STATEMENT OF ACCOUNTS, YEAR 1909.

GENERAL ACCOUNT.

INCOME.

Balance at credit of last Account,	£11 18 0
By Cash Subscriptions from Members at 1s. each,	£3 19 0
,, Cash Grant from parent Society,	5 0 0
,, Cash Savings Bank Interest,	0 5 9
	£21 2 9

EXPENDITURE.

To Cash paid for use of Halls,	£0 5 0
,, Cash paid for Printing, etc.,	2 10 9
,, Cash paid Honorarium to late Secretary for year 1908, per Minute of 12th December 1908,	2 2 0
,, Cash paid postages and incidents for the year,	1 11 3
,, Balance,	14 13 9
	£21 2 9

EXCURSION ACCOUNT.

INCOME.

Balance at credit of last Account,	£1 4 4
Savings Bank Interest,	0 0 7
By Cash from 21 Members for Fasque Excursion at 2s. each	2 2 0
	£3 6 11

EXPENDITURE.

To Cash paid William Mutch, Printer,	£0 7 0
,, Cash paid Expense of Hiring at Excursion to Fasque	1 15 0
,, Balance	1 4 11
	£3 6 11

ABSTRACT.

Balance at credit of General Account,	£14 13 9
Balance at credit of Excursion Account,	1 4 11
	£15 18 8

ABERDEEN, *7th January* 1910.—I have examined the foregoing Statement of Accounts for Year 1909 of the Aberdeen Branch of the Royal Scottish Arboricultural Society, and have found the same correctly stated and fully vouched. The balance at the credit of the Society, at the end of the year, amounting to Fifteen pounds eighteen shillings and eightpence, is deposited in the Aberdeen Savings Bank.

J. G. HOPKINSON, *Auditor.*

APPENDIX F.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY (NORTHERN BRANCH).

REPORT 1909.

The Committee have the honour to submit the Report for the Branch for the second complete year of its existence. In consequence of the broken nature of the weather and other causes, it was not found possible to hold more than one meeting. Advantage was taken of the assembling of the Members of the Society together to hear an address by Mr Dawson on the subject of "Forestry Education," and also upon "Some Likely Foreign Trees," and an interesting and instructive discussion followed upon the address.

In consequence of the arrangements made by gentlemen connected with the Museum in Inverness for the care of objects of interest entrusted to them, the Committee of the Branch entered into communication with the Trustees of the Museum and arranged that if a collection of forestry specimens could be obtained by the Branch, the Trustees would house and take care of the collection. A circular was accordingly issued appealing for specimens, and already a commencement has been made. Specimens have been kindly presented by the Countess of Seafield and Lord Lovat. It is hoped that proprietors and others interested in wood-work and forestry in the neighbourhood will still further add to this collection, so as to make it really worthy of Arboriculture in the north of Scotland.

The Membership of the Branch to the end of the year is 95, which contrasts with a Membership of 70 when the Committee made the report this time last year.

The income of the Branch to the date of the return is £8, 18s., of which £5 has been received from the Parent Society and £3, 18s. from the Members and Subscribers. From the Statement of Accounts appended to this return, it will be seen that there is a sum of £10, 7s. 1d. at the credit of the Branch, which sum is lying in bank in the name of the Treasurer.

On behalf of the Committee of the Northern Branch of the Society,

ALEX. FRASER,
Secretary and Treasurer.

APPENDIX G.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY—NORTHERN BRANCH.

Abstract of Receipts and Expenditure for Year ending 31st December 1909.

RECEIPTS.

1909.			
Sum in Bank at 31st December 1908,	£7	17	6
By Cash Members' Subscriptions to Branch during year 1909,	4	5	0
,, Cash Contribution from Parent Society,	5	0	0
Bank Interest for year,	0	2	7
	£17	5	1

EXPENDITURE.

1909.				
To Cash Paid Caretaker, Town Hall, Inverness, for room,	£0	10	0	
,, Cash Paid Deed Box for Papers,	1	6	0	
,, Cash Paid Printing, Stationery, Postages, etc.,	2	11	7½	
				£4 7 7½
Balance at credit of the Branch at 31st Dec. 1909,				12 17 5½
Made up thus—				
Sum in Treasurer's hands (since paid into Bank),	£2	10	4½	
Sum in Bank,	10	7	1	
				£17 5 1

APPENDIX H.

Office-Bearers for 1910:—

PATRON.

His Majesty The King.

PRESIDENT.

Sir John Stirling-Maxwell, Bart. of Pollok, Pollokshaws.

VICE-PRESIDENTS.

John Methven, Nurseryman, 15 Princes Street, Edinburgh.
Maclachlan of Maclachlan, Castle Lachlan, Argyll.
W. H. Massie, Nurseryman, 1 Waterloo Place, Edinburgh.
Sir Kenneth J. Mackenzie, Bart. of Gairloch, 10 Moray Place, Edinburgh.
W. Steuart Fothringham of Murthly, Perthshire.
Robert Forbes, Overseer, Kennet Estate Office, Alloa.

COUNCIL.

Dr A. W. Borthwick, Royal Botanic Garden, Edinburgh.
George Leven, Forester, Auchincruive, St Quivox, Ayr.
John Broom, Wood Merchant, Bathgate.
Sydney J. Gammell of Drumtochty, Countesswells House, Bieldside, Aberdeen.
John W. M'Hattie, Superintendent of City Parks, City Chambers, Edinburgh.
Earl of Mansfield, Scone Palace, Perth.
John F. Annand, Lecturer on Forestry, Armstrong College, Newcastle-upon-Tyne.
Charles Buchanan, Overseer, Penicuik Estate, Penicuik.
A. T. Gillanders, F.E.S., Forester, Park Cottage, Alnwick.
John D. Crozier, Forester, Durris Estate, Drumoak, Aberdeenshire.
James Whitton, Superintendent of City Parks, City Chambers, Glasgow.
D. F. Mackenzie, F.S.I., Estate Office, Mortonhall, Midlothian.
W. S. Haldane, of Foswell, 55 Melville Street, Edinburgh.
Fred. Moon, Forester, Bowmont Forest, Roxburgh.
G. U. Macdonald, Overseer, Haystoun Estate, Woodbine Cottage, Peebles.
Robert Allan, F.S.I., F.H.A.S., Factor, Polkemmet, Whitburn.
Adam Spiers, Timber Merchant, Warriston Saw-Mills, Edinburgh.
James Cook, Land Steward, Arniston, Gorebridge, Midlothian.
Alexander Mitchell, Forester, Rosebery, Gorebridge, Midlothian.
Sir Andrew Agnew, Bart., Lochnaw Castle, Stranraer.
Frank Scott, Forester, Jeaniebank, Scone.

HON. EDITOR.

Lieut-Colonel F. Bailey, F.R.S.E., 7 Drummond Place, Edinburgh.

AUDITOR.

John T. Watson, 16 St Andrew Square, Edinburgh.

HON. SECRETARY.

The Right Hon. R. C. Munro Ferguson, M.P., of Raith and Novar, Raith House, Kirkcaldy.

SECRETARY AND TREASURER.

Robert Galloway, S.S.C., 19 Castle Street, Edinburgh.

TRUSTEES.

The Right Hon. R. C. Munro Ferguson, M.P., W. Steuart Fothringham of Murthly, and Sir John Stirling-Maxwell, Bart. of Pollok.

LOCAL BRANCHES.

Aberdeen.

President.—Sydney J. Gammell of Drumtochty.

Hon. Secretary.—George D. Massie, Solicitor, 143 Union Street, Aberdeen.

Northern.

President.—Lord Lovat.

Hon. Secretary.—Alex. Fraser, Solicitor, 63 Church Street, Inverness.

LOCAL SECRETARIES.

Scotland.

Counties.	
Aberdeen,	John Clark, Forester, Haddo House, Aberdeen.
	John Michie, M.V.O., Factor, Balmoral, Ballater.
Argyle,	John D. Sutherland, Estate Agent, Oban.
Ayr,	Andrew D. Page, Overseer, Culzean Home Farm, Ayr.
	A. B. Robertson, Forester, The Dean, Kilmarnock.
Berwick,	Wm. Milne, Foulden Newton, Berwick-on-Tweed.
Bute,	Wm. Inglis, Forester, Cladoch, Brodick.
	James Kay, Forester, Bute Estate, Rothesay.
Clackmannan,	Robert Forbes, Estate Office, Kennet, Alloa.
Dumfries,	D. Crabbe, Forester, Byreburnfoot, Canonbie.
East Lothian,	W. S. Curr, Factor, Ninewar, Prestonkirk.
Fife,	Wm. Gilchrist, Forester, Nursery Cottage, Mount Melville, St Andrews.
	Edmund Sang, Nurseryman, Kirkcaldy.
Forfar,	James Crabbe, Forester, Glamis.
	James Robertson, Forester, Barnhill, Broughty Ferry.
Inverness,	James A. Gossip, Nurseryman, Inverness.
Kincardine,	John Hart, Estates Office, Cowie, Stonehaven.
Kinross,	James Terris, Factor, Dullomuir, Blairadam.
Lanark,	John Davidson, Forester, Dalzell, Motherwell.
	James Whitton, Superintendent of Parks, City Chambers, Glasgow.
Moray,	D. Scott, Forester, Darnaway Castle, Forres.
Perth,	John Scrimgeour, Doune Lodge, Doune.
Renfrew,	S. MacBean, Overseer, Erskine, Glasgow.
Ross,	John J. R. Meiklejohn, Factor, Novar, Evanton.
	Miss Amy Frances Yule, Tarradale House, Muir of Ord.
Roxburgh,	John Leishman, Manager, Cavers Estate, Hawick.
	R. V. Mather, Nurseryman, Kelso.
Sutherland,	Donald Robertson, Forester, Dunrobin, Golspie.
Wigtown,	James Hogarth, Forester, Culhorn, Stranraer.
	H. H. Walker, Monreith Estate Office, Whauphill.

England.

Counties.	
Beds, . .	Francis Mitchell, Forester, Woburn.
Berks, . .	W. Storie, Whitway House, Newbury.
Cheshire, .	Wm. A. Forster, Belgrave Lodge, Pulford, Wrexham.
Devon, . .	James Barrie, Forester, Stevenstone Estate, Torrington.
Durham, .	John F. Annand, Lecturer on Forestry, Armstrong College, Newcastle-upon-Tyne.
Hants, . .	W. R. Brown, Forester, Park Cottage, Heckfield, Winchfield.
Herts, . .	James Barton, Forester, Hatfield.
	Thomas Smith, Overseer, Tring Park, Wigginton, Tring.
Kent, . .	R. W. Cowper, Gortanore, Sittingbourne.
Lancashire, .	D. C. Hamilton, Forester, Knowsley, Prescot.
Leicester, .	James Martin, The Reservoir, Knipton, Grantham.
Lincoln, .	W. B. Havelock, The Nurseries, Brocklesby Park.
Middlesex, .	Professor Boulger, 11 Onslow Road, Richmond Hill, London, S.W.
Notts, . .	Wm. Elder, Thoresby, Ollerton, Newark.
	W. Michie, Forester, Welbeck, Worksop.
	Wilson Tomlinson, Forester, Clumber Park, Worksop.
Suffolk, . .	George Hannah, The Folly, Ampton Park, Bury St Edmunds.
Surrey, . .	John Alexander, 24 Lawn Crescent, Kew Gardens.
Warwick, .	A. D. Christie, 16 Oak Tree Lane, Selly Oak, Birmingham.
Wilts, . .	Andrew Boa, Land Agent, Glenmore, The Avenue, Trowbridge.
York, . .	D. Tait, Estate Bailiff, Owston Park, Doncaster.

Ireland.

Dublin, . .	A. C. Forbes, Department of Forestry, Board of Agriculture.
	James Wilson, B.Sc., Royal College of Science, Dublin.
	Arch. E. Moeran, Lessadell, Thelorgan Park.
Galway, . .	Thomas Robertson, Forester and Bailiff, Woodlawn.
King's County,	Wm. Henderson, Forester, Clonad Cottage, Tullamore.
Tipperary, .	David G. Cross, Forester, Kylisk, Nenagh.
	Alex. M'Rae, Forester, Dundrum.

CORRESPONDENTS.

Canada, .	Robert Bell, I.S.O., M.D., LL.D., D.Sc.(Cantab.), F.R.S. of Ottawa. Chief Geologist to Government of Canada, Ottawa.
India, . .	F. L. C. Cowley Brown, Deputy Conservator of Forests, c/o Inspector-General of Forests, Simla.
British East Africa, .	Edward Battiscombe, Assistant Conservator of Forests, Nigeri, *via* Naivasha, East Africa Protectorate.
United States of America,	Hugh P. Baker, Forester, State College, Pennsylvania.
Cape Colony, .	W. Nimmo Brown, M'Kenzie's Farm, Mowbray, P.O.

PHOTOGRAPHIC ARTIST.

A. D. Richardson, 6 Dalkeith Street, Joppa.

APPENDIX I.

Presentations to the Society's Library since the publication of last List in Volume XXII. Part 2.

Books.

1. *Trees and Shrubs of the British Isles.* In parts. By Cooper and Westell.
2. *Trees.* Vol. v.—*Form.* By the late H. Marshall Ward.
3. *Die Spitzenberg'schen Kulturgeräthe*, 1898. Presented by Professor Mayr, Munich.
4. *Proceedings of a Conference of Governors in the White House, Washington, D.C.*, May 13-15 1908, *on the subject of Conservation of Natural Resources.*
5. *Bulletin of Royal Botanic Gardens, Kew*, 1909.
6. *Illustrations of Conifers.* By H. Clinton Baker.
7. *British Woods and their Owners.* By John Simpson.
8. *In the Evening.* By Charles Stewart.

Government Reports.

9. *Report of Commissioners of Woods and Forests, London*, 29th June 1909.
10. *Leaflets of the Board of Agriculture and Fisheries.* London.
11. *Leaflets of the Department of Agriculture and Technical Instruction for Ireland.*
12. *Reviews of Forest Administration in British India for* 1906-1907 *and* 1907-1908.
13. *Annual Report of the Forest Department of the Madras Presidency*, 1907-1908.
14. Indian Forest Department Pamphlets:—
    The Collection of Statistical Data relating to the principal Indian Spices. By A. M. F. Caccia.
    Forest Reservation in Burma in the Interests of an Endangered Water Supply. By Alex. Rodger.
    Burmese Leza Wood. By R. S. Troup.
    Carallia Wood. By R. S. Troup.
    Burmese Inwood. By R. S. Troup.
15. *Report of the Superintendent of Forestry, Canada, for* 1908 and 1909.
16. *Tree Planting on the Prairies of Manitoba*, 1907. Forestry Branch of Department of Interior of Canada.
17. *Trees Free to Farmers*, 1907. Forestry Branch of Department of Interior of Canada.

18. *Bulletins of Department of Agriculture, Canada.*
19. Bulletins of Forestry Branch of Department of Interior of Canada :—
    Care of Planting of a Forest of Evergreens, 1908.
    Forest Products of Canada, 1909.
    Forest Conditions in the Crow's Nest Valley, Alberta, 1909.
    The Riding Mountain Forest Reserve, 1909.
    Forest Fires in Canada during 1908.
20. *Report of State Forest Administration of South Australia.* (2 copies). 1907-1908.
21. *Journal of Department of Agriculture, Victoria.* March 1909.
22. *Annual Report of the Woods and Forest Department of South Australia,* 1908-1909.
23. *Report of Conservator of Forests, Cape of Good Hope,* 1908.
24. *Report on the Forests of British East Africa.* By D. E. Hutchins, 1909.
25. *Forestry in New Zealand,* 1909.
26. Farmers' Bulletins :—*Forest Fires in* 1903. From the United States Department of Agriculture. Forest Service Circulars.
27. *Report of the Pennsylvania Department of Forestry,* 1907.
28. *Bulletins of Pennsylvania State College Agriculture Experimental Station.*
29. Bulletin No. 4 (National Conservation Commission). *Presenting the Report of the National Conservation Commission, and a Chronological History of the Conservation Movement, United States of America.*

Societies' Reports and Transactions.

30. *Transactions of the Highland and Agricultural Society,* 5th series, vol. xxi., 1909.
31. *Transactions of the Botanical Society of Edinburgh,* vol. xxiii., part 4, 1908, and vol. xxiv., part 1, 1909.
32. *Annual Report of the Smithsonian Institution,* 1907.
33. *Scientific Proceedings of the Royal Dublin Society,* vol. xi., Nos. 31 and 32, Contents and Index.
34. *Scientific Proceedings of the Royal Dublin Society,* vol. xii., Nos. 3-20, 22 and 23, and Contents of vol. ix.
35. *Economic Proceedings of the Royal Dublin Society,* No. 16 of vol. i., and Index.
36. *Reports of the Canadian Forestry Association,* 1902-1909.
37. *Canadian Forestry Journal.* June and October, 1909. Nos. 2 and 3 of vol. v.
38. *Transactions of the Foresters' and Gardeners' Society of Argyll,* vol. i., 1909.
39. *Proceedings of the Society of American Foresters,* No. 2, vol. iv., 1909.
40. *Transactions and Proceedings of the Perthshire Society of Natural Science,* vol. v., part 1, 1908-09.
41. *Journal of the Royal Horticultural Society,* vol. xxxiv., part 3, and vol. xxxv., parts 1 and 2.
42. *Journal of Royal Agricultural Society,* vol. lxix., 1908.

Reprints and Miscellaneous.

43. *Indian Forester.* Series, Forest Zoology :—
    Leaflet No. 1 *The Sal Bark Borer.*
    ,, 2 *The Teak Defoliator.*
    ,, 3 *The Teak Leaf Skeletoniser.*
44. *Indian Forest Memoirs,* vol. i., parts 2 and 4 ; vol. ii., part 1.
45. *Forest Pamphlets,* Nos. 4-7.
46. *Indian Forest Memoirs* (Economic Product Series), *Indian Woods and their Uses,* vol. i., No. 1.
47. *Prospectus of Biltmore Forest School,* 1909-10.
48. *Biltmore Lectures on Silviculture.* By C. A. Schenck, Ph.D.
49. *Forest Protection.* By C. A. Schenck, Ph.D.
50. *Forest Mensuration.* By C. A. Schenck, Ph.D.
51. *Afforestation and Timber Planting in Great Britain and Ireland.* By Dr Nisbet. *Journal of Royal Society of Arts,* 26th March 1909.
52. *Working-Plan Report on the Keir Woods,* 1907-1940. By Prof. Fisher.
53. *Bulletin of Lloyd Library,* No. 11. *Reproduction Series* No. 7.
54. *Calendar for* 1909-10 *of Edinburgh and East of Scotland College of Agriculture.*
55. *Catalogue of Ohio State University,* 1909.
56. *Report of Board of Trustees of Ohio State University,* 1908.
57. *Directory of the Royal Society of Arts,* 1909.
58. *American Cratægi in the Species Plantarum of Linnæus.* By C. S. Sargent.
59. *Report on the Chestnut Tree Blight, Pennsylvania.* By J. Mickleborough, Ph.D., 1909.
60. *Jahresbericht des Königl Pomologischen Instituts zu Proskau,* 1908.
61. Back Parts of *Transactions* and of *Journal of Forestry.* From James Robertson, formerly Wood Manager, Panmure.
62. Back Parts of *Transactions.* From W. Davidson, Wood Manager, Panmure.
63. *Quarterly Journal of Forestry.* London.
64. *Forestry Quarterly.* New York.
65. *Forestry and Irrigation.* Washington.
66. *Journal of the Board of Agriculture for Ireland.*
67. *Journal of the Board of Agriculture.* London.
68. *Skogsvårdsföreningens Tidsskrift.* Stockholm.
69. *Tidsskrift for Skogbrug.* Kristiania.
70. *Timber Trades Journal.* London.
71. *Journal da Commerce des Bois.* Paris.
72. *Timber News.* London.
73. *Estate Magazine.*
74. *Agricultural Economist.* London.
75. *Indian Forester.* Allahabad.
76. *L'Alpe.* Bologna, October 1908.
77. *Revue des Eaux et Forêts.* Paris. (By purchase.)
78. *Allgemeine Forst- und Jagd-Zeitung.* (,,)
79. *Zeitschrift für Forst- und Jagdwesen.* (,,)
80. *Bulletin de la Société Forestière de Franche Comté et Belfort.* (By purchase.)

Royal Scottish Arboricultural Society.

(INSTITUTED 16th FEBRUARY 1854.)

LIST OF MEMBERS, &c.

As at 20th June 1910.

PATRON.

HIS MOST EXCELLENT MAJESTY THE KING.

PRESIDENT.

Sir JOHN STIRLING MAXWELL, Bart. of Pollok.

FORMER PRESIDENTS.

YEAR.	
1854–56.	JAMES BROWN, { Deputy-Surveyor of the Royal Forest of Dean. Wood Commissioner to the Earl of Seafield.
1857.	The Right Hon. THE EARL OF DUCIE.
1858.	The Right Hon. THE EARL OF STAIR.
1859.	Sir JOHN HALL, Bart. of Dunglass.
1860.	His Grace THE DUKE of ATHOLL.
1861.	JOHN I. CHALMERS of Aldbar.
1862.	The Right Hon. THE EARL OF AIRLIE.
1863.	The Right Hon. T. F. KENNEDY.
1864–71.	ROBERT HUTCHISON of Carlowrie, F.R.S.E.
1872–73.	HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie.
1874–75.	JOHN HUTTON BALFOUR, M.D., M.A., F.R.SS. L. & E., Professor of Botany in the University of Edinburgh.
1876–78.	The Right Hon. W. P. ADAM of Blairadam, M.P.
1879–81.	The Most Hon. THE MARQUESS OF LOTHIAN, K.T.
1882.	ALEXANDER DICKSON, M.D., F.R.S.E., of Hartree, Regius Professor of Botany in the University of Edinburgh.
1883–85.	HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie.
1886–87.	The Right Hon. Sir HERBERT EUSTACE MAXWELL, Bart. of Monreith.
1888–89.	The Right Hon. THE MARQUESS OF LINLITHGOW, Hopetoun House, South Queensferry.
1890–93.	ISAAC BAYLEY BALFOUR, M.D., Sc.D., F.R.S., Professor of Botany in the University of Edinburgh.
1894–97.	The Right Hon. R. C. MUNRO FERGUSON, M.P.
1898.	Colonel F. BAILEY, R.E.
1899–02.	The Right Hon. THE EARL OF MANSFIELD.
1903–06.	W. STEUART FOTHRINGHAM of Murthly.
1907–09.	Sir KENNETH J. MACKENZIE, Bart. of Gairloch.

HONORARY MEMBERS.

Date of Election.

1886. AVEBURY, The Right Hon. Baron, D.C.L., High Elms, Down, Kent.
1904. BAILEY, Colonel F., R.E., F.R.S.E., Lecturer on Forestry, Edinburgh University, 7 Drummond Place, Edinburgh. (Also Life Member by Subscription, 1887.)
1907. CASTLETOWN, Right Hon. Lord, of Upper Ossory, K.P., C.M.G., Granston Manor, Abbeyleix, Ireland.
1901. GAMBLE, J. Sykes, C.I.E., F.R.S., M.A., ex-Director of the Indian Forest School, Highfield, East Liss, Hants. (Also Life Member by Subscription.)
1905. HENRY, Auguste Edmond, Professor of Natural Science, etc., National Forest School, Nancy, France.
1886. HOOKER, Sir Joseph D., O.M., M.D., K.C.S.I., The Camp, Sunningdale, Berks.
1886. JOHORE, The Maharajah of, Johore, Malay Peninsula.
1904. KAY, James, Wood Manager, Bute Estate, Rothesay, Bute. (Elected Ordinary Member in 1867.)
1907. KUMÉ, Kinya, Chief of the Bureau of Forestry, Department of Agriculture and Commerce, Tokio, Japan.
1904. MACKENZIE, Donald F., F.S.I., Estate Office, Mortonhall, Edinburgh. (Also Life Member by Subscription, 1872.)
1907. MAYR, Heinrich, Dr. Philos. et D.Œc., Professor of Forestry, Munich.
1903. NILSON, Jägmästare Elis, Föreståndare för Kolleberga skogsskola Ljungbyhed, Sweden.
1889. SARGENT, Professor C. S., Director of the Arnold Arboretum, Harvard College, Brookline, Massachusetts, U.S.A.
1889. SCHLICH, Sir William, K.C.I.E., Professor of Forestry, Oxford University.
1895. SCHWAPPACH, Dr Adam, Professor of Forestry, Eberswalde, Prussia.
1907. SIMMONDS, Frederick, M.V.O., 16 Abingdon Court, Kensington West.
1904. SOMERVILLE, Dr William, M.A., D.Sc., D.Œc., F.R.S.E., Professor of Rural Economy, Oxford. (Also Life Member by Subscription, 1889.)
1886. TAKEI, Morimasa, 58 Mikumicho, Ushima, Tokio, Japan.
1904. THOMSON, John Grant, Retired Wood Manager, Mount Barker, Grantown-on-Spey. (Also Life Member by Subscription, 1855.)

HONORARY ASSOCIATE MEMBERS.

Date of Election.

1903. BATTISCOMBE, Edward, Assistant Conservator of Forests, Nigeri *via* Naivasha, East Africa Protectorate.
1901. BRUCE, William, College of Agriculture, 13 George Square, Edinburgh.
1901. CROMBIE, T. Alexander, Forester, Estate Office, Longhirst, Morpeth.
1902. GILBERT, W. Matthews, The *Scotsman* Office, Edinburgh.
1902. SMITH, Fred., Highfield Mount, Brook Street, Macclesfield.
1901. STORY, Fraser, Lecturer on Forestry, University of North Wales, Bangor.
1901. USHER, Thomas, Courthill, Hawick.

LIFE AND ORDINARY MEMBERS.

* *Indicates Life Member.* *Italics indicates that present Address is unknown.*

LAW V. Members in arrear shall not receive the *Transactions*. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.

Date of Election.

1895. ABBOT, Thomas, Forester, Neidpath Castle, Peebles.
*1906. ABERCROMBY, Sir George William, Forglen, Turriff.
1902. ACLAND, Sir Charles Thomas Dyke, Bart., M.A., D.L., etc., Killerton, Exeter.
*1900. ADAIR, David Rattray, S.S.C., 19 Castle Street, Edinburgh.
*1907. ADAIR, John Downie, Nurseryman, 75 Shandwick Place, Edinburgh,
*1883. ADAM, Sir Charles Elphinstone, Bart. of Blairadam, 5 New Square. Lincoln's Inn, London, W.C.
*1904. ADAMS, Joseph Wm. Atkin, Resident Agent, Mill Hill, Middlesex.
1906. ADAMSON, John, Assistant Forester, Brown's Lodge, Pembury Tunbridge Wells.
*1874. ADDINGTON, The Right Hon. Lord, Addington Manor, Winslow, Bucks.
*1904. AGNEW, Sir Andrew, Bart., Lochnaw Castle, Stranraer.
1903. AILSA, The Marquess of, Culzean Castle, Maybole.
1906. AINSLIE, John, Factor, Stobo, Peeblesshire.
1902. AINSLIE, Thomas, Glenesk, Penicuik.
1908. AIRD, William, Mechanical Engineer, Woodend, Muirkirk, Ayrshire.
1902. AITCHISON, William, Assistant Forester, Weirburn Cottage, Grant's House.
1907. AITKEN, James, Assistant Forester, Dean Road, Kilmarnock.
1907. ALDRIDGE, Arthur, Assistant Forester, Riseley Road, Swallowfield, near Reading, Berks.
1905. ALEXANDER, Henry, Head Forester, Grimstone Estate, Gilling East, York.
*1883. ALEXANDER, John, 24 Lawn Crescent, Kew Gardens, Surrey.
1908. ALEXANDER, John, Nurseryman, 8 Chamberlain Road, Edinburgh.
1905. ALLAN, James, Forester, Lyde Green, Rotherwick, Winchfield, Hants.
*1903. ALLAN, Robert, Factor, Halfway House, Polkemmet, Whitburn.
1909. ALLISON, Thomas, Solicitor and Factor, Fort William.
1907. *Anderson, James, Foreman Forester, Woodlawn, Co. Galway, Ireland.*
1906. ANDERSON, Robert, Hedger, Floors Castle, Kelso.
*1901. ANDERSON, Robert, Bailiff, Phœnix Park, Dublin.
1909. ANDERSON, Robert Lawson, Forester, Balgate, Kiltarlity, Beauly, N.B.
1887. ANNAND, John F., Lecturer on Forestry, Armstrong College, Newcastle-on-Tyne.
1903. ANSTRUTHER, Sir Ralph, Bart. of Balcaskie, Pittenweem.
1903. ARCHIBALD, John Clark, Head Forester, Eden Hall, Langwathby R.S.O. Cumberland.

Date of Election.

*1906. ARDWALL, The Hon. Lord, M.A., LL.D., 14 Moray Place, Edinburgh.
1898. ARMSTRONG, Thos. J. A., Factor, Glenborrodale, Salen, Fort William.
1904. ARNOTT, William, Foreman Forester, Invercolan Cottage, Stormontfield, Perth.
*1883. ATHOLL, His Grace the Duke of, K.T., Blair Castle, Blair Atholl.
1860. AUSTIN & M'ASLAN, Nurserymen, 89 Mitchell Street, Glasgow.
*1887. BAILEY, Colonel F., R.E., F.R.S.E., Lecturer on Forestry, Edinburgh University, 7 Drummond Place, Edinburgh.
1908. BAILLIE, Lieutenant-Colonel A. C., Factor, etc., Kirklands, Melrose.
*1906. BAIRD, Henry Robert, D.L., J.P., Durris House, Drumoak, Aberdeen.
*1896. BAIRD, J. G. A., of Adamton, 89 Eaton Square, London, S.W.
1903. BAIRD, William Arthur, of Erskine, Glasgow.
1908. BAKER, Guy S., Assistant Conservator of Forests, British East Africa.
*1908. BALCARRES, Lord, M.P., Balcarres, Fife; and 7 Audley Square, London, W.
*1909. BALDEN, John, Estate Agent, Bywell Office, Stocksfield-on-Tyne.
*1884. BALFOUR OF BURLEIGH, The Right Hon. Lord, K.T., Kennet House, Alloa.
*1900. BALFOUR, Charles B., of Newton Don, Kelso.
*1886. BALFOUR, Edward, of Balbirnie, Markinch, Fife.
1906. BALFOUR, Frederick Robert Stephen, J.P., Dawyck, Stobo, Peeblesshire.
*1877. BALFOUR, Isaac Bayley, LL.D., Sc.D., M.D., F.L.S., Professor of Botany, Royal Botanic Garden, Edinburgh.
1892. BALLINGALL, Niel, Sweet Bank, Markinch, Fife.
1909, BAPTIE, William, Assistant Forester, Larachbeg, Lochaline, Morvern.
*1904. BARBOUR, George Freeland, of Bonskeid, Pitlochry.
1897. BARCLAY, Robert Leatham, Banker, 54 Lombard Street, London, E.C.
1903. BARNES, Nicholas F., Head Gardener, Eaton Hall, Chester.
1909. BARR, D., Manager (Thos. Kennedy & Co.), Dumfries.
1907. BARR, John, Assistant Factor, Erskine, Bishopton.
*1895. BARRIE, James Alexander, Forester, Harlestone, Northampton.
*1866. BARRIE, James, Forester, Stevenstone, Torrington, North Devon.
1907. BARRON, Colin Campbell, Wood and Grain Merchant, Nairn Mills, Nairn.
*1877. BARRY, John W., of Fyling Hall, Fylingdales, Scarborough, Yorks.
1909. BARTON, Ebenezer Johnstone, Assistant Forester, Damshot, Pollok Estate, Pollokshaws.
1874. BARTON, James, Forester, Hatfield House, Herts.
1904. BARTON, James Robert, Factor, 3 Coates Crescent, Edinburgh.
*1908. BAXTER, Edward Gorrel, J.P., Teasses, Lower Largo, Fife.
1908. BAXTER, James, Gardener, Gorddinog, Llanfairfechan, Carnarvonshire.
*1903. BAZLEY, Gardner Sebastian, Hatherof Castle, Fairford, Gloucestershire.
1904. BEAUMONT, Robert, Assistant Forester, c/o Mr Brown, Colliers End, North Ware, Herts.
*1897. BEGG, James, Rosslyne, Culter, by Aberdeen.
*1883. BELL, Andrew, Forester, Rothes, Elgin.

Date of Election.

1898. Bell, David, Seed Merchant, Coburg Street, Leith.
1907. Bell, David, Assistant Forester, Pilsley, Bakewell, Derbyshire.
1907. Bell, James, Assistant Forester, Dundrum, Co. Tipperary.
1908. Bell, John R., Assistant Forester, Crown Cottages, Parkend, Lydney, Glos.
1900. Bell, Robert, Land Steward, Baronscourt, Newtown-Stewart, Ireland.
1900. Bell, William, Forester, Balthayock, Perth.
*1871. Bell, William, of Gribdae, 181 Queen Victoria Street, London, E.C.
1895. Bennett, J. B., C.E., A.M.I., 42 Frederick Street, Edinburgh.
1905. Bennett, John, Forester and Acting Sub-Agent, Town's End, Wolverton, Basingstoke.
1903. Bentinck, Lord Henry, M.P., Underley Hall, Kirkby Lonsdale.
*1904. Berry, Charles Walter, B.A., 11 Atholl Crescent, Edinburgh.
1889. Berry, Francis, Forester, Minto, Hawick.
1907. Beveridge, James, Forester, Normanby, Doncaster.
1903. Binning, The Lord, Mellerstain, Kelso.
1909. Biscoe, T. R., of Newton, Kingillie, Kirkhill R.S.O., Inverness-shire.
*1897. Black, Alexander, The Gardens, Carton, Maynooth, Co. Kildare.
*1908. Black, Florance William, of Kailzie, Peeblesshire.
1904. Black, John, Factor, Cortachy Castle, Kirriemuir.
1908. Blacklaws, John, Head Forester, Seafield Cottage, Portsoy.
1908. Blair, Charles, Glenfoot, Tillicoultry.
1903. Blair, Thomas, Farmer, Hoprig Mains, Gladsmuir.
1872. Boa, Andrew, Estate Agent, Glenmore, The Avenue, Trowbridge.
*1877. Bolckow, C. F. H., of Brackenhoe, Kentisknowle, Torquay.
1892. Bond, Thomas, Forester, Lambton Park, Fence Houses, Durham.
*1895. Boord, W. Bertram, Land Agent, Bewerley, Pateley Bridge, Yorks.
1909. Booth, Miss Cary, 39 Mozartstrasse, Grosslichterfelde, Germany.
*1898. Borthwick, Albert W., D.Sc., Royal Botanic Garden, Edinburgh.
1898. Borthwick, Francis J. G., W.S., 9 Hill Street, Edinburgh.
*1908. Borthwick, Henry, Borthwick Castle, Gorebridge.
1887. Boulger, Professor, 11 Onslow Road, Richmond Hill, London, S.W.
1906. Bowman, John, Assistant Forester, Kinchuny, Durris, Aberdeen.
1883. Boyd, John, Crown Forester's House, Ford, Argyll.
1897. Braid, J. B., Forester, Witley Court, Great Witley, Worcester.
*1902. Braid, William Wilson, Tossville, 12 Milton Road, Craigmillar Park, Edinburgh.
1907. Breadalbane, Marchioness of, Black Mount, Bridge of Orchy, Argyllshire.
1909. Brews, William, Assistant Forester, Midhope, Hopetoun, South Queensferry.
1910. Broadford, David, Assistant Forester, Goldsboro', Knaresboro'.
1907. Brodie, Ian, of Brodie, Brodie Castle, Forres.
*1900. Broom, John, Wood Merchant, Bathgate.
*1900. Brown, Charles, Factor, Kerse, Falkirk.
1904. Brown, George, Timber Merchant, Buckhaven Saw-mills, Buckhaven.
1900. Brown, Gilbert, Forester, Kiltarlity, Beauly.

Date of Election.

1878. Brown, J. A. Harvie-, of Quarter, Dunipace House, Larbert.
1899. Brown, John, Forester and Ground Officer, Craighall, Rattray, Perthshire.
*1896. Brown, Rev. W. Wallace, Minister of Alness, Ross-shire.
1895. *Brown, Walter R., Forester, Park Cottage, Heckfield, near Winchfield, Hants.*
1900. Brown, William, Forester, Lissadell, Sligo, Ireland.
1905. Bruce, Alexander, Timber Merchant, 53 Bothwell Street, Glasgow.
1907. Bruce, Charles, Assistant Forester, Goldsboro', Knaresbro', Yorks.
1901. Bruce, David, Forester, Earnock Estate Office, Hillhouse, Hamilton.
*1895. Bruce, Peter, Manager, Achnacloich, Culnadalloch, by Connel.
*1867. Bruce, Thomas Rae, Old Garroch, New Galloway.
1909. Brunton, James S., Forester, Hursley Park, near Winchester, Hants.
1904. Brunton, John, Head Forester, Langley Park, Norwich.
1907. Bryden, Thomas, Nurseryman, Dennison Nurseries, Ayr.
1897. Brydon, John, Seed Merchant and Nurseryman, Darlington, Co. Durham.
*1879. Buccleuch, His Grace the Duke of, K.T., Dalkeith Palace, Dalkeith.
*1879. Buchanan, Charles, Overseer, Penicuik Estate, Penicuik.
1906. Burnett, Sir Thomas, Bart., Crathes Castle, Crathes, N.B.
1909. Burnley-Campbell, Colin N., of Ormidale, Colintraive, Argyllshire.
1909. Burn-Murdoch, Alfred Maule, Conservator of Forests, Federated Malay States and Straits Settlements, Kuala Lumpur, Federated Malay States.
1904. Butler, Robert, Forester, Estate Office, Blenheim Palace, Woodstock, Oxfordshire.
1906. Butler, Walter James, Assistant Forester, Hillend Cottage, Minto, Hawick.
*1909. Buxton, Walter L., of Bolwich, Marsham, Norwich.
*1909. Caccia, Anthony M., M.V.O., c/o Messrs Coutts & Sons, Ludgate Circus, London.
*1902. Cadell, Henry Moubray, of Grange and Banton, B.Sc., F.R.S.E., F.A.S., J.P., etc., Grange, Linlithgow.
1903. Cairns, Thomas, Forester, Lissduff House, Errill, Ballybrophy, Queen's County.
*1908. Calder, James Charles, of Ledlanet, Milnathort.
1906. Calderhead, William, Overseer, Eredine, Port Sonachan, Argyleshire.
1901. Cameron, Alex., Land Steward, Balmina, Cookstown.
1910. Cameron, Angus, F.S.I., Factor, Benmore, Kilmun, by Greenock.
1908. Cameron, Colin M., Factor, Balmakyle, Munlochy.
1907. Cameron, Donald Walter, of Lochiel, Achnacarry, Spean Bridge.
1902. Cameron, Ewan, of Rutherford, West Linton.
1908. Cameron, John, Forester, Isel Hall, Cockermouth, Cumberland.
*1899. Cameron, John J., Norwood, Hamilton.
1904. Cameron, Robert, Forester, Ardtornish, Morven, by Oban.
1909. Campbell, Alexander, Assistant Forester, Dalzell Farm, Motherwell.
1895. Campbell, Alexander, Land Steward, Rosemill Cottage, Strathmartin, by Dundee.

Date of Election.

1899. Campbell, Alexander, Tullymully, Dunkeld.
1904. Campbell, David S., Forester, Wilton Castle, Redcar, Yorks.
1908. Campbell, Donald, Assistant Forester, Dean Road, Kilmarnock.
*1897. Campbell, James Arthur, Arduaine, Lochgilphead, Argyleshire.
1900. Campbell, James S., Forester, Ginsboro Hall, Ginsboro, Yorks.
1906. Campbell, John, Land Steward, Forss Estates, Westfield, Thurso.
1908. Campbell, Patrick William, of Auchairne, W.S., 25 Moray Place, Edinburgh.
1901. Campbell, Peter Purdie, Factor, Lee and Carnwath Estates Office, Cartland, Lanark.
1908. Campbell, Robert, B.Sc., Geological Laboratory, Edinburgh University.
1909. Campion, Edward, Assistant Forester, Stockeld Park, Wetherby, Yorks.
1903. Canch, Thomas Richard, B.Sc., P.A.S.I., 3 Greenbank Crescent, Morningside, Edinburgh.
*1903. Capel, James Carnegy Arbuthnott, of Ballnamon, 34 Roland Gardens, London, S.W.
*1896. Carmichael, His Excellency Sir Thos. D. Gibson, Bart. of Skirling, Governor-General, Melbourne, Australia.
1910. Carmichael, James Brown, Student in Forestry, Bridgend, Craigmillar.
1908. Carmichael, James Louis, younger of Arthurstone, Arthurstone, Meigle.
1906. Carnegie, James, of Stronvar, Balquhidder.
1907. Carnegie, Robert, Foreman Forester, Forester's Cottage, Grantully, Ballinluig.
1903. Carruthers, Major Francis John, of Dormont, Lockerbie.
*1898. Carson, David Simpson, C.A., 209 West George Street, Glasgow.
1907. Cassells, Andrew, Assistant Forester, Bandon, Balbirnie, Markinch, Fife.
1904. Cathcart, Sir Reginald Gordon, Bart., Cluny Castle, Aberdeenshire.
1904. Cavers, A. R. S., Menzies Estate Office, Aberfeldy.
1909. Chadwick, James Melville, Findhorn House, Forres.
*1906. Chalcraft, George Barker, "Hillside," Gimingham, near North Walsham, Norfolk.
1897. Chalmers, James, Overseer, Gask, Auchterarder, Perthshire.
1898. Chalmers, James, Forester, Estate Office, Killin, Perthshire.
1904. Chalmers, Robert W., Assistant Forester, Auchencrash Cottage, Glenapp Castle, Ballantrae.
1892. Chapman, Andrew, Factor, Dinwoodie Lodge, Lockerbie, Dumfriesshire.
1892. Chapman, Mungo, Torbrix Nurseries, St Ninians, Stirling.
1909. Chapman, William, Foreman, Canonbie Sawmill, Canonbie.
1908. Chermside, Sir Herbert, Newstead Abbey, Nottingham.
1906. Chisholm, Alexander M'Kenzie, Clerk of Works, Dalkeith Park, Dalkeith.

Date of Election.

1897. CHISHOLM, Colin, Forester, Lundin and Montrave Estates, Hattonlaw, Lundin Links.

1909. CHISHOLM, George, Forester, Wishaw House, Wishaw.

*1882. CHOWLER, Christopher, Gamekeeper, Dalkeith Park, Dalkeith.

1884. CHRISTIE, Alex. D., Hillside, Frederick Road, Selly Oak, Birmingham.

1906. CHRISTIE, Charles, Factor, Estate Office, Strathdon.

1910. CHRISTIE, James Sinton, Assistant Gardener, c/o Mitchell, 8 Stevenson Drive, Glasgow.

1908. CHRISTIE, Miss Isabella Robertson, of Cowden, Dollar.

1906. CHRISTIE, Thomas, Nurseryman, Rosefield Nurseries, Forres.

*1883. CHRISTIE, William, Nurseryman, Fochabers.

1908. CHRYSTAL, Robert, Assistant Forester, Bowmont Forest, Roxburgh.

1909. CLAPPERTON, James Martin, B.L., Solicitor, 177 Union Street, Aberdeen.

1890. CLARK, Charles, Forester, Cawdor Castle, Nairn.

1902. CLARK, Francis Ion, Estate Office, Haddo House, Aberdeen.

1891. CLARK, John, Forester, Kelly, Methlick, Aberdeen.

1906. CLARK, John, Forester, Almond Dell, Old Clapperton Hall, Midcalder.

*1892. CLARK, William, 66 Queen Street, Edinburgh.

1902. CLARK, William, Assistant Factor, Craigielaw Cottage, Longniddry.

*1872. CLERK, Sir George D., Bart. of Penicuik, Midlothian.

1910. CLINTON-BAKER, Henry Wm., J.P. for Herts, Bayfordbury, Hertford.

*1902. CLINTON, The Right Hon. Lord, Fettercairn House, Fettercairn.

1906. CLYNE, James, Engineer, Knappach, Banchory.

*1898. COATS, Sir Thomas Glen, Bart., Ferguslie Park, Paisley.

1904. COBB, Herbert Mansfield, Land Agent, Higham, Rochester, Kent.

1906. COCKER, Alexander Morrison, Nurseryman, Sunnypark Nursery, Aberdeen.

*1904. COKE, Hon. Richard, Weasenham, Swaffham.

1906. COLES, Walter G., Engineer, 122 George Street, Edinburgh.

1900. COLLIE, Alexander, Head Forester, Nettlebed, Henley-on-Thames.

1907. COLLIER, James, Assistant Forester, Estate Yard, Woodlawn, Co. Galway.

*1879. *Colquhoun, Andrew, 75 Buchanan Street, Glasgow.*

1908. COLSTON, William G., Estate Clerk, Rossie Estate Office, Inchture.

1908. COLTMAN, William Hew, J.P., B.A., Barrister, Blelack, Dinnet, Aberdeenshire.

1907. COMRIE, Patrick, Land Agent, Waterside, Dalry, Ayrshire.

1905. COMRIE, William Lewis, Factor, Cally Estates Office, Gatehouse.

1895. CONNOR, George A., Factor, Craigielaw, Longniddry.

*1887. COOK, James, Land Steward, Arniston, Gorebridge, Midlothian.

1906. COOK, Melville Anderson, Assistant Forester, Glamis, Forfarshire.

1904. COUPAR, Charles, Assistant Forester, Rose Cottage, Achnacarry, Spean Bridge.

Date of Election.

*1897. COUPAR, Wm., Overseer, Balgowan, Perthshire.
1908. COUTTS, Wm., Forester, Gardener, and Ground Officer, Learney, Torphins, Aberdeen.
*1908. COWAN, Alexander, Valleyfield, Penicuik.
*1876. COWAN, Charles W., Dalhousie Castle, Bonnyrigg, Lasswade.
*1892. COWAN, George, 1 Gillsland Road, Edinburgh.
1908. COWAN, Henry Hargrave, Lauderdale Estates Office, Lauder; 41 College Bounds, Old Aberdeen.
*1899. COWAN, Robert, Chisholm Estates Office, Erchless, Strathglass.
*1901. COWAN, Robert Craig, Eskhill, Inveresk.
*1874. COWPER, R. W., Gortanore, Sittingbourne, Kent.
*1904. COX, Albert E., of Dungarthill, Dunkeld.
*1904. COX, William Henry, of Snaigow, Murthly.
1900. CRABBE, Alfred, Forester, Glamis.
1875. CRABBE, David, Forester, Byreburnfoot, Canonbie, Dumfriesshire.
1867. CRABBE, James, Glamis.
1904. CRAIG, Alexander, Assistant Forester, Glamis.
*1909. CRAIG, Sir Archibald Gibson, Bart. of Riccarton, Currie.
*1875. CRAIG, Wm., M.D., C.M., F.R.S.E., 71 Bruntsfield Place, Edinburgh.
1909. CRAIGIE, John, Superintendent Overtoun Park, 23 Burns Street, Dalmuir.
1903. CRANSTOUN, Charles Joseph Edmondstoune, of Corehouse, Lanark.
*1908. CRAW, John Taylor, Factor and Farmer, Coldstream.
1899. CRERAR, David, Land Steward, Methven Castle, Perth.
1898. CRICHTON, William, Manager, Castle Ward, Downpatrick.
1903. CROLL, John, of D. & W. Croll, Nurseryman, Dundee.
*1900. CROOKS, James, Timber Merchant, Woodlands, Eccleston Park, Prescot.
*1865. CROSS, David G., Forester, Kylisk, Nenagh, Ireland.
*1895. CROZIER, John D., Forester, Durris, Drumoak, Aberdeen.
1910. CRUDEN, Lewis G., Forester, East Lodge, Brucklay, Aberdeenshire.
1908. *Cruickshank, Adam, Forester, Fasque, Fettercairn.*
1907. CRUICKSHANK, James, Farmer and Hotelkeeper, Port Erroll, Aberdeenshire.
1900. CUMMING, John H., Overseer, Royal Dublin Society, Ball's Bridge, Dublin.
1906. CUMMING, William, Nursery Foreman, Burnside Nurseries, Aberdeen.
*1901. CUNNINGHAM, Captain John, Leithen Lodge, Innerleithen.
*1898. CUNNINGHAM, George, Advocate, 30 Queen's Gate Terrace, London, S.W.
1908. CUNNINGHAM, John Gilchrist, of Letham, 2 Gladstone Terrace, Burntisland.
1909. CUNNINGHAM, Robert, Forester, Glenlogan, by Mauchline, Ayrshire.
*1893. CURR, W. S., Factor, Ninewar, Prestonkirk.
1907. CUTHBERTSON, Evan James, W.S., 12 Church Hill, Edinburgh.

Date of Election.

1907. DALE, Robert, Forester, Kilnknowe, Sorn, Mauchline.
*1867. DALGLEISH, John G., of Ardnamurchan, Brankston Grange, Stirling.
*1906. DALGLEISH, Sir William Ogilvie, Bart., Errol Park, Errol.
*1900. DALHOUSIE, The Right Hon. the Earl of, Brechin Castle, Forfarshire.
1908. DALKEITH, The Earl of, Eildon Hall, St Boswells.
*1910. DALLIMORE, William, Assistant, Royal Gardens, Kew, 36 Leyborne Park, Kew Gardens, Surrey.
1901. DALRYMPLE, Hon. Hew H., Lochinch, Castle Kennedy, Wigtownshire.
*1906. DALRYMPLE, Lord, M.P., Lochinch, Stranraer.
1904. DALRYMPLE, The Right Hon. Sir Charles, Bart. of Newhailes, Musselburgh.
1901. *Dalziel, Henry, Assistant Forester, Cormiston Towers, Biggar.*
1905. DAVID, Albert E., Assistant Forester, Pilsley, Bakewell, Derbyshire.
1905. DAVID, William J., Assistant Forester, Turgisgreen, Shewfield-on-Lodden, Basingstoke.
1908. DAVIDSON, David, Assistant Forester, Indian Head, Sask, Canada.
1904. DAVIDSON, James, 12 South Charlotte Street, Edinburgh.
1892. DAVIDSON, John, Forester, Dalzell, Motherwell, Lanarkshire.
1908. DAVIDSON, Major Duncan Francis, Dess, Aberdeenshire.
*1892. DAVIDSON, William, Forester, Panmure, Carnoustie.
1901. DAVIE, George, Overseer, Balruddery Gardens, near Dundee.
1904. DAVIE, Thomas, Forester, Glenreardell, Whitehouse, Argyllshire.
1909. DAWSON, Fred, Assistant Forester, Brotto, Dale Head, Grasmere.
*1908. DAWSON, William, M.A., B.Sc.(Agr.), Lecturer on Forestry, Marischal College, Aberdeen.
1910. DEAS, James, Devon Cottage, Bonnyrigg.
1904. DENHOLM, John, Timber Merchant, Bo'ness.
1906. DENTON, Sydney, Assistant Forester, Harewood, Leeds.
1906. DEWAR, Alex., Factor, Fasque Estates Office, Fettercairn.
1902. DEWAR, H. R., Forester, Beaufort Castle, Beauly.
*1901. DEWAR, John A., M.P., Perth.
1909. DICK, Colonel A. C. D., Pitkerro House, by Dundee.
1904. DICK, William, Timber Merchant, Hamilton.
*1898. DIGBY, The Right Hon. Baron, Minterne, Cerne, Dorsetshire.
1904. *Dodds, Thomas, Cashier, Pollok Estate Office, 216 West George Street, Glasgow.*
*1903. DON, Alex., Namitomba Estate, Zomba, British Central Africa.
1893. DONALDSON, James, Timber Merchant, Tayport, Fife.
1907. DONNE, Cyril Henry, Land Agent, The Abbey Ruins, Bury St Edmunds.
1908. DOUGHTY, James T. S., Solicitor and Factor, Ayton.
*1896. DOUGLAS, Alex., Estate Bailiff's Office, Dean Road, Scarborough.
1882. DOUGLAS, Captain Palmer, of Cavers, Hawick.
1904. DOUGLAS, James A., Assistant Forester, Ardgowan, Inverkip.
1887. DOUGLAS, Robert, 64 Princes Street, Edinburgh.
1903. DOUGLAS, William G., Forester, Ingleborough Estate, Clapham, Yorks.
1903. DOW, Alexander, Forester, Bretby Park Burton-on-Trent.

Date of Election.

1898. Dow, Thomas, Forester, Wakefield Lawn, Stony Stratford, Bucks.
1909. Drummond, A. Hay, of Cromlix, Dunblane.
1900. Drummond, Dudley W., Commissioner, Cawdor Estate Office, Carmarthen, South Wales.
1908. Drummond, James, Assistant Forester, Haggs Cottage, Almondbank, Perth.
1904. Drummond, William, Forester, Craigo Estate, Montrose.
1862. Drummond & Sons, William, Nurserymen, Stirling.
1909. Drysdale, Thomas, Land Steward, Estate Office, Auchinleck.
1908. Duchesne, M. C., Land Agent, Farnham Common, Slough, Bucks.
*1909. Duff, Alexander M., Land Steward and Farm Manager, Ninewells, Snaigow, Murthly.
1907. Duff, John Wharton Wharton, of Orton and Barmuchity, Morayshire.
1903. Duff, Mrs M. M. Wharton-, of Orton, Morayshire.
1907. Duff, Thomas Gordon, of Drummuir and Park, Banffshire.
1907. Duguid, Charles, Head Forester, Philorth, Fraserburgh.
1910. Duncan, Robert, Head Forester, Dryfeholm Estate, Lockerbie.
*1895. Dundas, Lieut.-Colonel Sir Robert, of Arniston, Gorebridge, Midlothian.
1907. Dunglass, Lord, Springhill, Coldstream.
1907. Dunlop, George, W.S., 32 Abercromby Place, Edinburgh.
1905. Dunstan, M. I. R., Principal of South-Eastern Agricultural College, Wye, Kent.
*1902. Durham, Right Hon. the Earl of, Lambton Castle, Durham.
1873. Durward, Robert, Estate Manager, Blelack, Dinnet, Aberdeenshire.
1900. Duthie, James A., of Benjamin Reid & Co., Nurserymen, Aberdeen.

1898. Eadson, Thomas G., Forester, Whaley, Mansfield.
1885. Edington, Francis, Overseer, Monk Coniston Park, Lancashire.
1906. Edgar, James, Factor, Poltalloch Estate Office, Lochgilphead.
1898. Edminson, Wm. D., Tweed View, Berwick-on-Tweed.
1904. Edmond, James, Assistant, Wemyss Castle Estate Office, East Wemyss, Fife.
1899. Edwards, Alex. W. B., Forester, Thirlmere Estate, *via* Grasmere.
1893. Elder, William, Forester, Thoresby, Ollerton, Newark, Notts.
1903. Elgar, Walter Robinson, Land Agent, Hill House, Sittingbourne.
1902. Ellice, Captain Edward Charles, Invergarry.
*1899. Ellison, Francis B., Bragleenbeg, Kilninver, Oban.
*1904. Elphinstone, The Lord, Carberry Tower, Musselburgh.
1901. Elwes, Henry John, F.R.S., of Colesborne, Cheltenham.
1901. Erskine, Richard Brittain, Oaklands, Trinity, Edinburgh.
1898. Ewan, Peter, Assistant Forester, Wood Cottage, Newland Park, Chalfont St Giles, Bucks.
1873. Ewing, David, Forester, Strichen House, Aberdeen.
1904. Ewing, Guy, F.S.I., 80 Chancery Lane, London, W.C.

Date of Election.

1906. Faichney, John, Assistant Forester, Blythswood, Renfrew.
1906. Fairbairn, John, Assistant Forester, Softlaw, Kelso.
1909. Falconer, James, Farmer, Hill, Errol.
1905 Farago, Adalbert, Forest Nurseries and Seed Establishment to His Majesty the Emperor, Zalaegerszeg, Hungary.
1910. Farquharson, Major James, of Corrachree, Tarland, Aberdeenshire.
*1894. Farquharson, James, Forester, Ardgowan, Inverkip.
1900. Feaks, Matthew, Forester, Benmore, Kilmun.
1904. Fenwick, Andrew, Assistant Forester, Lime Walk Cottage, Rosehaugh, Avoch, Ross-shire.
1903. Fenwick, William, Factor, Darnaway Castle Estates Office, Earlsmill, Forres.
1908. Ferguson, Donald, Joiner and Timber Merchant, Quarry Lane, Lennoxtown.
*1900. Ferguson, James Alex., Ardnith, Partickhill, Glasgow.
*1888. Ferguson, The Right Hon. R. C. Munro, M.P., of Raith and Novar, Raith, Fife.
1899. Ferguson, Sir J. E. Johnson, Bart. of Springkell, Ecclefechan.
1880. Fergusson, Sir James Ranken, Bart., Spitalhaugh, West Linton.
1908. Fernie, Alexander, Head Forester, Hopetoun, South Queensferry.
*1909. Fernie, Andrew, Forester, Balcarres, Fife.
*1907. Ferrie, Thomas Young, Timber Merchant, 69 Buchanan St., Glasgow.
*1901. Findlay, John Ritchie, of Aberlour, Aberlour House, Aberlour.
1893. Finlayson, Alexander, Ancrum Bridge, Jedburgh.
1893. Finlayson, Malcolm, Solicitor, Crieff, Perthshire.
1908. Finnie, Alexander, Clerk of Works, Woodlands Cottage, Durris.
1907. Fish, Andrew, Assistant Forester, Dean Road, Kilmarnock.
1909. Fisher, Malcolm, Assistant Forester, North Stables, Helbrom Estate, Fairley.
1869. Fisher, William, Estate Agent, Wentworth Castle, Barnsley, Yorkshire.
1899. Fisher, W. R., Assistant Professor of Forestry, 6 Linton Road, Oxford.
*1902. Fitzwilliam, Right Hon. the Earl of, Wentworth, Rotherham.
1910. Fleming, Archibald, Overseer, Culcreuch, Fintry, Stirlingshire.
1899. Fleming, Sir John, Timber Merchant, Albert Saw-mills, Aberdeen.
*1906. Fletcher, J. Douglas, of Rosehaugh, Avoch, Ross-shire.
1909. Fletcher, John Sydney, Under Forester, Thirlmere, Grasmere.
1890. Forbes, Arthur C., Department of Agriculture, Dublin.
1898. Forbes, James, Factor, Blair Castle, Blair Atholl.
*1896. Forbes, James, The Gardens, Overtoun, Dumbartonshire.
*1878. Forbes, Robert, Estate Office, Kennet, Alloa.
1904. Forbes, Robert Guthrie, Forester, Cliff House, Gulworthy, Tavistock, Devon.
*1873. Forbes, William, Consulting Forester and Wood Surveyor, Beechwood, Blairgowrie.
*1869. Forgan, James, Forester, 5 Viewlands Terrace, Perth.
1892. Forgan, James, Sunnybraes, Largo, Fife.
1889. Forster, William A., Forester, Belgrave Lodge, Pulford, Wrexham.

Date of Election.

1908. Fortescue, William Irvine, M.B.C.M., 7 Bon Accord Square, Aberdeen.
*1908. Fortune, George R., Factor, Colinsburgh, Fife.
1904. *Foster, Henry, Assistant Forester, Glenalmond, Methven.*
*1897. Fothringham, W. Steuart, of Murthly, Perthshire.
*1909. Foulis, Arch. Keith, Factor's Assistant, 24 St Andrew Square, Edinburgh.
1908. Fowler, Sir John Edward, Bart., Braemore, Garve.
*1866. France, Charles S., 13 Cairnfield Place, Aberdeen.
*1901. Fraser, Alexander, Solicitor and Factor, *Hon. Secretary and Treasurer, Northern Branch*, 63 Church Street, Inverness.
1908. Fraser, Charles James Roy, of Lochavich, Argyllshire.
1909. Fraser, George, Assistant Forester, Kingswood, Murthly.
*1892. Fraser, George, Factor, Dalzell, Motherwell, Lanarkshire.
*1902. Fraser, George M., 13 Drumsheugh Gardens, Edinburgh.
1898. Fraser, James, Assistant Forester, 10 Woodside Walk, Hamilton.
*1899. Fraser, James, Home Steward, Factor's Office, North Harris, Portree.
1895. Fraser, J. C., Nurseryman, Comely Bank, Edinburgh.
1905. Fraser, John, Forester, The Little Hill, Leighton, Ironbridge R.S.O., Salop.
1901. Fraser, John M'Laren, of Invermay, Forgandenny, Perthshire.
1904. Fraser, Peter, Land Steward, Dalguise, Dunkeld.
1904. Fraser, Robert A., Cab Proprietor, 3 Sunbury Street, Edinburgh.
1907. Fraser, Robert S., Bunchrew House, Bunchrew, Inverness; Ivy House, Comshall, Surrey.
*1892. Fraser, Simon, Land Agent, Hutton in the Forest, Penrith.
*1907. Fraser, Sweton, Forester, Gallovie, Kingussie.
1908. Fraser-Tytler, James Francis, of Woodhouselee, Rosslyn.
1896. Frater, John, Foreman Forester, Ardross Mains, Alness, Ross-shire.
1902. Frater, John, Head Forester, Ardross Castle, Alness, Ross-shire.
1907. Fyfe, Harry Lessels, Assistant Forester, Elko, B.C., Canada.
1909. *Fyfe, William, Assistant Forester, North Lodge, Blair Drummond, Doune.*
1907. Fyffe, Robert Bullett, Factor, Aden Estates Office, Old Deer.
1910. Fyffe, Robert, Botanical, Forestry, and Scientific Department, Entibbe, Uganda.

1904. Galloway, George, Quarrymaster, Roseangle, Wellbank, by Dundee.
*1893. Galloway, Robert, S.S.C., *Secretary*, 19 Castle Street, Edinburgh.
*1909. Gamble, J. Sykes, C.I.E., etc., Highfield, East Liss, Hants (Hon. Member of the Society).
1896. Gammell, Sydney James, of Drumtochty, Countesswells House, Bieldside, Aberdeen.
1909. Gardiner, Francis Forsyth, Assistant Forester, Home Farm, Newmains, Douglas, Lanarkshire.
1908. Gardiner, R., Assistant Forester, Toxside, Gorebridge.

Date of Election.

1908. GARDYNE, Lieutenant-Colonel Greenhill, of Finavon, Forfar.
*1899. GARRIOCH, John E., Factor, Lovat Estates, Beauly.
*1907. GARSON, James, W.S., Albyn Place, Edinburgh.
*1903. GASCOIGNE, Lieut.-Col. Richard French, D.S.O., Craignish Castle Ardfern, Argyleshire.
1898. GAULD, William, Forester, Coombe Abbey, Binley, Coventry.
1902. GAVIN, George, Factor, Falkland Estate, Falkland.
1900. GELLATLY, John, Forester, Newhall, by Penicuik.
1897. GELLATLY, Thomas, Forester, Hallyburton, Coupar Angus.
1903. GIBSON, William, Forester, Carnell, Hurlford, Ayrshire.
1905. GILBERT, Alexander, Assistant Forester, Midhope Castle, Hopetoun, South Queensferry.
*1881. GILCHRIST, Wm., Forester, Nursery Cottage, Mount Melville, St Andrews.
1897. GILLANDERS, A. T., F.E.S., Forester, Park Cottage, Alnwick, Northumberland.
*1904. GILLESPIE, David, Advocate of Mountquhanie, Cupar, Fife.
1894. GILLESPIE, James, Forester, Blairmore, Braco.
1894. GILMOUR, Colonel Robert Gordon, of Craigmillar, The Inch, Midlothian.
1908. GLADSTONE, Hugh Steuart, F.Z.S., M.A., etc., Lannhall, Thornhill.
*1900. GLADSTONE, Sir John R., Bart. of Fasque, Laurencekirk.
1906. GLASS, James, Forester, Back Road Cottage, Larbert House, Larbert.
*1901. GODMAN, Hubert, Land Agent, Ginsborough, Yorkshire.
1903. GOLD, William, Forester, Dellavaird, Auchinblae.
1909. GOODFELLOW, John, Forester, Faskally, Pitlochry.
1906. GORDON, Alex. M., J.P., D.L., of Newton, by Insch.
1907. GORMAN, Alfred W., Timber Merchant's Clerk, 14 Smith Street, Hillend, Glasgow.
*1868. GOSSIP, James A., of Howden & Co., The Nurseries, Inverness.
*1897. GOUGH, Reginald, Forester, Wykeham, York.
1909. GOW, Alexander, Home Farm, Hatfield Park, Hatfield, Herts.
1897. GOW, Peter Douglas, Farmer, Bonaly, Colinton, Midlothian.
1897. GOW, Peter, Land Steward, Laggan, Ballantrae, Ayrshire.
1905. GOW, Robert, Head Forester, Appin House, Argyleshire.
*1904. GRAHAM, Anthony George Maxtone, of Cultoquhey, Crieff.
1906. GRAHAM, David A., Teacher, 19 St Fillan's Terrace, Edinburgh.
1907. GRAHAM, Hugh Meldrum, Solicitor, Inverness.
1908. GRAHAM, James, Marquis of, Brodick Castle, Arran (per Mr Douglas, Strabane, Brodick).
1910. GRAHAM, Robert Francis, M.A., of Skipness, Argyll.
*1884. GRAHAM, Wm., 6 Royal Crescent, W., Glasgow.
1905. GRAHAM, William, Foreman Forester, North Lodge, Morton Hall, Liberton.
1909. GRAINGER, Henry Herbert Liddell, Ayton Castle, Ayton.
1887. GRANT, Alexander, Forester, Rinagaip, Dallas, by Forres.
1867. GRANT, Donald, Forester, Drumin, Ballindalloch, Banffshire.
1908. GRANT, Donald, Forester, Fersit, Tulloch, Inverness-shire.

Date of Election.

1904. GRANT, Ewan S., Head Forester, c/o Mrs Goater, Lower Tilgate, near Crawley, Sussex.
1908. GRANT, Iain Robert James Murray, of Glenmoriston, Inverness-shire.
1909. GRANT, James, Forester, Raith, Kirkcaldy.
1893. GRANT, John B., Forester, Downan House, Drumin, Glenlivet.
*1874. GRANT, John, Overseer, Daldowie, Tollcross, Glasgow.
1907. GRANT, Robert, Fernleigh, Birchington, Kent.
1908. GRANT, Sir John Macpherson, Bart., Ballindalloch Castle, Ballindalloch.
1906. GRASSICK, William Henderson, Land Steward, Daviot Branch Asylum, Pitcaple, Aberdeenshire.
1906. GRAY, David, Wheelwright, 270 Great Western Road, Aberdeen.
1907. GRAY, George, Forester, Glentyan Estate, Kilbarchan.
*1908. GRAY, James Lowrie, Tenant Farmer, Elginhaugh, Dalkeith.
1909. GRAY, James Ritchie, Wheelwright, 270 Great Western Road, Aberdeen.
1902. GRAY, Walter Oliver, Forester, Pallinsburn, Cornhill, Northumberland.
1901. GRAY, Major William Anstruther-, of Kilmany, Cupar, Fife.
1908. GRAY, William, Forester, Lundie, Lochee.
1906. GREIG, Robert Blyth, F.H.A.S., F.R.S.E., Marischal College, Aberdeen.
1898. GREY, The Right Hon. Sir Edward, Bart., M.P., of Falloden, Chathill, Northumberland.
1908. GRIEVE, J. W. A., Indian Forest Service, The Club, Darjeeling, Bengal.
1903. GRIFFITHS, Sir Richard Waldie, of Hendersyde Park, Kelso.
*1905. GURNEY, Eustace, Sprowston Hall, Norwich.

1879. HADDINGTON, The Right Hon. the Earl of, K.T., Tyninghame, Prestonkirk.
1910. HALDANE, David, Assistant Forester, Dalzell, Motherwell.
*1900. HALDANE, William S., of Foswell, W.S., 55 Melville Street, Edinburgh.
1905. HALL, Thomas, Forester, Moore Abbey, Monasterevan, Co. Kildare.
1906. HALL, William, Head Forester, Church Cottages, Bilton, near York.
1904. HALLEY, John Y. (of Garvie & Syme), Ironmonger, etc., Perth.
*1897. HALLIDAY, Geo., Timber Merchant, Rothesay.
1908. HALLIDAY, James, Timber Merchant, Grunecruie Sawmill, Methven.
*1901. HALLIDAY, John, Timber Merchant, Rothesay.
1907. HAMILTON, Andrew, Naval Architect, 124 Shiel Road, Liverpool.
1908. HAMILTON, David R., Catcune Mills, Gorebridge.
*1882. HAMILTON, Donald C., Forester, Knowsley, Prescot.
1909. HAMILTON, John, C.A., 34 York Place, Edinburgh.
*1899. HAMILTON, The Right Hon. Baron, of Dalzell, Dalzell House, Motherwell.
1892. HANNAH, George, Overseer, The Folly, Ampton Park, Bury St Edmunds, Suffolk.

Date of Election.

1905. HANSON, Clarence Oldham, Deputy Conservator, Indian Forest Department, Latimer Lodge, Littledean Hill, Newnham Gloucestershire.

1907. HARBEN, Henry Andrade, J.P., Newland Park, Chalfont St Giles, Bucks.

1907. HARBOTTLE, William, Assistant Forester, Woodhouse, Loughborough, Leicestershire.

*1903. HARDIE, David, Factor, Errol Park, Errol.

*1880. HARE, Colonel, Blairlogie, Stirling.

*1896. HARLEY, Andrew M., Forester, 5 Thayer Street, Manchester Square, London.

1908. HARLOND, Henry, Park Forester, Sutton Coldfield, Warwickshire.

*1910. HARRISON, Alexander, Apprentice C.A., 3 Napier Road, Edinburgh.

1905. HARROW, R. L., Head Gardener, Royal Botanic Garden, Edinburgh.

1897. HART, John, Factor, Mains of Cowie, Stonehaven, Kincardineshire.

*1880. HAVELOCK, W. B., The Nurseries, Brocklesby Park, Lincolnshire.

*1908. HAY, Athole Stanhope, of Marlefield, Roxburgh.

1905. HAY, Henry Ferguson, Forester, Cholmondeley Estate Yard, near Malpas, Cheshire.

1892. HAY, John, Overseer, Dollars Estate Office, 8 Rennie Street, Kilmarnock.

1904. HAY, Sir Duncan Edwyn, Bart. of Haystoun, 42 Egerton Gardens, London, S.W.

1906. HAY, Thomas, Head Gardener, Hopetoun House, South Queensferry.

1905. HAY, William Black, Assistant Forester, Bondgate, Harewood, Leeds.

1896. HAY, Wm. P., Merchant, Rosebank, Loanhead, Midlothian.

1869. HAYMAN, John, Glentarff, Ringford, Kirkcudbrightshire.

1902. HAYNES, Edwin, Editor *Timber Trades Journal*, 164 Aldersgate Street, London.

1909. HECTOR, Thomas Gordon, Estate Clerk, Philorth Estate Office, Fraserburgh.

1906. *Henderson, Henry, Overseer, Bantaskin, Falkirk.*

1907. HENDERSON, John, Assistant Forester, Gateside, Balbirnie, Markinch.

*1908. HENDERSON, John G. B., W.S., Nether Parkley, Linlithgow.

1901. HENDERSON, Peter, Factor, Ballindalloch.

1908. HENDERSON, R., Assistant Forester, c/o Mrs Charlwood, Bury Creath, Banstead Surrey.

1893. HENDERSON, R., 4 High Street, Penicuik, Midlothian.

1893. HENDERSON, William, Forester, Clonad Cottage, Tullamore, King's County.

*1906. HENDRICK, James, B.Sc., F.I.C., Marischal College, Aberdeen.

1898. HENDRY, James, 5 Thistle Street, Edinburgh.

1910. HENKEL, John Spurgeon, Assistant Conservator of Forests, Midland Conservancy, Knysna, Cape Colony.

1908. HENRY, Augustine, M.A., etc., Reader in Forestry, 23 Chesterton Road, Cambridge.

*1901. HEPBURN, Sir Archibald Buchan-, Bart. of Smeaton-Hepburn, Prestonkirk.

Date of Election.

*1874. Herbert, H. A., of Muckross, Killarney, Co. Kerry, Ireland.
*1884. Heywood, Arthur, Glevering Hall, Wickham Market, Suffolk.
1895. Hill, Claude, of Messrs John Hill & Sons, Spot Acre Nurseries, Stone, Staffordshire.
1904. Hill, George, Assistant Forester, Fothringham, Forfar.
*1904. Hill, J. Smith, The Agricultural College, Aspatria.
*1903. Hill, Robert Wylie, of Balthayock, Perthshire.
*1905. Hillier, Edwin L., F.R.H.S., Nurseryman and Landscape Gardener, Culross, Winchester.
*1902. Hinckes, Ralph Tichborne, J.P., D.L., Foxley, Hereford.
1907. Hinds, John, Forester, Stockeld Park, Wetherby, Yorks.
1906. Hislop, Robert, Assistant Forester, 11 Bawdsey Street, Bawdsey Manor Estate, near Woodbridge, Suffolk.
1895. Hoare, Sir Henry Hugh Arthur, Bart. of Stourhead, Bath.
1909. Hobart-Hampden, A. C., Indian Forest Service, Ferns, Great Hampden, Great Missenden.
1909. Hodgson, Joseph, Assistant Forester, Fisher Place, Thirlmere, Grasmere.
*1908. Hog, Steuart Bayley, B.A., Newliston, Kirkliston.
1866. Hogarth, James, Forester, Culhorn, Stranraer, Wigtownshire.
1908. Hogg, Alexander, Assistant Forester, Nibbetstane, Durris, Drumoak.
*1905. Holms, John A., Formaken, Erskine, Renfrewshire.
1910. Holzapfel, John William, B.Sc. and N.D.A., Student in Forestry, North Elswick Hall, Newcastle-on-Tyne.
1909. Honeyman, John, Overseer, Kemback Estate, Cupar, Fife.
*1902. Hood, Thomas, jun., Land Agent, Bogend, Duns.
*1908. Hope, Captain Thomas, of Bridge Castle, Westfield, Linlithgowshire.
*1871. Hope, H. W., of Luffness, Drem, Haddingtonshire.
1907. Hopkinson, James Garland, Factor, Drumtochty Estates Office, 11a Dee Street, Aberdeen.
*1876. Horsburgh, John, Aberdour House, Aberdour, Fife.
1908. Houston, Samuel, Foreman Forester, Benmore, Kilmun.
1909. Howe, James, Assistant Forester, Midhope, Hopetoun, South Queensferry.
1902. Howe, John Arnold, Forester, Kippendavie, Dunblane.
1905. Hudson, W. F. A., M.A., Lecturer on Forestry, Agricultural College, Glasgow.
1905. Hutton, George Kerse, Assistant Forester, Castle Kennedy, Wigtownshire.
1906. Hutton, James, Head Forester, Glendye, Banchory.
1905. Imrie, Charles, Assistant Forester, Balgove, Rossie, Montrose.
1910. Imrie, George James, Forest Officer Transvaal Forest Service, P.O. Box 44, Belfast, Transvaal.
1901. Imrie, James, Assistant Forester, c/o Mrs Macdonald, 287 Dalkeith Road, Edinburgh.
*1884. *Inglis, Alex., Greenlaw Dean, Greenlaw, Berwickshire.*
*1908. Inglis, Alexander Wood, of Glencorse, Loganbank, Milton Bridge.

Date of Election.

*1904. INGLIS, David, Accountant, National Bank, Allanmore, Abbotshall Road, Kirkcaldy.

1909. INGLIS, Walter, Assistant Forester, Dalzell Farm, Motherwell.

1891. INGLIS, William, Forester, Brodick, Isle of Arran.

1904. INNES, Alexander Berowald, of Raemoir and Dunnottar, Raemoir House, Banchory.

1895. INNES, Alexander, Forester, Drummuir, Keith.

1901. INNES, George, Forester, Kettleholm, Lockerbie.

1909. IRONSIDE, William, Solicitor, Royal Bank Buildings, Oban.

*1906. IRVINE, Alexander Forbes, J.P., B.A.(Oxon.), Drum Castle, Aberdeen.

1904. IRVINE, Cosmo Gifford, Assistant Forester, Hollycombe Estate, c/o Mrs Luckins, Wardley Marsh, Liphook, Hants.

1901. IRVINE, John, Assistant Forester, Colesborne, Cheltenham, Gloucestershire.

1906. IRVING, James Rae Anderson, Forester, Crawfordton Estate, Kirkland, by Thornhill, Dumfriesshire.

*1908. IZAT, Alexander, C.I.E., Mem. Inst. C.E., Balliliesk, Muckhart, Perthshire.

1907. JACK, David, Assistant Forester, Houston House, Houston, Johnstone.

*1906. JACKSON, George Erskine, B.A.(Oxon.), W.S., Kirkbuddo, Forfar.

1898. JAMIESON, James, Forester, Ynyslas, Llanarthney R.S.O., Carmarthenshire.

1896. JARDINE, Sir R. W. B., Bart. of Castlemilk, Lockerbie, Dumfriesshire.

1907. JERVOISE, Francis Henry Tristram, J.P., Herriard Park, Basingstoke.

1904. JOANNIDES, Pericles, Student of Forestry, Willesden, Sporting Club Station, Ramlek, Egypt; and 4 Merchiston Place, Edinburgh.

1909. JOHNSTON, David T., Gardener, Dalmeny House Gardens, Edinburgh.

1899. JOHNSTON, Edward, Forester, Dalquharran, Dailly, Ayrshire.

1910. JOHNSTON, Frank James, Nurseryman and Forester, Claycroft, Dalbeattie.

*1901. JOHNSTON, James, F.S.I., Factor, Alloway Cottage, Ayr.

*1883. JOHNSTON, Robert, Forester, Bon Ryl Estate, Duns, Berwickshire.

1907. JOHNSTON, Robert, Forester, Dalkeith Park, Dalkeith.

*1907. JOHNSTONE, Richard, Forester, The Glen, Innerleithen.

1900. JOHNSTONE, William, Head Forester, Beil, Prestonkirk.

*1882. JONAS, Henry, Land Agent and Surveyor, 23 Pall Mall, London, S.W.

*1902. JONAS, Robert Collier, Land Surveyor, 23 Pall Mall, London.

1903. JONES, Ireton Arthur, of Kennick & Co., Delgany Nurseries, Co. Wicklow.

1888. JONES, James, Wood Merchant, Larbert, Stirlingshire.

1893. JONES, Thomas Bruce, Wood Merchant, Larbert.

1907. KAY, James, Nursery Station, Indian Head, Sask, Canada.

1867. KAY, James, Wood Manager, Bute Estates, Rothesay.

1909. KAY, John, Assistant Gardener, Grangemuir Lodge, Prestwick.

1896. KEIR, David, Forester, Ladywell, Dunkeld.

Date of Election.

1906. KEIR, James S., Estate Manager, Borrodale, Arisaig.
*1909. KEITH, Marshall John, Factor, Brucklay Estates Office, Aberdour House, Fraserburgh.
1910. KEMP, Tainsh, Saw Mill Manager, Lochend Road, Leith.
*1901. KENNEDY, Frederick D. C.-Shaw-, Dyroch, Maybole.
*1890. KENNEDY, James, Doonholm, Ayr.
1906. KENNEDY, Stewart Winter, Assistant Forester, Glamis.
1899. KENNEDY, Thomas, Assistant Forester, Lambton Park, Fence Houses, Durham.
1904. KENNEDY, Colonel Watson, Wiveton Hall, Cley, Norfolk.
1901. KENT, William, Forester, Burnfoot, Barskimming, Mauchline.
*1892. KERR, John, Farmer, Barney Mains, Haddington.
*1908. KERR, J. Ernest, of Harviestoun, Harviestoun, Dollar.
1896. KETTLES, Robert, Assistant Forester, Craigend, Perth.
1907. KIDD, John, Forester, Hackwood Park, W., Basingstoke.
1894. KIDD, Wm., Forester, Harewood, Leeds.
*1908. KIMMETT, John, Forester, The Lodge, Glenstriven, Toward, Argyllshire.
1900. KING, David, Nurseryman, Osborne Nurseries, Murrayfield.
1910. KININMONTH, Robert, Assistant Forester, Raith, Kirkcaldy.
*1906. KINLOCH, Charles Y., of Gourdie, by Murthly.
*1903. KINNAIRD, The Hon. Douglas A., Master of Kinnaird, 10 St James Square, London.
1906. *Kinnear, Alexander T., Wood Manager and Forester, Jeaniebank House, Old Scone, Perth.*
1905. KINROSS, D. A., Farmer, Hillend, Clackmannan.
*1898. KINROSS, John, Architect, 2 Abercromby Place, Edinburgh.
1908. KIPPEN, John, Assistant Forester, Doune Lodge, Doune.
*1902. KIPPEN, William James, Advocate, B.A., LL.B., Westerton, Balloch, Dumbartonshire.
1910. KIRKPATRICK, James, Forester, Balhary, Meigle.
1898. KYLLACHY, The Hon. Lord, of Kyllachy, 6 Randolph Crescent, Edinburgh.

1907. LAIRD, Charles, Assistant Forester, Home Farm, Dalzell, Motherwell.
1907. LAIRD, John, Forester, Powerscourt, Enniskerry, Co. Wicklow.
*1896. LAIRD, Robert, Nurseryman, 17a South Frederick Street, Edinburgh.
*1901. LAMB, Alexander, Overseer, Freeland, Forgandenny.
*1894. LAMINGTON, The Hon. Lord, G.C.M.G., Lamington, Lanarkshire.
1899. LAMOND, Alexander, Forester, Freeland, Forgandenny.
*1905. LAMONT, Norman, M.P., of Knockdow, Toward, Argyleshire.
*1906. LANGLANDS, James H., Cunmont House, by Dundee.
*1896. LANSDOWNE, The Most Hon. the Marquess of, K.G., 54 Berkeley Square, London, S.W.
1906. LAUDER, Alexander, D.Sc., Edinburgh and East of Scotland College of Agriculture, 13 George Square, Edinburgh.
1901. LAUDER, William, Steward, Summerhill House, Enfield, Co. Meath.
1897. LAURISTON, John, Assistant Forester, c/o Mrs James Blair, Wynd, Cumbernauld.

Date of Election.

1906. LAWSON, William, Assistant Factor, Cromartie Estates, Kildary, Ross-shire.
1902. LEARMONT, John, Nurseryman, Larchfield Nurseries, Dumfries.
1904. LEES, D., of Pitscottie, Cupar, Fife.
1905. LEES, Ernest A. G., Factor, Durris Estate, by Aberdeen.
1909. LE FANN, Victor Charles, B.A., F.S.I., Estate Office, Bray, Co. Wicklow.
1909. LEGAT, Charles Edward, B.Sc.(Agric.), Chief of Forestry Division, Department of Agriculture, Transvaal, Pretoria.
1880. LEISHMAN, John, Manager, Cavers Estate, Hawick, Roxburghshire.
1908. LESLIE, Archibald Stewart, W.S., Factor to Colonel A. G. Leslie of Kininvie, etc., 33 Queen Street, Edinburgh.
1909. LEITH, Lord, of Fyvie, Fyvie Castle, Aberdeenshire.
*1868. LESLIE, Charles P., of Castle-Leslie, Glaslough, Ireland.
*1893. LEVEN, George, Forester, Auchincruive, Ayr.
*1881. LEYLAND, Christopher, Haggerston Castle, Beal, Northumberland.
1907. LINDSAY, Hugh, Head Forester, Torwoodlee Estate, Galashiels.
*1909. LINDSAY, John, Under Forester, Station Lodge, Brodie.
1879. LINDSAY, Robert, Kaimes Lodge, Murrayfield, Midlothian.
1907. LINDSAY, William, of Messrs J. & H. Lindsay, Ltd., Tourist Agents, 18 St Andrew Street, Edinburgh.
1909. Little, Thomas, Assistant Forester, Burnside Cottage, Canonbie.
1905. LOGAN, David, Factor, Saltoun, Pencaitland.
*1908. LOGAN, Douglas Campbell, Assistant Factor, Portree House, Portree, Isle of Skye.
1908. LOGUE, Hugh, Forester, Knockdow, Toward, Argyleshire.
*1883. LONEY, Peter, Estate Agent, 6 Carlton Street, Edinburgh.
1909. LONGMUIR, James, Assistant Forester, Monreith, Port-William.
1907. LOUTIT, Rev. John Smeaton, Minister of Foveran, Manse of Foveran, Aberdeen.
*1898. LOVAT, The Right Hon. Lord, C.B., D.S.O., Beaufort Castle, Beauly, Inverness.
*1880. *Love, J. W., c/o Mrs Boyce, Byron Street, St Kilda, Victoria, South Australia.*
*1875. LOVELACE, The Right Hon. the Earl of, East Horsley Towers, Woking, Surrey.
1909. LOW, David, Assistant Forester, Brook Cottage, Bowmont Forest, Roxburgh.
1898. LOW, James, Forester, Ballindalloch, Strathspey.
*1900. LOW, William, B.Sc., of Balmakewan, Marykirk, Kincardineshire.
1908. LOWDEN, Thomas, Assistant Forester, Canmore, Alberta, Canada.
*1908. LUMSDEN, George James, Aithernie, Lundin Links, Fife.
*1891. LUMSDEN, Hugh Gordon, of Clova, Lumsden, Aberdeenshire.
1900. LUMSDEN, Robert, jun., 11 Morningside Terrace, Edinburgh.
1908. LUNN, George, Forester, Invercauld, Ballater.
*1875. LUTTRELL, George F., of Dunster Castle, Taunton, Somersetshire.
*1900. LYELL, Sir Leonard, Bart. of Kinnordy, Kirriemuir.
*1909. LYLE, Alexander Park, of Glendelvine, Murthly.

Date of Election.

*1907. M'Ainsh, Duncan, Wood Merchant, Crieff.
1908. M'Ainsh, R., Assistant Forester, Bowmont Forest, Roxburgh.
1906. Macalpine-Leny, Major R. L., of Dalswinton, Dumfriesshire.
1909. MacArthur, Alaster, Bank Agent, etc., Inverary.
1909. M'Bain, John, M.A., Headmaster, High School for Girls, 35 Hamilton Place, Aberdeen.
1907. M'Bain, William, Forester, Estates Office, Drumnadrochit.
*1892. Macbean, Simon, Land Steward, Erskine, Bishopton.
1896. M'Beath, David, Forester, Brinscall, Chorley, Lancashire.
1908. M'Callum, Alexander, Assistant Forester, Dunira Cottages, Comrie, Perthshire.
1908. M'Callum, D., Assistant Forester, Innerbuist Cottage, Stormontfield, Perth.
1894. M'Callum, Edward, Overseer, Kerse Estate, Falkirk.
1898. M'Callum, James, Forester, Canford, Wimborne, Dorset.
*1901. M'Callum, Thomas W., Retired Ground Officer, Dailly, Ayrshire.
1904. M'Clellan, Frank C., Zanzibar Government Service, Pemba, *via* Zanzibar, East Africa.
*1870. M'Corquodale, D. A., Bank of Scotland, Carnoustie, Forfarshire.
1893. M'Coubrie, M. S., Land Steward, Tullamore, King's County, Ireland.
1900. Macdiarmid, Hugh, Factor, Island House, Tiree, Oban.
1904. Macdonald, Alexander, Factor, Meggernie, Aberfeldy.
1907. MacDonald, Alexander, Farmer, Rhives, Delny.
1908. M'Donald, Donald, Assistant Forester, 166 Darnley Street, Pollokshields, Glasgow.
1901. Macdonald, Mrs Eleanor E., The Manse, Swinton.
1893. Macdonald, George U., Overseer, Haystoun Estate, Woodbine Cottage, Peebles.
1908. Macdonald, The Hon. Godfrey Evan Hugh, Factor, Macdonald Estates Office, Portree.
*1900. Macdonald, Harry L., of Dunach, Oban.
*1894. Macdonald, James, Forester, Kinnaird Castle, Brechin.
1897. M'Donald, James N. B., Forest Nursery Station, Indian Head, Sask, Canada.
*1903. Macdonald, James Farquharson, S.S.C. and N.P., Kilmuir, Linlithgow.
1895. Macdonald, John, Forester, Skibo, Dornoch.
1908. M'Donald, John, Foreman Forester, Culzean Estate, Maybole.
1908. Macdonald, John Ronald M., of Largie, M.A., D.L., J.P., Largie Castle, Tayinloan, Kintyre.
1910. MacDonald, John, Assistant Forester, Rose Cottage, Achnacarry, Spean Bridge.
1907. Macdonald, T. Martin, of Barguillean, Taynuilt.
1906. Macdonald, William Kid, Windmill House, Arbroath.
1904. M'Donald, William Yeats, of Auquharney, Hatton, Aberdeenshire.
1894. M'Dougall, Alex., Forester, Tuncombe Park, Helmsley R.S.O., Yorks.

Date of Election.

1907. MACDOUGALL, James, Assistant Forester, Inverliever Estate, Dalavich, Kilchrenan, Lochaweside.

*1895. MACDOUGALL, Professor Robert Stewart, M.A., D.Sc., 9 Dryden Place, Edinburgh.

*1884. MACDUFF, Alex., of Bonhard, Perth.

1906. M'EWAN, James, Assistant Forester, Glamis.

1909. M'EWAN, John, Assistant Forester, Castle Lachlan, by Greenock.

1908. M'EWAN, W., Assistant Forester, Drummond Cottage, Logiealmond, by Perth.

1909. MACEWAN, William, Assistant Forester, Pollok.

1904. M'EWAN, Wm., Forester, Allangrange, Munlochy, Ross-shire.

1901. M'EWEN, Alexander, Overseer, Castle Lachlan, Stralachlan, Greenock.

1898. MACFADYEN, Donald, Assistant Forester, Drumlanrig, Thornhill.

1907. MACFARLANE, Archibald, Timber Merchant, Harbour Saw-mills, Paisley.

1909. M'FARLANE, Peter Graham, Assistant Forester, East End, Gartmore.

1910. MACFARQUHAR, Donald, Forester, Port Glas, Kenmore, Aberfeldy.

*1904. MACFIE, John William, of Dreghorn, Rowton Hall, Chester.

*1901. M'GARVA, Gilbert Ramsay, Factor, Estate Office, Innes, Elgin.

1901. M'GHIE, John, Overseer, Kelburne Estate, Fairlie.

*1901. M'GIBBON, Donald, Forester, Rossie Estate, Inchture.

1904. M'GIBBON, R., Forester, Wentworth, Rotherham.

1908. M'GLASHAN, James, Forester, Belladrum, by Beauly.

*1902. MACGREGOR, Alasdair Ronald, Edinchip, Lochearnhead.

1902. M'GREGOR, Alexander, Forester, Abbeyleix, Queen's Co.

*1908. MACGREGOR, Alexander, Iron Merchant, Ravenswood, Dalmuir, Dumbartonshire.

1896. M'GREGOR, Angus, Forester, Craigton, Butterstone, Dunkeld.

1899. M'GREGOR, Archibald, Forest Office, Forestry Department, Nairobi, B.E.A.

*1906. MACGREGOR, Evan Malcolm, Factor, Ard Choille, Perth.

1909. MACGREGOR, James, Head Forester, Broomhill, Airthrey Castle, Bridge of Allan.

1910. M'GREGOR, John, Assistant Forester, Brucefield, Clackmannan.

1910. M'GREGOR, John, Wood Merchant, Tam's Brig Sawmills, Ayr.

1905. M'HARDY, James, Forester, Forglen, Turiff, Aberdeenshire.

1906. M'HARDY, Peter, Seedsman, 30 Guild Street, Aberdeen.

1904. M'HARDY, William, Forester, Chancefield, Falkland, Fife.

1901. M'HATTIE, John W., City Gardener, City Chambers, Edinburgh.

1894. M'ILWRAITH, Wm., Forester, Riddell, Lilliesleaf, Roxburghshire.

1907. M'INNES, William, Assistant Forester, Advie, Strathspey.

1905. M'INTOSH, Alexander, Foreman Forester, Townsend Street, Birr, King's Co., Ireland.

*1895. MACINTOSH, D. L., The Gardens, Stronvar, Lochearnhead.

*1879. M'INTOSH, Dr W. C., Professor of Natural History, University of St Andrews, 2 Abbotsford Crescent, St Andrews.

1904. M'INTOSH, Robert, Forester, Cullentragh Cottage, Rathdrum, Co. Wicklow.

Date of Election.

*1885. MacIntosh, William, Fife Estates Office, Banff.
1901. Macintosh, William, Forester, New Chapel, Boncath R.S.O., South Wales.
1907. M'Intyre, Charles, Forester, Inver, Dunkeld.
1910. Macintyre, John Finlayson, Assistant Forester, Rose Cottage, Achnacarry, Spean Bridge.
1908. Macintyre, Peter Brown, Findon Mains, Conon Bridge.
1898. Mackay, Æneas J. G., LL.D., Advocate, 2 Albyn Place, Edinburgh.
1892. M'Kay, Allan, c/o Park & Co., Ltd., Timber Merchants, Fraserburgh.
1910. Mackay, James Waite, Forest Apprentice, Novar (c/o Miss Munro, Holly Bank, Evanton, Ross-shire).
1865. Mackay, John, Lauderdale Estate Office, Wyndhead, Lauder.
1908. M'Kay, Murdo, Forester, Castlecomer, Co. Kilkenny.
1887. Mackay, Peter, Forester and Overseer, Bargany Mains, Dailly, Ayrshire.
1907. Mackay, William, Factor, Chisholm Estates, 19 Union Street, Inverness.
1900. M'Kechnie, Angus, Assistant Forester, Walkergate, Alnwick.
1891. Mackendrick, James, Forester, Estate Office, Pallas, Loughrea, Co. Galway.
1908. MacKenzie, A., Assistant Forester, Innerbuist Cottage, Stormontfield, Perth.
1908. Mackenzie, Major A. F., of Ord, Ord House, Muir of Ord.
1867. Mackenzie, Alex., Warriston Nursery, Inverleith Row, Edinburgh.
1909. Mackenzie, Alex. James, Factor, 62 Academy Street, Inverness.
1907. Mackenzie, Sir Arthur, Bart. of Coul, Strathpeffer.
1901. Mackenzie, Charles, Factor, Clunes, Achnacarry, Spean Bridge.
1909. Mackenzie, Charles J. S., Assistant Forester, Caberfeidh, Carr Bridge.
1908. *M'Kenzie, Colin, Assistant Forester, Hursley Park, Hants.*
1901. M'Kenzie, Daniel, Forester, Wynyard Estate, Stockton-on-Tees.
*1872. Mackenzie, Donald F., F.S.I., Estate Office, Mortonhall, Edinburgh.
1904. Mackenzie, Major E. Walter Blunt, Castle Leod, Strathpeffer.
1908. Mackenzie, Evan North Barton, Kilcoy Castle, Killearnan.
1908. Mackenzie-Gillanders, Captain E. B., of Highfield, Muir of Ord.
*1893. Mackenzie, James, Forester, Cullen House, Cullen.
1899. M'Kenzie, James, Wood Merchant, Carr Bridge, Inverness-shire.
1897. Mackenzie, John, Forester, Holmhead, Daljarrock, Ayrshire.
1907. Mackenzie, John, jun., Factor, Dunvegan, Skye.
1900. Mackenzie, Sir Kenneth John, Bart. of Gairloch, 10 Moray Place, Edinburgh.
1908. Mackenzie, Nigel Banks, Factor, Fort William.
1908. Mackenzie, Nigel Blair, Assistant Factor, Fort William.
1907. Mackenzie, Colonel Stewart, of Seaforth, Brahan Castle, Dingwall.
1907. Mackenzie, W. Dalziel, of Farr, Inverness.
1896. Mackenzie, Wm., Forester, Novar, Evanton, Ross-shire.

Date of Election.

1905. M'Kerchar, John, Commercial Traveller and Seedsman, 35 Giesbach Road, Upper Holloway, London, N.
*1897. *M'Kerrow, Robert, Manager, Carton, Maynooth, Co. Kildare.*
1907. MacKezzack, George Ross, of Ardgye, Elgin.
1909. M'Kie, Henry B., Factor, Freeland, Erskine, Bishopton.
*1898. MacKinnon, A., The Gardens, Scone Palace, Perth
1883. MacKinnon, George, The Gardens, Melville Castle, Lasswade.
1902. MacKinnon, John, Gardener, Terregles, Dumfries.
1907. Mackinnon, Robert, Forester, Smithton, Culloden.
1878. Mackintosh, The, of Mackintosh, Moy Hall, Inverness.
*1905. Mackintosh, W. E., Yr. of Kyllachy, 28 Royal Circus, Edinburgh.
*1895. Maclachlan, John, of Maclachlan, 12 Abercromby Place, Edinburgh.
1904. Maclaggan, George C. R., Forester, Munday Cottages, Aberdalgie.
1903. Maclaggan, John G., Overseer, Lethendy Cottage, Glenalmond, Perthshire.
1901. M'Laren, Donald, Ellistoun, 19 St Andrew Street, Ayr.
1908. M'Laren, James, Sub-Agent, Haggerston, Beal, Northumberland.
*1879. M'Laren, John, 12 Findhorn Place, Edinburgh.
1909. MacLarty, Alexander Sinclair, Forester, Tullichewan Cottage, Alexandria.
*1898. Maclean, Archibald Douglas, J.P., Harmony, Balerno.
1908. M'Lean, Donald, Factor, Sutherland Estate Offices, Golspie.
1906. M'Lean, James Smith, Forester, Douglas Castle, Lanarkshire.
1902. Maclean, Peter, Forester, Invergarry.
1898. M'Lennan, John, The Gardens, Castle Boro, Enniscorthy, Co. Wexford.
1909. MacLennan, Murdo, Assistant Forester, Hopetoun, South Queensferry.
1901. M'Leod, Peter, Nurseryman, Perth.
1908. M'Millan, Duncan, Estate Overseer, Hafton S.O., Sandbank.
1895. Macmillan, John D., Steward, Margam Park, Port Talbot, Wales.
1910. M'Morran, Peter, Assistant Forester, Dalzell, Motherwell.
*1904. M'Nab, David Borrie, Solicitor, Clydesdale Bank, Bothwell.
1909. M'Nair, Gregor, Overseer, Conaglen, Ardgour.
1903. M'Naughton, George, Assistant Forester, Turleum Cottage, Drummond Castle, Crieff.
1903. M'Naughton, John, Forester, Auchterarder House, Perth.
1906. MacNicoll, David Greenhill, Assistant Forester, Glamis.
1910. M'Pherson, Alexander, Tayness, Kilmartin, Lochgilphead.
1909. Macpherson, Duncan, Foreman Forester, Erskine, Bishopton.
1900. M'Rae, Alexander, Forester, Dundrum, Co. Tipperary.
*1899. Macrae-Gilstrap, Major John, of Ballimore, Otter Ferry, Argyllshire.
1900. M'Rae, Henry, Assistant Forester, Ufton, Southam, Rugby.
1908. M'Rae, John, Assistant Forester, Lintonill, Cullen, Banffshire.
1908. Macrae, Sir Colin G., W.S., 45 Moray Place, Edinburgh.
1906. Macrae, John, Forester, Highfield, Muir of Ord, Ross-shire.
1907. M'Raw, Donald, Manager, Strathgarve, Garve R.S.O.
*1879. MacRitchie, David, C.A., 4 Archibald Place, Edinburgh.

Date of Election.

1895. M'Tavish, John, Assistant Forester, The Glen, Skelbo, Sutherland.
1905. M'Vinnie, Samuel, Forester, Skeagarvie, Rossmore Park, Monaghan.
*1905 Maitland, A. D. Steel, of Sauchie, etc., Sauchieburn, Stirling.
1908. Malcolm, George, Factor, Invergarry, Inverness-shire.
*1880. Malcolm, Lieut.-Col. E. D., R.E., Achnamara, Lochgilphead.
1907. Malkin, Herbert C., J.P., 46 Phillimore Gardens, Kensington, W.
*1895. Mann, Charles, Merchant, Lumsden, Aberdeenshire.
*1909. Mann, James, of Castlecraig, Dolphinton.
*1898. Mansfield, The Right Hon. the Earl of, Scone Palace, Perth.
1896. Mar and Kellie, The Right Hon. the Earl of, Alloa House, Alloa.
*1895. Margerison, Samuel, English Timber Merchant, Calverley, near Leeds.
1909. Marsden, Reginald Edward, Indian Forest Service, 13 Leinster Gardens, London, W.
*1901. Marshall, Archd. M'Lean, Crogen, Corwen, North Wales.
*1905. Marshall, Henry Brown, of Rachan, Broughton.
1899. Marshall, John, Timber Merchant, etc., Maybole.
1893. Marshall, J. Z., Timber Merchant, 2 Dean Terrace, Bo'ness.
1907. Marshall, William, Assistant Forester, Castle Grant, Grantown-on-Spey.
1910. Martin, Lieut-Col. Martin, Upper Ostaig, by Broadford, Isle of Skye.
*1876. Martin, James, Forester, Knipton, Grantham, Lincolnshire.
1909. Massie, George Duncan, Solicitor (Hon. Secretary, Aberdeen Branch), 143 Union Street, Aberdeen.
*1884. Massie, W. H., of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1907. Masson, William, Forester, Meikleour, Perth.
1910. Masterton, James, Hedger and Assistant Forester, Kennet Cottages, Alloa.
1893. Mather, R. V., of Laing & Mather, Nurserymen, Kelso.
1901. Matthews, Robert, Land Steward, Duncrub Park, Dunning.
1909. Maude, James, Timber Merchant, Hebden Bridge, Yorks.
*1894. Maughan, John, Estate Agent, Jervaulx Abbey, Middleham R.S.O. Yorks.
1907. Maw, Percival Trentham, Holmsdale, Nutfield, Surrey.
1907. Maxtone, James, Overseer, Strathallan, Machany, Perthshire.
1896. Maxtone, John, Forester, Duff House, Banff.
*1904. Maxwell, Aymer, Yr. of Monreith, Wigtownshire, Lieutenant, Grenadier Guards.
1891. Maxwell, James, Forester and Overseer, Ruglen, Maybole.
*1893. Maxwell, Sir John Stirling-, Bart. of Pollok, Pollokshaws.
1886. Maxwell, The Right Hon. Sir Herbert E., Bart. of Monreith, Port William, Wigtownshire.
1908. Maxwell, Wellwood, of Kirkennan, Dalbeattie.
1908. Maxwell, William James, Factor, Terregles Banks, Dumfries.
1905. Maxwell, William Jardine Herries, of Munches, Dalbeattie.
1907. Meacher, Sydney George, Land Agent, Marlee, Blairgowrie.
1896. Meiklejohn, John J. R., Factor, Novar, Evanton, Ross-shire.
1906. Meldrum, Thomas C., Nurseryman, Forfar.

Date of Election.

1899. MELVILLE, David, The Gardens, Dunrobin Castle, Golspie.
1901. MENZIES, James, Assistant Forester, Dollardstown Nursery, Wageney, Carlow.
*1908. MENZIES, William Dudgeon Graham, J.P., Hallyburton, Coupar-Angus.
*1880. MESHAM, Captain, Pontryffydd, Bodvari, Rhyl, Denbighshire.
1906. MESTON, William, Assistant Forester, Tower Cottage, Durris, Aberdeen.
1877. METHVEN, Henry, of Thomas Methven & Sons, 15 Princes Street Edinburgh.
1869. METHVEN, John, of Thomas Methven & Sons, Leith Walk Nurseries, Edinburgh.
1892. METHVEN, John, Viewforth, Kennoway, Fife.
*1881. MICHIE, John, M.V.O., Factor, Balmoral, Ballater, Aberdeenshire.
1893. MICHIE, William, Forester, Welbeck, Worksop, Notts.
*1893. MIDDLEMASS, Archibald, Forester, Tulliallan, Kincardine-on-Forth.
1905. MIDDLETON, James, Factor, Braehead House, Kilmarnock.
1910. MIDDLETON, James, Assistant Forester, 63 Manse Street, Renfrew.
*1905. MILLAR, John, Timber Merchant, Greenhaugh Saw-mills, Govan.
1908. MILLAR, John W., Manager, Eldin Chemical Co., Loanhead.
1908. MILLER, James, Assistant Forester, Dalcrue Cottage, Almondbank, Perth.
*1908. MILLER, Robert E., Bonnycraig, Peebles.
1910. MILLIGAN, Alexander, Assistant Forester, Wellington Cottage, Houston, by Johnstone.
1910. MILLIGAN, J. A., Assistant Forester, Ivy House, Baslow, Derbyshire.
1899. MILNE, Alexander, Factor, Urie Estate Office, Stonehaven.
1902. MILNE, Alexander, Forester, Charboro' Park, Wareham, Dorset.
1903. MILNE, Colonel George, of Logie, Aberdeenshire.
1904. MILNE, Frederick, Assistant Forester, Nursery Cottage, Tarbrax, by Forfar.
1908. MILNE, G., Assistant Forester, Innerbuist Cottage, Stormontfield, Perth.
1895. MILNE, James, Land Steward, Carstairs House, Carstairs.
1906. MILNE, John, Assistant Forester, Woodlands, Durris, Aberdeen.
1899. MILNE, Ritchie, Assistant, Annandale Estate Office, Hillside, Lockerbie.
*1898. MILNE, Robert P., Spittal Mains, Berwick-on-Tweed.
1890. MILNE, William, Farmer, Foulden, Berwick-on-Tweed.
1902. MILNE, William, Forester, Huntly Hill, Stracathro, Brechin.
1906. MILNE, William, Nurseryman (Wm. Fell & Co., Ltd.), Hexham.
1901. MILNE-HOME, David William, of Wedderburn, Caldra, Duns.
*1897. MILNE-HOME, J. Hepburn, Irvine House, Canonbie.
1894. MILSOM, Isaac, Gardener and Steward, Claydon Park, Winslow, Bucks.
*1909. MIRRIELEES, Frederick Donald, B.A.Oxon., of Pasture Wood, Dorking, Surrey.
1904. MITCHELL, Alexander, Forester, Rosebery, Gorebridge.
1898. MITCHELL, David, Forester, Drumtochty, Fordoun.

Date of Election.

*1882. MITCHELL, Francis, Forester, Woburn, Beds.
1904. MITCHELL, James, Organising Secretary for Technical Education to Fife County Council, County Buildings, Cupar, Fife.
*1902. MITCHELL, John, jun., Timber Merchant, Leith Walk Saw-mills, Leith.
1904. MITCHELL, John Irvine, M.A., Teacher, 3 Craighouse Terrace, Edinburgh.
1901. MITCHELL, William Geddes, Estate Agent, Doneraile, Co. Cork.
1909. MITCHELL, William, Foreman Forester, Skippers Cottage, Langholm.
1903. MOERAN, Archibald E., Land Agent, etc., Lissadell, Thelorgan Park, Co. Dublin.
1902. MOFFAT, John, Forester, Blackwood, Lesmahagow.
1909. MOFFAT, William, Forester, Castle Wemyss, Weymss Bay.
1909. *Moffatt, Thomas, Assistant Forester, Thirlmere, Grasmere.*
*1908. MOISER, Cyril, P.A.S.I., Heworth Grange, York.
*1895. MONCREIFFE, Sir Robert D., Bart. of Moncreiffe, Perth.
1897. MOON, Frederick, Forester, Bowmont Forest, Roxburgh.
*1906. MOON, John Laurence, Forest Ranger, Forestry Department, Nairobi, British East Africa.
1907. MOORE, Frederick G., Assistant Forester, Estate Office, Colwyn Bay.
1903. MORAY, The Right Hon. the Earl of, Darnaway Castle, Forres.
*1897. MORGAN, Alex., Timber Merchant, Crieff, Perthshire.
*1899. MORGAN, Andrew, Assistant Factor, Glamis.
*1895. MORGAN, Malcolm, Timber Merchant, Crieff, Perthshire.
1907. MORRISON, Andrew, Estate Manager, Brodie Mains, Forres.
1895. MORRISON, Hew, LL.D., Librarian, Edinburgh Public Library.
*1908. MORRISON, Hugh, Little Ridge, Tisbury, Wilts.
1908. MORRISON, John, Factor, House of Tongue, Sutherland.
1903. MORRISON, William, Manufacturer, 61 Grant Street, St George Road, Glasgow.
1905. MORTON, Andrew, Assistant Forester, Douglas, Lanarkshire.
1905. MOTHERWELL, A. B., Writer, Airdrie.
*1908. MOUBRAY, John J., Naemoor, Rumbling Bridge.
1907. MOULTRIE, James, Assistant Forester, Star, Balbirnie, Markinch.
1908. MOWAT, George, Forester, Carmichael, Thankerton, Lanarkshire.
1906. MOWAT, John, Overseer, Hazelhead Estate, Aberdeen.
1906. MUIR, William, Estate Clerk, Broomlands, Kelso.
1890. MUIRHEAD, George, F.R.S.E., Commissioner, Speybank, Fochabers.
1901. MULLIN, John, Forester, Eglinton Castle, Irvine.
1904. MUNRO, Alexander, Overseer, Invereshie, Kincraig.
1903. MUNRO, Alexander J., 48 Castle Street, Edinburgh.
1895. MUNRO, Donald, Forester, Holkham Hall, Norfolk.
1906. MUNRO, Donald, Wood Merchant, Ravenswood, Banchory.
1902. MUNRO, George A., S.S.C., 6 Rutland Square, Edinburgh.
1908. MUNRO, George, M.B.C.M., 51 Albany Street, Leith; and Kergord, Shetland.
1905. MUNRO, Sir Hector, Bart. of Foulis Castle, Evanton, Ross-shire.
1900. MUNRO, Hugh R., Assistant Forester, Kingswood, Murthly.

Date of Election.

*1902. MUNRO, Hugh Thomas, Lindertis, Kirriemuir.
1910. MUNRO, James Watson, Student for B.Sc. in Agriculture and Forestry, c/o Lindsay, 15 Spottiswoode Street, Edinburgh.
1907. MUNRO, John, Foreman Forester, Kingswood, Murthly.
1907. MUNRO, John, Land Steward and Forester, The Lodge, Tarland, Aberdeenshire.
1909. MUNRO, William, Factor, Glenferness, Dunphail.
*1909. MURRAY, Major Alastair Bruce, of Polmaise, Stirling.
*1892. MURRAY, Alexander, Forester, Murthly, Perthshire.
1910. MURRAY, Arthur, Assistant Forester, Cruachan, Kilchrenan, Argyll.
1904. MURRAY, Charles A., of Taymount, Stanley.
1906. MURRAY, David, Assistant Forester, Windsor Cottage, Fern, by Brechin.
1900. MURRAY, George J. B., Forester, Holylee, Walkerburn.
1902. MURRAY, Bailie John, J.P., 9 Strathearn Road, Edinburgh.
1904. MURRAY, John M., Assistant Forester, Kingswood, Murthly.
1900. MURRAY, William, of Murraythwaite, Ecclefechan, Dumfriesshire.
*1896. MURRAY, William Hugh, W.S., 48 Castle Street, Edinburgh.

*1899. NAIRN, Sir Michael B., Bart. of Rankeillour, Manufacturer, Kirkcaldy.
1904. NAIRN, Robert, Forester, Rowallan, Kilmarnock.
1907. NASH, William, Assistant Forester, Airdsmill, Muirkirk, Ayrshire.
*1905. NASMYTH, Norman, of Glenfarg, Glenfarg Lodge, Abernethy.
*1909. NAYLOR, John Murray, Laighton Hall, Welshpool.
*1909. NEISH, Edward William, Advocate, etc., Woodville, Greenock.
1893. NELSON, Robert, Assistant Forester, Hannahgate Cottage, Kinmount Estate, Cummertrees, Dumfriesshire.
*1908. NELSON, Thomas Arthur, of Achnacloich, Connel, Argyleshire.
1910. NEWTON, James Whittet, Student for B.Sc. in Agriculture and Forestry, c/o Lindsay, 15 Spottiswoode Street, Edinburgh.
1893. NICOL, James, Forester, Aird's Mill, Muirkirk, Ayrshire.
1895. NICOL, James, Forester, Croxteth, Liverpool.
1906. NICOL, William, Forester, Cluny Castle, Ordhead, Aberdeenshire.
*1903. NICOL, William Edward, D.L., J.P., of Ballogie, Aboyne.
1909. NICOLL, William, Assistant Forester, Blair Drummond Cottages, Perthshire.
1901. NICOLL, William Peter, Assistant Forester, Kippo, Kingsbarns, Fife.
*1901. NICOLSON, Edward Badenach, Advocate, 12 Atholl Crescent, Edinburgh.
*1893. NISBET, J., D.Œc., Royal Societies' Club, 63 St James Street, London, S.W.
*1902. *Nisbet, Robert C., Farmer, Kingsknowe, Slateford.*
*1899. NOBBS, Eric Arthur, B.S., Ph.D., Department of Agriculture, Salisbury, Rhodesia.
1899. NOBLE, Charles, Forester, Donibristle, Aberdour.
1904. NOBLE, Hugh, Assistant Forester, Bunachton, Inverness.

*1909. OGILVIE, George Hamilton, Westlands, Broughty Ferry.
1910. OGILVY, Mrs Mary Georgiana Constance N. Hamilton, of Biel, Prestonkirk.

Date of Election.

1906. Ogilvie, Thomas, D.L., J.P., Kepplestone, Aberdeen.
1908. Ogston, Alexander Milne, of Ardoe, near Aberdeen.
*1908. Ogston, James, of Kildrummy, Kildrummy, Aberdeenshire.
1900. Oliphant, Joseph, Assistant Forester, Quarterbank, Abercairney, Crieff.
1909. Oliver, Colonel William J., of Lochside, Kelso (18 Victoria Place, Stirling).
*1894. Orkney, William C., Surveyor's Office, Montrose Royal Asylum.
*1899. Orr-Ewing, Sir Archibald Ernest, Bart , Ballikinrain Castle, Balfron.
*1906. Orr, George W., Cowdenhall, Neilston.
1906. Orr, Harry D., Timber Merchant, 73 Saltergate, Chesterfield.
1907. Oswald, Major Julian, Kindar Lodge, New Abbey, Dumfries.
1902. Oswald, Richard Alexander, of Auchincruive, Ayr.
1906. *Owen, Harry, Foreman Forester, Peacock Cottage, Knipton, Grantham, Lincolnshire.*

1875. Page, Andrew Duncan, Land Steward, Culzean Home Farm, Ayr.
1908. Park, Robert, Contractor, Hamilton Street, Motherwell.
1908. Paterson, Alexander, Foreman Forester, Linton, Morebattle, Kelso.
1900. Paterson, George, Timber Merchant, 64 Queen's Road, Aberdeen.
*1879. Paton, Hugh, Nurseryman, Kilmarnock, Ayrshire.
*1898. Paton, Robert Johnston, Nurseryman, Kilmarnock.
*1902. Paton, Tom W., Nurseryman, Kilmarnock.
1898. Patterson, Thomas L., Nisbet, Pentcaitland, East Lothian.
1908. Pearson, Andrew, Commissioner, Dalkeith House, Dalkeith.
1897. Pearson, James, Forester, Sessay, Thirsk, Yorks.
1899. Pearson, James, Factor, The Cottage, Airdrie.
1909. Peattie, William, Assistant Forester, Bowmont Forest, Roxburgh.
*1908. Pentland, Lord, The Right Hon., Secretary for Scotland, Dover House, Whitehall, London.
*1900. Perrins, C. W. Dyson, of Ardross, Ardross Castle, Alness.
1904. Peters, William, Assistant Forester, Gateside, Markinch, Fifeshire.
*1897. Philip, Alexander, Solicitor, Brechin, Forfarshire.
*1895. Philip, William Watt, Factor, Estate Office, Gigha, Argyleshire.
1908. Phillips, John, Nurseryman, Granton Road, Edinburgh.
*1896. Philp, Henry, jun., Timber Merchant, Campbell Street, Dunfermline.
*1896. Philp, John, Timber Merchant, Campbell Street, Dunfermline.
*1896. Pitman, Archibald Robert Craufurd, W.S., 48 Castle Street, Edinburgh.
1902. Plummer, C. H. Scott, of Sunderland Hall, Selkirk.
1901. Pollock, Alexander, Rustic Builder, Tarbolton, Ayrshire.
1897. Poole, Wm., Corn Exchange Buildings, Edinburgh.
1902. Popert, E. P., Assistant Surveyor, Forest of Dean, Coleford, Gloucestershire.
1908. Porteous, James, Solicitor and Factor, Coldstream.
1899. Porteous, Colonel James, of Turfhills, Kinross.
1896. Prentice, George, Strathore, Kirkcaldy, Fife.
*1898. Price, W. M., Factor, Minto, Hawick.

Date of Election.

1908. Pringle, James Lewis, of Torwoodlee, J.P., D.L., B.A., Torwoodlee, Galashiels.
1908. Pritchard, Henry A., Professor of Estate Management and Forestry, Royal Agricultural College, Cirencester.
1908. Proctor, John, Assistant Forester, Castle Stead, Dalkeith Park, Dalkeith.
*1908. Purvis, Colonel Alexander, St Andrews.
1907. Purvis, George, Forester, Cowden Estate, Dollar.

1907. Rae, Frederick S., Assistant Forester, Pollok, Pollokshaws.
1907. *Rae, Louis, Assistant Forester, Dalzell Estate, Motherwell.*
*1876. Rae, William A., Factor, Murthly Castle, Perthshire.
*1901. Raffan, Alexander, Forester, Bonskeid, Pitlochry.
1898. Raffan, James, Estate Steward, Fota Farm, Carrigtwohill, Co. Cork.
1899. Rafn, Johannes, Tree-Seed Merchant, Skovfrökontoret, Copenhagen, F.
1902. Ralph, William, I.S.O., Forrester Road, Corstorphine.
1897. Ralston, A. Agnew, Factor, Philipstoun House, West Lothian.
1907. Ralston, Charles W., Chamberlain on Dukedom of Queensberry, Dabton, Thornhill, Dumfriesshire.
*1908. Ralston, Claude, Factor, Estates Office, Glamis.
*1908. Ralston, Gavin, Factor, Glamis.
1904. Ralston, Gavin W., M.A., Advocate, 6 Abercromby Place, Edinburgh.
1907. Ramsay, William, J.P., Longmorn House, Longmorn R.S.O.
*1855. Ramsden, Sir John, Bart., Byram Hall, Ferrybridge, Normanton.
*1908. Rattray, Lieut.-General Sir James Clark, K.C.B., of Craighall Rattray, Blairgowrie.
1870. Rattray, Thos., Forester, Westonbirt House, Tetbury, Gloucestershire.
1909. Rattray, William, Wood Merchant, Tullylumb Terrace, Perth.
1908. Redpath, John, Forester, Paxton, Berwick-on-Tweed.
1905. Reid, Alexander T., Assistant, Foret de Berlredine, Medjez-Spa, Bone, Algeria.
1905. Reid, Andrew, The Gardens, Durris, Drumoak, Aberdeenshire.
1901. Reid, Hugh, Forester, Ashton Court, Long Ashton, near Bristol.
1908. *Reid, J., Assistant Forester, Ardgilzean, Old Scone, Perth.*
1909. Reid, James, jun., Assistant Forester, Balbirnie, Milldeans, Markinch,
1894. Reid, James S., Forester, Balbirnie, Markinch, Fife.
1907. Reid, John, Assistant Forester, Mill House, Brig o' Turk, Callander.
1910. Reid, Peter, Assistant Forester, Cruachan, Kilchrenan, Argyll.
1905. Reid, Robert, Overseer, Kincairney, Dunkeld.
1903. Reid, Robert Matelé, Druimneil, Appin, Argyleshire.
1908. Reid, Wm., Estate Overseer, Kildrummy Castle, Mossat, Aberdeenshire.
1910. Reis, Gordon Stanley, B.Sc., The Laurels, Bright's Crescent, Edinburgh.
1901. Rennie, Joseph, Overseer, Hillend, Possil, Maryhill.
*1908. Renshaw, Charles Stephen Bine, B.A., Barochan, Houston.
*1873. Richardson, Adam D., 6 Dalkeith Street, Joppa.

Date of Election.

1910. Rigg, Patrick Home, of Tarvit, Cupar.
1907. Rillie, Joseph, Assistant Forester, Lazenby, Eston R.S.O., Yorks.
1892. Ritchie, Alexander, Overseer, Brucehill, Cardross Estate, Port of Menteith.
*1908. Ritchie, Charles Ronald, Law Apprentice, 37 Royal Terrace, Edinburgh.
*1876. Ritchie, William, Hope Lodge, Moffat.
1898. Ritchie, Wm., Assistant Forester, Moss-side Cottage, Lynedoch, Perth.
1906. Ritchie, Wm. H., of Dunnottar House, Stonehaven.
1906. Robb, Archibald, Riverslea, Rothes.
1900. Robb, John, Road Surveyor, County Buildings, Edinburgh.
*1909. Roberts, Alex. Fowler, of Fairnilee, Clovenfords, Galashiels.
1904. *Robertson, Alexander, Assistant Forester, Meikledams, Durris.*
1909. Robertson, Alexander, Factor, Polmaise, Stirling.
*1897. Robertson, A. Barnett, Forester, The Dean, Kilmarnock, Ayrshire.
1897. Robertson, Andrew N., Forester, Glenferness, Dunphail.
1899. Robertson, Charles, Forester, Colstoun Old Mill, Gifford.
*1879. Robertson, Donald, Forester, Dunrobin, Golspie.
*1907. Robertson, Edward Hercules, B.A., Advocate, Burnside, Forfar.
1896. Robertson, George, Forester, Ponsbourne Park Estate, near Hertford.
1908. Robertson, George, Assistant Forester, The Cottage, Stormontfield, Perth.
1900. Robertson, James, Assistant Forester, Perlethorpe, Ollerton, Newark, Notts.
1904. Robertson, James, Assistant Forester, Pollok Estate, Pollokshaws.
*1866. Robertson, Jas., Wood Manager, Taybank Cottage, Barnhill, Broughty Ferry.
*1905. Robertson, James Morton, of Cowieslinn, Portmore House, Eddleston.
1905. Robertson, James W., Head Gardener, Letham Grange and Fern, Arbroath.
1907. Robertson, J. P., Forester, Edensor, Bakewell.
*1905. Robertson, John, Factor, Panmure Estates Office, Carnoustie.
1896. Robertson, John, Forester, Altyre, Forres.
1909. Robertson, John Alexander, c/o Macdonald, 65 St Stephen Street, Edinburgh.
1895. Robertson, Thomas, Forester and Bailiff, Woodlawn, Co. Galway.
1907. *Robertson, Thomas, Forester, Edgehead Ford, Dalkeith.*
1910. Robertsonwhite, John Peregine, M.A., LL.B., Advocate in Aberdeen, 80 Union Street, Aberdeen.
1909. Robinson, Alfred Whitmore, Forester, Bamford, near Sheffield.
1902. Robinson, Stewart, "The Ovals," Kington, Herefordshire.
*1890. Robinson, William, Gravetye Manor, East Grinstead, Sussex.
1899. Robson, Alex., of Smith & Son, 18 Market Street, Aberdeen.
1901. Robson, Alexander, Head Gamekeeper, The Kennels, Culzean, Maybole.
*1897. Robson, Charles Durie, 66 Queen Street, Edinburgh.

Date of Election.

1900. Robson, John, Assistant Forester, Baronscourt, Co. Tyrone.
1893. Rodger, James, Forester, Leinster Street, Athy, Co. Kildare.
1908. Rogers, E. Percy, Estate Office, Stanage Park, Brampton Byran, Herefordshire.
*1883. Rollo, The Hon. Wm. Chas. Wordsworth, Master of Rollo, Duncrub Park, Dunning, Perthshire.
1893. Romanes, James, C.A., Fordel, Melrose.
*1872. Rosebery, The Right Hon. the Earl of, K.G., K.T., Dalmeny Park, Edinburgh.
1898. Ross, Charles D. M., Factor, Abercairney, Crieff.
1905. Ross, John S., Factor's Clerk, Monreith Estate Office, Wigtownshire.
*1906. Roxburghe, His Grace the Duke of, K.T., Floors Castle, Kelso.
1903. Rule, John, Forester, Huntly.
*1908. Russell, David, Silverburn, Leven.
1893. Rutherford, James A., Land Agent, Highclere Park, Newbury, Berks.
1910. Rutherford, James, Assistant Forester, Royal Botanic Garden, Edinburgh.
1909. Rutherford, J. D., Apprentice W.S., 198 Grange Loan, Edinburgh.
1870. Rutherford, John, Forester, Linthaugh, Jedburgh, Roxburghshire.
1904. Rutherfurd, Henry, Barrister-at-Law, Fairnington, Roxburgh.

*1894. Samson, David T., Factor, Seafield Estates Office, Elgin.
1875. Sang, Edmund, of E. Sang & Sons, Nurserymen, Kirkcaldy.
*1906. Sang, J. H., LL.B., W.S., Westbrook, Balerno.
1903. Schott, Dr Peter Carl, Nursery and Seed Establishments, Knittelsheim, Palatinate, Germany.
*1867. Scott, Daniel, Wood Manager, Darnaway, Forres.
1892. Scott, David, Overseer, Dumfries House, Cumnock, Ayrshire.
1901. Scott, Frank, Forester, Jeaniebank, Old Scone, Perth.
1881. Scott, James, Forester, Wollaton Hall, Nottingham.
*1907. Scott, James Cospatrick, P.A.S.I., Yarrow Cottage, Poynder Place, Kelso.
1908. Scott, James Henry, of Eredine, Port Sonachan, Argyllshire.
1903. Scott, John, Forester, Annfield, Hartrigge, Jedburgh.
1908. Scott, John A., Forester, The Gardens, Knockbrex, Kirkcudbright, N.B.
1890. Scott, John D., Land Steward, Estate Office, Brushford, Dulverton, Somerset.
*1906. Scott, John Henry Francis Kinnaird, of Gala, Gala House, Galashiels.
1906. Scott, Robert, Solicitor, 230 Union Street, Aberdeen.
*1902. Scrimgeour, James, Gardener, Manor House, Donaghadee.
*1890. Scrimgeour, John, Overseer, Doune Lodge, Doune.
1909. Seed, Frederick Hutton, Plant Import Inspector, Mombasa, East Africa Protectorate.
1897. Sharpe, Thomas, Forester, Monreith, Port William, Wigtownshire.
1904. Shaw, John, Factor, Kilmahew Estate Office, Cardross.
*1896. Shaw-Stewart, Sir Hugh, Bart., M.P., of Ardgowan, Greenock.

Date of Election.

*1904. Shelley, Sir John Courtown Elward, Bart., Avington, Alresford, Hants.

*1898. Sheppard, Rev. H. A. Graham-, of Rednock, Port of Menteith, Stirling.

*1907. Shiach, Gordon Reid, L.D.S., etc., Ardgilzean, Elgin.

*1903. Shiel, James, Overseer, Abbey St Bathans, Grant's House.

1907. Shiels, George Henry, Forester, Low Entercommon, Great Smeaton, Northallerton.

1905. Sim, John, Forester, Fernybrae, Cornhill, Banffshire.

1903. Simon, Thomas, jun., Assistant Forester, c/o Mrs Luckins, Wardley Marsh, Liphook, Hants.

1910. Simpson, Robert, Under Forester, Drumtochty, Auchinblae.

1909. Sinclair, Magnus H., Seedsman, 156a Union Street, Aberdeen.

1906. Sinclair, Robert, Factor for North Harris, Harris, by Portree.

1909. Singer, George, Forester, Rothienorman.

1900. Singer, John G., Forester, Culzean, Ayr.

1908. Skimming, Robert, Timber Merchant, Kirkinner.

1907. Skirving, Robert, D.L., J.P., of Cobairdy, Huntly, Aberdeenshire.

1868. Slater, Andrew, War Department Estates Office, Durrington, Salisbury, Wilts.

1902. Smart, John, Merchant, 18 Leith Street, Edinburgh.

*1893. Smith, Charles G., Factor, Haddo House, Aberdeen.

1906. Smith, Douglas, P.A.S.I., Land Agent, Estate Office, Thwaite, Erpingham, Norwich.

1904. Smith, D. D., Nurseryman and Seed Merchant, St Catherine's Street, Cupar, Fife.

1908. Smith, Edwin Hedley, B.L., Factor, Whittinghame, Prestonkirk.

1873. Smith, G. B., Wire Fence Manufacturer, The Cottage, Port Lamont, Toward.

1909. Smith, Harold, Assistant Forester, Heckfield, Winchfield, Hants.

1901. Smith, James, Forester, 1 Oxmantown Mall, Birr, King's County.

1908. Smith, James, Nurseryman, Darley Dale Nurseries, near Matlock.

1908. Smith, James, Assistant, Jeaniebank, Old Scone, Perth.

1906. Smith, James Fraser, F.R.H.S., late Gardener, Barons Hotel, Auchnagatt.

1907. Smith, Right Hon. James Parker, P.C., 20 Draycott Place, London, S.W.

1895. Smith, John, Cabinetmaker, 1 Eastgate, Peebles.

*1907. Smith, J. Grant, Factor, Seafield Estates Office, Grantown-on-Spey.

1901. Smith, Matthew, Manager for Dyer & Co., Peebles.

1908. Smith, Robert, Factor, Cranstoun Riddell, Dalkeith.

1901. Smith, Sydney, Factor, Drummuir Estates Office, Keith.

1901. Smith, Thomas, Factor, The Castle, Maybole.

1909. Smith, Thomas, Nurseryman, Stranraer.

*1895. Smith, Thomas, Overseer, The Nursery, Tring Park, Wiggington, Tring, Herts.

1896. Smith, William, Forester, Camperdown, Dundee.

1899. Smith, William, Overseer, Rothes Estate Office, Leslie, Fife, N.B.

Date of Election.

*1896. Smith, William G., B.Sc., Ph.D., Lecturer on Biology, Edinburgh and East of Scotland College of Agriculture, George Square, Edinburgh.

*1907. Smithson, Harry S. C., of Inverernie, Daviot, Highland R.S.O.

1910. Smyly, John George, B.A., Consulting Forester and Land Agent, 22 Earlsfort Terrace, Dublin.

*1882. Smythe, David M., of Methven Castle, Perth.

1907. Somerset, His Grace the Duke of, Maiden Bradley, Bath; 35 Grosvenor Square, W.

1906. Somerville, Hugh Christopher, 2 Fairhaven, Dalkeith.

1906. Somerville, Robert Anderson, Eastwoodbrae, Dalkeith.

*1889. Somerville, Dr William, M.A., D.Sc., D.Œc., F.R.S.E., Professor of Rural Economy, Oxford.

1904. Soutar, William, Forester, The Farm, Titsey Place, Limpsfield, Surrey.

1898. Spence, William, Forester, Strathenery, Leslie.

*1899. Spiers, Adam, Timber Merchant, Warriston Saw-mills, Edinburgh.

*1883. Sprot, Major Alexander, of Garnkirk, Chryston, Glasgow.

*1909. Stair, The Earl of, Lochinch, Castle Kennedy.

1899. Stalker, Wm. J., Nurseryman, Nairn.

1908. St Clair, The Right Hon. Charles William, Lord Sinclair, 55 Onslow Square, London, S.W.

1908. St Quintin, Geoffrey Apsley, Estate Commissioner, Kincurdy, Fortrose.

1903. Stephen, Alfred, Assistant Forester, Drumtochty, Fordoun.

1907. Stephen, John, Forester, Dell Nursery, Nethy Bridge.

1901. Stewart, Alistair D., Kinfauns Estates Office, Rockdale, Perth.

1897. Stewart, Charles, Forester, Castle Menzies, Aberfeldy.

*1908. Stewart, Charles, Achara, Duror of Appin, Argyll.

1907. Stewart, David, Assistant Forester, Lisduff, Errill, Ballybrophy, Ireland.

1909. Stewart, Sir David, of Banchory-Devenick, Banchory House, Banchory, Devenick.

*1899. Stewart, Duncan D., Factor, Rossie Estate, Inchture.

1901. Stewart, James, Forester, Letham and Fern Estates, Fern, near Brechin.

1903. Stewart, John, Forester, Cavens, Kirkbean, Dumfries.

1909. Stewart, John M'Gregor, Assistant Forester, Sawmill Cottage, Strathord, by Stanley.

*1892. Stewart, Sir Mark J. M'Taggart, Bart. of Southwick, Kirkcudbrightshire.

1908. Stewart, Colonel R. K., of Murdostoun, Murdostoun Castle, Lanarkshire.

1876. Stewart, Robert, Forester, Stonefield, Tarbert, Lochfyne, N.B.

1906. Stewart, William Maitland, Factor, 5 Inverleith Terrace, Edinburgh.

1910. Stewart, William, of Shambellie, Kirkcudbrightshire.

*1904. Stirling, Archibald, of Keir, Dunblane.

Date of Election

1907. Stirling, John Alexander, of Kippendavie, Dunblane.
*1908. Stirling, William, D.L., J.P., of Fairburn, Muir of Ord.
1909. Stobart, Lionel Forrester, 9 Westminster Mansions, London, S.W.
*1909. Stodart, Charles, Farmer, Wintonhill, Pencaitland.
1910. Stodart, Thomas, Major, Indian Medical Service, The Croft, Colinton.
1897. Stoddart, James, Builder, Bonnyrigg, Midlothian.
1906. Stoddart, James, jun., Joiner, Norwood, Bonnyrigg.
1893. Storie, W., Whitway House, Newbury, Berks.
1908. Stratheden and Campbell, The Right Hon. Lord, Hartriggs, Jedburgh.
*1908. Strathmore and Kinghorne, The Earl of, Glamis Castle, Glamis.
1908. Stuart, Alexander, Estate Clerk, Benmore, Kilmun.
1910. Stuart, George Morrison, Gardener, The Gardens, Forglen, Turriff.
1908. Stuart, Lord Ninian Edward Crichton, House of Falkland, Fife.
1906. Stuart, Peter, Brewer, Glen Grant, Rothes.
1902. Stunt, Walter Charles, Lorenden, Ospringe, Kent.
*1880. Sutherland, Evan C., Highland Club, Inverness.
1907. Sutherland, George, Assistant Forester, Park Cottage, Cardross, by Port of Monteith.
*1883. Sutherland, His Grace the Duke of, K.G., Dunrobin Castle, Golspie.
1892. Sutherland, John D., Ardconnel Lodge, Oban, Argyll.
1909. Sutherland, John S., Assistant Forester, Pilsley, Bakewell, Derbyshire.

1869. Tait, David, Overseer, Owston Park, Doncaster, Yorkshire.
*1892. Tait, James, Builder, Penicuik, Midlothian.
*1900. Tait, James, jun., Westshiel, Penicuik.
1898. Tait, William, Seedsman, 75 Shandwick Place, Edinburgh.
1895. Tait, Wm. A., 13 Brandon Terrace, Edinburgh.
1902. Taylor, John, Forester, Orchill Estate, by Braco, Perthshire.
1904. Taylor, Robert, Assistant Forester, Chapelhill, Logiealmond, Methven.
1905. Taylor, Robert, Forester, Broomhall Estate, Charlestown, Fife.
1897. Taylor, William, Forester, Sandside, Kirkcudbright.
1905. Telfer, John, Forester, Hardwick House, Whitchurch, Oxon.
*1891. Tennant, Sir Edward P., Bart. of The Glen; 31 Lennox Gardens, London, S.W.
*1877. Terris, James, Factor, Dullomuir, Blairadam, Kinross-shire.
1908. Thompson, Archibald, Overseer, Auchindarroch, Lochgilphead.
*1909. Thompson, David Peat, Tea Planter and Engineer (Retired), 6 Queen Street, Inverkeithing.
1904. Thompson, Dugald, Forester, Drimsynie, Lochgoilhead.
1909. *Thompson, John, Assistant Forester, Abercairney, Crieff.*
1893. Thomson, David W., Nurseryman, 113 George Street, Edinburgh.
1903. Thomson, John Burnside, Estate Manager, Calderwood Castle, High Blantyre.
*1855. Thomson, John Grant, Retired Wood Manager, Mount Barker, Grantown-on-Spey.

Date of Election.

*1902. THOMSON, Peter Murray, S.S.C., Cockbridge, Mealsgate, Cumberland.
1903. THOMSON, Robert, Foreman Forester, Park Hill, Ampthill, Bedfordshire.
*1901. THOMSON, Spencer Campbell, of Eilean Shona, 10 Eglinton Crescent, Edinburgh.
*1908. THORBURN, Michael Grieve, D.L., etc., of Glenormiston, Innerleithen.
1904. THREIPLAND, Captain W. Murray, Dryburgh Abbey, St Boswells.
1906. TINDAL, Robert, Forester, Bellspool Cottages, Stobo.
1901. TIVENDALE, William D., Head Forester to Duke of Portland, Burnhouse, Galston.
*1871. TOMLINSON, Wilson, Forester, Clumber Park, Worksop, Notts.
1906. *Tosh, Hendry, Assistant Forester, Bridgend, Inverkip, Greenock.*
*1906. TRAIL, James William Helenus, A.M., M.D., F.R.S., Professor of Botany in University of Aberdeen, 71 High Street, Old Aberdeen.
*1902. TROTTER, A. E. C., of Bush, Milton Bridge, Midlothian.
*1903. TULLIBARDINE, The Most Hon. the Marquis of, D.S.O., Blair Castle, Blair Atholl.
1903. TURNBULL, John, Forester, Forester's Lodge, Arbigland, Dumfries.
1883. UNDERWOOD, Henry E., Fornham, St Martin, Bury St Edmunds, Suffolk.
*1903. UNWIN, Arthur Harold, D.Œc., Town House, Haslemere, Surrey.
*1908. URQUHART, Angus, Assistant Nursery and Seedsman, Inverness.
*1902. URQUHART, Farquhar, Nurseryman, Inverness.
1907. URQUHART, Colonel Robert, Town Clerk, Forres.
*1908. USHER, Sir Robert, Bart. of Norton and Wells, Norton, Ratho Station, Midlothian.
1903. USHER, Thomas, Factor, Courthill, Hawick.
1908. VEITCH, Andrew, Seedsman and Nurseryman, Melrose.
1908. WALDRON, Major Patrick John, East Haugh, Pitlochry.
1903. WALKER, Captain George Lawrie, of Crawfordton, Thornhill.
1894. WALKER, Henry H., Factor, Monreith, Port William, Wigtownshire.
*1878. WALKER, Colonel I. Campbell, Newlands, Camberley, Surrey.
*1907. WALKER, James, Wood Merchant, Inverness.
*1906. WALKER, John Steven, Yard Foreman, Saw-mills, Hurlford, Ayrshire.
*1906. WALKER, Robert Williamson, C.E., Factor and Land Surveyor, 3 Golden Square, Aberdeen.
1870. WALL, G. Y., Land Agent, Grange House, Darlington, Durham.
1903. WALLACE, Andrew, Saw-miller, Gateside, Balbirnie, Markinch.
1893. WALLACE, David P., Forester, The Saw-mills, Filleigh, Molton, S. Devon.
*1897. WALLACE, John A. A., of Lochryan, Cairnryan, Stranraer.
1893. WALLACE, Robert B. P., Timber Merchant, 12 Danube Street, Edinburgh.
*1905. WALLACE, Thomas Douglas, F.S.I., Callendar Estate Office, Callendar Park, Falkirk.
1909. WALLACE, William, Foreman Forester, Hollows, Canonbie.
1899. WANDESFORDE, R. H. Prior, of Castlecomer, Co. Kilkenny.

Date of Election.

1909. WARDLAW, Andrew Main, Solicitor, Bridge of Allan.
1909. WARING, Captain Walter, M.P., of Lennel, Coldstream.
*1900. WARWICK, Charles, Forest Department, Caledon Co. Tyrone.
1901. WASON, Right Hon. Eugene, M.P., of Blair, Dailly, Ayrshire; 8 Sussex Gardens, Hyde Park, London.
1901. WATSON, James, Manager, Moy Hall, Inverness-shire.
1893. WATSON, John, Timber Merchant, Annandale Street, Edinburgh.
*1893. WATSON, John T., 6 Bruntsfield Gardens, Edinburgh.
1910. WATSON, William Johnstone, Student of Forestry, 35 Blythswood Drive, Glasgow.
1872. WATT, James, J.P., of Little & Ballantyne, Nurserymen, Carlisle.
1893. WATT, James W., Knowefield Nurseries, Carlisle.
1908. WAUGH, J., Assistant Forester, Moulton Cottages, Moulton Road, near Newmarket.
1906. WEBSTER, Charles, Gardener and Forester, The Gardens, Gordon Castle, Fochabers.
*1908. WEDDERBURN, Ernest Maclagan, LL.B., W.S., F.R.S.E., Factor, 2 Glenfinlas Street, Edinburgh.
*1908. WEIR, William, of Kindonan, Adamton, Monkton, Ayrshire.
*1891. WELSH, James, of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1904. WENTWORTH-FITZWILLIAM, George Charles, of Milton, Peterborough.
1902. WHELLENS, Henry, Forester, Comlongon Nurseries, Ruthwell.
1905. WHITE, Andrew, Forester, Portmore, Eddleston.
*1898. WHITE, J. Martin, Balruddery, near Dundee.
1895. WHITE, William, Farmer, Gortonlee, Lasswade.
1909. *Whitehead, David, Assistant Forester, Kingswood, Murthly.*
*1884. WHITTON, James, Superintendent of Parks, 249 George Street, Glasgow.
*1899. WHYTE, John D. B., Factor, Estate Office, Elveden, Suffolk.
1901. WHYTOCK, James, The Palace Gardens, Dalkeith.
1895. WIGHT, Alexander, Overseer, Thurston, Temple Mains, Innerwick.
*1869. WILD, Albert Edward (Conservator of Forests, Darjeeling, India), c/o Henry S. King & Co., 65 Cornhill, London, E.C.
1883. WILKIE, Charles, Forester, Lennoxlove, Haddington.
1891. WILKIE, G., Architect, Hayfield, Peebles.
1904. WILKINSON, Henry Bevis, Factor, Holmhead, Corsock, Dalbeattie.
1902. WILKINSON, John, Factor, The Grange, Kirkcudbright.
1903. WILL, George, Manager, Crichton Royal Institution Farm, Dumfries.
1908. WILLIAMSON, James A., A.R.I.B.A., Public Works Office, City Chambers, Edinburgh.
1895. WILLIAMSON, John, Bank Agent, Loanhead, Midlothian.
*1907. WILLIAMSON, John, Joiner and Builder, Grangemouth.
1907. WILSON, Adam Frank, C.D.A.(Edin.), 164 Braid Road, Edinburgh.
1907. WILSON, Andrew Robertson, M.A., M.D., Hopewell, Tarland, Aboyne; and Trafford House, Liscard, Cheshire.
*1898. WILSON, David, Timber Merchant, Troon, Ayrshire.
*1889. WILSON, David, jun., of Carbeth, Killearn, Glasgow.

Date of Election.

1908. Wilson, Edward Arthur, Rockingham, Edgbaston Park Road, Birmingham.
1907. Wilson, Ian Hall, Saw-mill Manager, Brodie Cottage, Brodie.
1896. Wilson, James, M.A., B.Sc., Royal College of Science, Stephens Green East, Dublin.
1900. Wilson, James, jun., Nurseryman, St Andrews.
1907. Wilson, James G., Assistant, Dalzell Estates Office, Motherwell.
1910. Wilson, John, Assistant Forester, Arniston, Gorebridge.
1902. Wilson, Sir John, Bart. of Airdrie.
1901. Wilson, John Currie, Factor, Tulliallan Estate Office, Kincardine-on-Forth.
1903. Wilson, Thomas, Head Gardener, Glamis Castle, Glamis.
1899. Wilson, William, Timber Merchant, Auchenleck, Ayrshire.
1893. Wiseman, Edward, Nurseryman, Elgin.
1895. Wiseman, William, Nurseryman, Forres.
1906. Wolfe, George, sen., J.P., Shovel Manufacturer, Millburn, Bathgate.
1904. *Wood, James, Forester, Marr Doncaster, Yorkshire.*
1909. Wood, James, of Wallhouse, Torphichen.
1907. Wood, Thomas, Forester, Pitfour, Aberdeenshire.
1907. Woolford, Albert, Assistant Forester, c/o Mrs S. Cox, Basingstoke Road, Swallowfield, Berks.
1904. Worsfold, Edward Mowll, Land Agent, Christ Church Villas, Priory Road, Dover.
1904. Wotherspoon, George, Factor, Cromartie Estate Office, Kildary, Ross-shire.
1909. Wright, John Moncrieff, of Kinmonth, Bridge of Earn.
1904. Wright, Robert Patrick, F.H.A.S., F.R.S.E., Principal of West of Scotland Agricultural College, Blythswood Square, Glasgow.
1909. Wright, William Girvan, M.R.A.C., Cuiloona, Helensburgh.
1868. Wyllie, George, Ballogie, Aboyne, Aberdeenshire.
1906. Wyllie, William, Seedsman, 18 Market Street, Aberdeen.

*1908. Yeaman, Alexander, W.S., 32 Charlotte Square, Edinburgh.
1904. Yool, Thomas, Factor, Menzies Estates Office, Aberfeldy.
1905. Young, John, Hedger, West Lodge, Corehouse, Lanark.
1908. Young, John, Hedger and Assistant Forester, Muirhouse, Falkirk.
1907. Young, John U., Cart Craigs, Pollokshaws.
1909. Young, Peter, Assistant Forester, Loch Cottage, Taymount, Stanley.
1910. Young, R. M., Nursery Manager, Cathcart Nurseries, Newlands, Glasgow.
1910. Young, William George, Estate Clerk, Craigielaw, Longniddry.
1910. Younger, Harry George, 21 Grosvenor Crescent, Edinburgh.
*1898. Younger, Henry J., of Benmore and Kilmun, Greenock.
*1899. Yule, Miss Amy Frances, L.A., Tarradale House, Muir of Ord.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

LIEUT.-COLONEL F. BAILEY, F.R.S.E.,
HONORARY EDITOR.

ROBERT GALLOWAY, S.S.C.,
SECRETARY AND TREASURER.

VOL. XXIV.

EDINBURGH:
PRINTED FOR THE SOCIETY.
SOLD BY DOUGLAS & FOULIS, CASTLE STREET.
1911.

CONTENTS.

The Society does not hold itself responsible for the statements or views expressed by the authors of papers.

TRANSACTIONS

OF THE

ROYAL
SCOTTISH ARBORICULTURAL SOCIETY.

VOL. XXIV.—PART I.

January 1911.

LIEUT.-COLONEL F. BAILEY, F.R.S.E.,
HONORARY EDITOR.

ROBERT GALLOWAY, S.S.C.,
SECRETARY AND TREASURER.

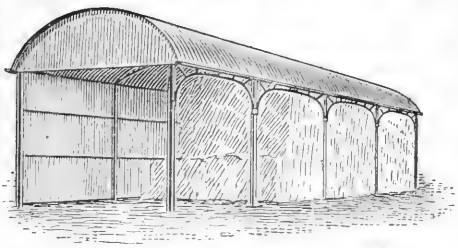
EDINBURGH:
PRINTED FOR THE SOCIETY.
SOLD BY DOUGLAS & FOULIS, CASTLE STREET.

Price to Non-Members, 3/-

A. & J. MAIN & Co., LTD.,

MANUFACTURERS OF

HAY & GRAIN SHEDS.

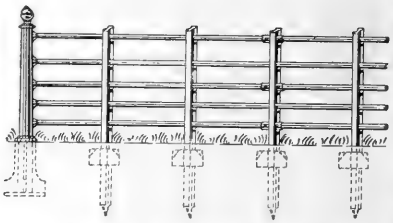


Design No. 661.

In this SHED the HAY or GRAIN can be stored to within a few inches of ROOF.

FOLD YARD COVERINGS,
STEEL AND IRON BUILDINGS,
of every description.

CONTINUOUS BAR FENCING,
IRON & WIRE FENCING,
WROUGHT IRON RAILINGS,
GATES, HURDLES,
PALE FENCING, TREE GUARDS,
Etc., Etc.



Roofing and Fencing Catalogues
on Application.

GALVANIZED WIRE NETTING & FENCING WIRE
at Lowest Prices.

SPECIAL QUOTATIONS ON APPLICATION.

CLYDESDALE IRON WORKS,
POSSILPARK, GLASGOW.

31 BUDGE ROW,
LONDON, E.C.

CORN EXCHANGE BUILDINGS,
EDINBURGH.

BY SPECIAL APPOINTMENT TO HIS MAJESTY THE KING.

Telegrams—
"Hothouse, Edinburgh."
"Iron, Edinburgh."
"Treibhaus, London."

Telephone Nos.—
Edinburgh—Central, 2674, 2675, and 4665.
Glasgow—Argyle, 2336, National.
London—2117 P.O., Hampstead.

MACKENZIE & MONCUR,

HOTHOUSE BUILDERS, LTD.

Heating, Ventilating, and Electrical Engineers, and Iron Founders.

Plant Houses erected at Royal Botanic Garden, Edinburgh.

HOTHOUSE BUILDING.—Hothouses of every description designed and erected in any part of the country, with improved Ventilation, Gearing, Staging, and Heating Apparatus complete.

HEATING.—Churches, Public Buildings of all kinds, Schools, Mansions, Villas, &c., heated efficiently by Low Pressure, Hot Water, or by Steam. Also by "Barker's" Cable System of Hot Water Low Pressure Heating, with small bore pipes and no sunk stoke-holes.

LIGHTING.—Complete Installations by Electricity or Petrol Vapour Gas.

FOUNDRY.—Architectural Ironwork of all kinds, Stable Fittings, Sanitary Castings, Manhole Covers, Ventilators, Gratings, &c.

PLANS AND ESTIMATES ON APPLICATION.

EDINBURGH — Registered Office — Balcarres Street.
WORKS—Balcarres Street. **FOUNDRY**—Slateford Road.
GLASGOW—121 St Vincent Street. **LONDON**—8 Camden Road, N.W.

NOTICE.

WANTED TO PURCHASE.

Any of the following Parts of the ***Transactions,*** viz :—

Parts 1, 2, and 3	of Vol. I.
Parts 2 and 3	of Vol. III.
Parts 1 and 2	of Vol. IV.
Part 2	of Vol. V.
Part 2	of Vol. IX.
Part 1	of Vol. XII.

Apply to

—— THE SECRETARY, ——
19 CASTLE STREET, EDINBURGH.

Membership.

THE Roll contains the names of over 1300 Members, comprising Landowners, Factors, Foresters, Nurserymen, Gardeners, Land Stewards, Wood Merchants, and others interested in Forestry, many of whom reside in England, Ireland, the British Colonies, and India.

Members are elected by the Council. The Terms of Subscription will be found on the back of the Form of Proposal for Membership which accompanies this Memorandum.

The Principal Objects of the Society,

and the nature of its work, will be gathered from the following paragraphs:—

Meetings.

The Society holds periodical Meetings for the transaction of business, the reading and discussion of Papers, the exhibition of new Inventions, specimens of Forest Products and other articles of special interest to the Members, and for the advancement of Forestry in all its branches. Meetings of the Council are held every alternate month, and at other times when business requires attention; and Committees of the Council meet frequently to arrange and carry out the work of the Society.

Prizes and Medals.

With the view of encouraging young Foresters to study, and to train themselves in habits of careful and accurate observation, the Society offers Annual Prizes and Medals for essays on practical subjects, and for inventions connected with appliances used in Forestry. Such awards have been granted continuously since 1855 up to the present time, and have yielded satisfactory results. Medals and Prizes are also awarded in connection with the Exhibitions aftermentioned.

School of Forestry, Afforestation, Etc.

Being convinced of the necessity for bringing within the reach of young Foresters, and others interested in the Profession, a regular systematic course of Instruction, such as is provided in Germany, France, and other European countries, the Society, in 1882, strongly urged the creation of a British School of Forestry; and with a view of stimulating public interest in the matter, a Forestry Exhibition, chiefly organised by the Council, was held in Edinburgh in 1884.

As a further step towards the end in view, the Society, in 1890, instituted a Fund for the purpose of establishing a Chair of Forestry at the University of Edinburgh, and a sum of £584, 3s. 10d. has since been raised by the Society and handed over to the University. Aided by an annual subsidy from the Board of Agriculture, which the Society was mainly instrumental in obtaining, a Course of Lectures at the University has been delivered without interruption since 1889. It is recognised, however, that a School of Forestry is incomplete without a practical

training-ground attached to it, which would be available, not only for purposes of instruction but also as a Station for Research and Experiment, and as a Model Forest, by which Landowners and Foresters throughout the country might benefit. The Society has accordingly drawn up a Scheme for the Establishment of a State Model or Demonstration Forest for Scotland which might serve the above-named objects. Copies of this Scheme were laid before the Departmental Committee on British Forestry, and in their Report the Committee recommended the establishment of a Demonstration Area and the provision of other educational facilities in Scotland.

The Government has recently acquired the Estate of Inverliever in Argyllshire; and while this cannot be looked on as a Demonstration Forest, it is hoped that it may prove to be the first step in a scheme of afforestation by the State of unwooded lands in Scotland. Meantime Mr Munro Ferguson, M.P., for a part of whose woods at Raith a Working-Plan has been prepared, and is now in operation, has very kindly agreed to allow Students to visit them.

In view of the passing of the Development Acts of 1909 and 1910, the Council passed a Resolution urging that the Government should, as soon as possible, create a Board of Forestry, with an adequate representation of Scottish Forestry upon it, and an Office in Scotland, where the largest areas of land suitable for Afforestation are situated, which would provide Demonstration Forests and Forest Gardens, and otherwise assist the development of University and other Educational enterprise, and would carry out, as an essential preliminary to any great scheme of National Afforestation, a Survey of all areas throughout the country suitable for commercial planting. The Society's policy for the development of Forestry in Scotland has also been fully laid before the Development Commission.

Excursions.

Since 1878 well-organised Excursions, numerously attended by Members of the Society, have been made annually to various parts of Scotland, England, Ireland, and the Continent. In 1895 a Tour extending over twelve days was made through the Forests of Northern Germany, in 1902 a Tour extending over seventeen days was made in Sweden, during the summer of 1904 the Forest School at Nancy and Forests in the north of France were visited, and during the past summer a visit was undertaken to the Bavarian Forests. These Excursions enable Members whose occupations necessarily confine them chiefly to a single locality to study the conditions and methods prevailing elsewhere; and the Council propose to extend the Tours during the next few years to other parts of the Continent. They venture to express the hope that Landowners may be induced to afford facilities to their Foresters for participation in these Tours, the instructive nature of which renders them well worth the moderate expenditure of time and money that they involve.

Exhibitions.

A Forestry Exhibition is annually organised in connection with the Highland and Agricultural Society's Show, in which are exhibited specimens illustrating the rate of growth of trees, different kinds of wood, pit-wood and railway timber, insect pests and samples of the damage done by them, tools and implements, manufactured articles peculiar to the district where the Exhibition is held, and other objects of interest relating to Forestry. Prizes and Medals are also offered for Special Exhibits. In addition to the Annual Exhibition before referred to, a large and important Forestry Section organised by this Society was included in the Scottish National Exhibition which was held in Edinburgh in 1908, and it has now been decided to have a similar Section in the Scottish Exhibition of National History, Art, and Industry, which is to be held in Glasgow during the ensuing summer.

The Society's *Transactions*.

The *Transactions* of the Society, which extend to twenty-three volumes, are now published half-yearly in January and July, and are issued *gratis* to Members. A large number of the Prize Essays and other valuable Papers, and reports of the Annual Excursions, have appeared in them, and have thus become available to Students as well as to those actively engaged in the Profession of Forestry.

Honorary Consulting Officials.

Members have the privilege of obtaining information gratuitously upon subjects connected with Forestry from the following Honorary Officials appointed by the Society.

Consulting Botanist.—ISAAC BAYLEY BALFOUR, LL.D., M.D., Sc.D., Professor of Botany, Royal Botanic Garden, Edinburgh.

Consulting Chemist.—ALEXANDER LAUDER, D.Sc., 13 George Square, Edinburgh.

Consulting Cryptogamist.—A. W. BORTHWICK, D.Sc., Royal Botanic Garden, Edinburgh.

Consulting Entomologist.—ROBERT STEWART MACDOUGALL, M.A., D.Sc., Professor of Entomology, etc., 9 Dryden Place, Edinburgh.

Consulting Geologist.—R. CAMPBELL, M.A., B.Sc., Geological Laboratory, University of Edinburgh.

Consulting Meteorologist.—ANDREW WATT, M.A., F.R.S.E., Secretary Scottish Meteorological Society, 122 George Street, Edinburgh.

Local Branches.

Local Branches have been established in Aberdeen and Inverness for the convenience of Members who reside in the districts surrounding these centres.

Local Secretaries.

The Society is represented throughout Scotland, England, and Ireland by the Local Secretaries whose names are given below. They are ready to afford any additional information that may be desired regarding the Conditions of Membership and the work of the Society.

Register of Estate Men.

A Register of men qualified in Forestry and in Forest and Estate Management is kept by the Society. Schedules of application and

other particulars may be obtained from the Local Secretaries in the various districts, or direct from the Secretary. It is hoped that Proprietors and others requiring Estate men will avail themselves of the Society's Register.

Consulting Foresters.

The Council has authorised the Secretary to keep a list of Consulting Foresters whose services will be available to Members of the Society and others.

Correspondents.

The following have agreed to act as Correspondents residing abroad:—

Canada,	Robert Bell, I.S.O., M.D., LL.D., D.Sc.(Cantab.), F.R.S. of Ottawa. Chief Geologist to Government of Canada, Ottawa.
India,	F. L. C. Cowley Brown, Deputy Conservator of Forests, c/o Inspector-General of Forests, Simla.
British East Africa,	Edward Battiscombe, Assistant Conservator of Forests, Nigeri, *via* Naivasha, East Africa Protectorate.
United States of America,	Hugh P. Baker, Forester, State College, Pennsylvania.
Cape Colony,	W. Nimmo Brown, M'Kenzie's Farm, Mowbray, P.O.

LOCAL SECRETARIES.

Scotland.

Counties.	
Aberdeen,	John Clark, Forester, Haddo House, Aberdeen.
	John Michie, M.V.O., Factor, Balmoral, Ballater.
Argyle,	John D. Sutherland, Estate Agent, Oban.
Ayr,	Andrew D. Page, Overseer, Culzean Home Farm, Ayr.
	A. B. Robertson, Forester, The Dean, Kilmarnock.
Berwick,	Wm. Milne, Foulden Newton, Berwick-on-Tweed.
Bute,	Wm. Inglis, Forester, Cladoch, Brodick.
	James Kay, Forester, Bute Estate, Rothesay.
Clackmannan,	Robert Forbes, Estate Office, Kennet, Alloa.
Dumfries,	D. Crabbe, Forester, Byreburnfoot, Canonbie.
East Lothian,	W. S. Curr, Factor, Ninewar, Prestonkirk.
Fife,	Wm. Gilchrist, Forester, Nursery Cottage, Mount Melville, St Andrews.
	Edmund Sang, Nurseryman, Kirkcaldy.
Forfar,	James Crabbe, Glamis.
Inverness,	James A. Gossip, Nurseryman, Inverness.
Kincardine,	John Hart, Estates Office, Cowie, Stonehaven.
Kinross,	James Terris, Factor, Dullomuir, Blairadam.
Lanark,	John Davidson, Forester, Dalzell, Motherwell.
	James Whitton, Superintendent of Parks, City Chambers, Glasgow.

Scotland

Countries.	
Moray, . .	D. Scott, Forester, Darnaway Castle, Forres.
Perth, . .	John Scrimgeour, Doune Lodge, Doune.
Renfrew, .	S. MacBean, Overseer, Erskine, Glasgow.
Ross, . .	John J. R. Meiklejohn, Factor, Novar, Evanton.
	Miss Amy Frances Yule, Tarradale House, Muir of Ord.
Roxburgh, .	John Leishman, Manager, Cavers Estate, Hawick.
	R. V. Mather, Nurseryman, Kelso.
Sutherland, .	Donald Robertson, Forester, Dunrobin, Golspie.
Wigtown, .	James Hogarth, Forester, Culhorn, Stranraer.
	H. H. Walker, Monreith Estate Office, Whauphill.

England.

Counties.	
Beds, . .	Francis Mitchell, Forester, Woburn.
Berks, . .	W. Storie, Whitway House, Newbury.
Cheshire, .	Wm. A. Forster, Belgrave Lodge, Pulford, Wrexham.
Devon, . .	James Barrie, Forester, Stevenstone Estate, Torrington.
Durham, .	John F. Annand, Lecturer on Forestry, Armstrong College, Newcastle-upon-Tyne.
Hants, . .	W. R. Brown, Forester, Park Cottage, Heckfield, Winchfield.
Herts, . .	James Barton, Forester, Hatfield.
	Thomas Smith, Overseer, Tring Park, Wigginton, Tring.
Kent, . .	R. W. Cowper, Gortanore, Sittingbourne.
Lancashire, .	D. C. Hamilton, Forester, Knowsley, Prescot.
Leicester, .	James Martin, The Reservoir, Knipton, Grantham.
Lincoln, .	W. B. Havelock, The Nurseries, Brocklesby Park.
Middlesex, .	Professor Boulger, 11 Onslow Road, Richmond Hill, London, S.W.
Notts, . .	Wm. Elder, Thoresby, Ollerton, Newark.
	W. Michie, Forester, Welbeck, Worksop.
	Wilson Tomlinson, Forester, Clumber Park, Worksop.
Suffolk, . .	George Hannah, The Folly, Ampton Park, Bury St Edmunds.
Surrey, . .	John Alexander, 24 Lawn Crescent, Kew Gardens.
Warwick, .	A. D. Christie, Hillside, Frederick Road, Selly Oak, Birmingham.
Wilts, . .	Andrew Boa, Land Agent, Glenmore, The Avenue, Trowbridge.
York, . .	D. Tait, Estate Bailiff, Owston Park, Doncaster.

Ireland.

Dublin, . .	A. C. Forbes, Department of Forestry, Board of Agriculture.
	James Wilson, B.Sc., Royal College of Science, Dublin.
	Arch. E. Moeran, Lessadell, Thelorgan Park.
Galway, . .	Thomas Robertson, Forester and Bailiff, Woodlawn.
King's County,	Wm. Henderson, Forester, Clonad Cottage, Tullamore.
Tipperary, .	David G. Cross, Forester, Kylisk, Nenagh.
	Alex. M'Rae, Forester, Dundrum.

Royal Scottish Arboricultural Society.

FORM OF PROPOSAL FOR MEMBERSHIP.

To be signed by the Candidate, his Proposer and Seconder, and returned to ROBERT GALLOWAY, S.S.C., *SECRETARY*, Royal Scottish Arboricultural Society, 19 Castle Street, Edinburgh.

Candidate's

Full Name, ...

Designation, Degrees, etc., ...

Address, ...

Life, or Ordinary Member, ...

Signature, ...

Proposer's

Signature, ...

Address, ...

Seconder's

Signature, ...

Address, ...

[CONDITIONS OF MEMBERSHIP, see Over.

CONDITIONS OF MEMBERSHIP (excerpted from the Laws).

III. Any person interested in Forestry, and desirous of promoting the objects of the Society, is eligible for election as an *Ordinary* Member in one of the following Classes:—

1. Proprietors the valuation of whose land *exceeds* £500 per annum, and others, subscribing annually . . One Guinea.
2. Proprietors the valuation of whose land *does not exceed* £500 per annum, Factors, Nurserymen, Timber Merchants, and others, subscribing annually . . Half-a-Guinea.
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, subscribing annually . . . Six Shillings.
4. Assistant-Foresters, Assistant-Gardeners, and others, subscribing annually . . . . . Four Shillings.

IV. **Subscriptions are due on the 1st of January in each year, and shall be payable in advance. A new Member's Subscription is due on the day of election unless otherwise provided, and he shall not be enrolled until he has paid his first Subscription.**

V. Members in arrear shall not receive the *Transactions*, and shall not be entitled to vote at any of the meetings of the Society Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.

VI. Any eligible person may become a *Life* Member of the Society, on payment, according to class, of the following sums:—

1. Large Proprietors of land, and others, . . . £10 10 0
2. Small Proprietors, Factors, Nurserymen, Timber Merchants, and others, ... 5 5 0
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, ... 3 3 0

VII. Any *Ordinary* Member of Classes 1, 2, and 3, who has paid *Five* Annual Subscriptions, may become a *Life* Member on payment of *Two-thirds* of the sum payable by a *new* Life Member.

XII. Every Proposal for Membership shall be made in writing, and shall be signed by two Members of the Society as Proposer and Seconder, and delivered to the Secretary to be laid before the Council, which shall accept or otherwise deal with each Proposal as it may deem best in the interest of the Society. The Proposer and Seconder shall be responsible for payment of the new Member's first Subscription. The Council shall have power to decide the Class under which any Candidate for Membership shall be placed.

CONTENTS.

The Society does not hold itself responsible for the statements or views expressed by the authors of papers.

CONTENTS.

The Society does not hold itself responsible for the statements or views expressed by the authors of papers.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY

1. A Development Grant.

The following letter, dated 10th September 1910, has been addressed by the President of the Society to the members of the Development Commission:—

My Lords and Gentlemen,

The Council of the Royal Scottish Arboricultural Society ventures to approach you with some practical suggestions for the expenditure of such portion of the Development Grant as may be allotted to Forestry in Scotland.

Our Society has over 1300 members, and includes practically every one who takes an active part in the practice and teaching of Silviculture north of the Tweed, besides many members from England, Ireland, and Wales. The scheme which the Council ventures to submit is the result of mature deliberation. It has been repeatedly urged upon the Government, and was actually adopted by the present Chancellor of the Exchequer in the speech with which he introduced the Budget of 1909.

We should have approached the Commissioners earlier, but for the following reason: We have been urging on the Chancellor of the Exchequer the need of appointing at once a recognised authority, such as exists in every other civilised country, to take charge of the interests of Forestry in Great Britain. If a Board of Forestry were appointed now, its first duty would be to frame a scheme for the Development Commissioners, and we have been unwilling to take any step which might anticipate or embarrass the initiative of such a Board. It appears, however, that the Government hesitates to appoint any responsible authority. We therefore feel that the time has arrived when we have no choice but to submit the outline of a scheme, since it is more particularly the duty and interest of

our Society to consider the subject from a comprehensive standpoint. At the same time, we desire to reiterate our opinion that the appointment of a Board of Forestry ought not longer to be delayed.

The preliminary steps which our Council considers essential to the orderly development of Forestry in Scotland are:—

1. A Survey to ascertain the Area which it is Economically desirable to Afforest.
2. A Demonstration Forest with a Forest School.
3. Forest Gardens for the Three Teaching Centres—Edinburgh, Glasgow, and Aberdeen.

There has been a great deal of loose talk on the subject of afforestation, but no precise information is available. In the absence of a SURVEY, it is impossible to form any opinion as to the scale of possible afforestation, or of the machinery, educational and administrative, which may be needed to promote it. Our Society is at present engaged upon the survey of an area in Inverness-shire, which it is hoped may serve as a model for future surveys of the same kind. The design and superintendence of this difficult and complicated undertaking—for the survey must, to be of any practical use, go far beyond the mere ascertainment of the area which is capable of growing good timber—has been entrusted by the Society to Lord Lovat, one of our members, who is preparing Reports and maps showing in detail how a large forest could be made in the area selected, with full particulars of its creation, exploitation, and attendant industries, and tracing the consequences to existing interests and local rates, as well as the effect upon employment in the district. The result of this survey will be submitted to the Commissioners as soon as it is complete, and has been checked by the best experts obtainable. We hope that it may be ready by the end of the year. We are of opinion that when the lines have been laid down upon which the survey is to proceed, a sum of money should be set aside for it every year out of the Development Grant, until it has been completed for every district in Scotland which contains large areas of plantable "waste lands." This survey would form the basis of all future schemes of afforestation, whether they be undertaken by private enterprise or by the State.

By a DEMONSTRATION FOREST we mean an area where Silviculture in all its branches can be practised and studied in accordance with British conditions. If the survey shows that the area to be afforested is as large as we expect, and practical experience confirms that view,—more than one Demonstration Forest will no doubt be required in Scotland. We believe, however, that it will be wiser to begin with one forest[1] and one school.

It is desirable that the Forest should be central and accessible, and essential that it should contain a considerable area of growing timber of different ages. Inverliever, unfortunately, fulfils neither of these conditions. An area of 10,000 acres would be sufficient. Suitable estates have recently changed hands at reasonable prices. Our Council is prepared to inquire further into the question of possible sites, if desired. The standing crop will not and need not be perfect. The first lesson the Forest will have to demonstrate, is the conversion of bad woods into good. The Forest should from the beginning be worked on a regular plan, thus providing another much needed lesson. Accurate records and accounts should be kept, and the results of the numerous desultory experiments which have been made throughout Scotland, should be collected and compared, and their progress watched. The science of British Silviculture, for which the materials already largely exist, will thus be gradually built up.

The FOREST SCHOOL should be attached to the Forest and under the same officer. Our Council will be glad, if desired, to advise as to a scheme for the allocation of Forest education between this new school and the Universities and Agricultural Colleges of Edinburgh, Glasgow, and Aberdeen, which now provide courses in Forestry. It is enough to say here that the Council contemplates the establishment in the Forest of a school for working apprentices, which would provide for a class of student which finds great difficulty in attending the Universities, and would bring them into that close touch with forest work which is conspicuously lacking at present. The University classes would thenceforward be confined to students who desired

[1] Should the Demonstration Forest be mainly coniferous, it may be necessary to have a detached hardwood area, as there are extensive woods of this character in the south of Scotland of which the proper management urgently requires demonstration.

a higher training, and required the tuition of experts in Botany, Chemistry, Entomology, Geology, Engineering, etc., in addition to Silviculture. A course of practical Silviculture in the Forest would also form part of the curriculum of these higher students.

No public body recognises more cordially than our Society the advance accomplished in the constitution of the Development Commission, and none can be more anxious to be of assistance to it. If, in this Memorandum, the Society ventures to deal broadly with the whole question, it is because our whole energies have been devoted for twenty years to endeavouring to attract the aid of the State in securing a wide extension of Silviculture on sound lines. We fear that the applications for money grants which reach the Commissioners, however good in themselves, may not provide the basis of a sufficiently simple and comprehensive scheme, and we believe that promiscuous grants to all kinds of subordinate authorities would be fatal both to National progress and to economy of public resources.

We are eager to see a beginning made at once, but know that so important a National undertaking will require very orderly and gradual development. The art of Silviculture is still at a low ebb in Great Britain, and we are convinced that the first steps must be educational. The steps advocated above, being designed to supply accurate information and trained men, are equally essential whether the actual work of afforestation is to be undertaken by private individuals or by the State, or, as we hope it may be, by a combination of both. They are, moreover, quite as necessary for the improvement of our existing woodlands. These, though small and neglected as compared with the woods of other countries, are still considerable in themselves. Improved management can make them of great value to their owners and to the country as a whole. This reform requires greater Silvicultural knowledge than the creation of new plantations, but it is, thanks to the growing crop, comparatively easy to finance, and it comes less into conflict with other interests.

We do not propose to over-burden this letter by entering into any discussion of the agencies by which new schemes of afforestation can best be accomplished. There are no doubt certain districts where it may be necessary for the State to undertake all the expense and risk of such schemes, if they are to be accomplished at all. We hope that in many districts it

will not be necessary for the State to take the initiative, and believe that reliable advice based on the actual experience of a Demonstration Forest, well secured loans, and a reduction or postponement of local burdens,[1] would induce many proprietors to undertake schemes of afforestation at their own expense, and submit the management of their woodlands to State supervision. We would only observe at present that such schemes are impossible in the absence of a responsible executive authority.

We believe that a sum of £10,000 a year will be required in Scotland to cover the cost of this programme as a whole for seven or eight years, until all the preliminaries outlined in this Memorandum are complete. At the end of this period the Survey will be finished, the Demonstration Forest and Forest School equipped, and the Forest Gardens in working order. The charges remaining will be limited to administration and teaching, together with any loss there may be on the capital invested in the Demonstration Forest and Forest Gardens.

As soon as the Survey is concluded, it will be for the Commissioners to consider what resources they should devote to the direct work or encouragement of new schemes of afforestation.

We desire, in conclusion, to offer the Commissioners every assistance in our power.

Signed on behalf of the Society,

JOHN STIRLING-MAXWELL,

President.

To the above the following reply, dated 22nd September 1910, was received from the Development Commission:—

Sir,—1. I am directed by the Development Commissioners to acknowledge the receipt of your letter forwarding copies of a letter from the Royal Scottish Arboricultural Society, on the subject of expenditure from the Development Fund on forestry in Scotland; and to inform you that they took the Society's letter into consideration at their meeting yesterday.

2. They understand that the Board of Agriculture and Fisheries propose to submit at an early date an application for

[1] We believe it will be found in practice, that the provisions of the Finance Act of 1909 are on the whole relatively favourable to afforestation. (See *Transactions*, Vol. XXIII. page 133).

an advance from the fund, with a scheme framed after examination of the forestry requirements of Great Britain as a whole: and they have therefore forwarded a copy of the Society's letter to the Board for their consideration in preparing their scheme.

3. The Society are no doubt aware that under the Development and Road Improvement Funds Act, 1909, the Commissioners can only take into consideration schemes and applications for advances from the Development Fund, received from bodies other than Government Departments, after such applications and schemes have been referred to and reported on by the Government Departments concerned.

I am, Sir,

Your obedient Servant,

H. E. DALE,

Secretary.

THE SECRETARY,
ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

[The undermentioned members of the Development Commission form a committee to confer, if necessary, with the Government Departments and unofficial associations interested, and to report on questions of forestry policy, and on schemes for that purpose which have been, and are about to be, submitted to the Commissioners from England, Scotland, and Ireland:—Mr Eardley Wilmot (chairman), Mr Jones-Davies, Mr Ennis and Mr Haldane.—HON. ED.]

2. The Vegetation of Woodlands.

By Dr W. G. SMITH.

During the past ten years several investigations on the vegetation of Britain have been in progress, and a considerable amount of information on woodlands and other forms of vegetation has been brought together. The papers and botanical maps of the late Robert Smith, published in 1900, are generally admitted to have opened a new era in the study of British vegetation, and led ultimately to the formation of the Central Committee for the Study and Survey of British Vegetation, which consists of active workers most of whom have published memoirs and vegetation maps. Although mainly botanical, this type of work is intimately related to economic

and practical questions. In response to a request from the editor, we propose to collect together here some of the more important observations on woodlands. This is rendered the more easy because an important paper on the woodlands of England has been published recently.[1] The time has not yet come for publishing a similar account of Scottish woodlands, but observations are being collected. Although the first botanical survey was Scottish, yet the later investigations have been more actively pursued south of the Border; the areas dealt with in England are, however, sufficiently varied to apply generally to woodlands in Scotland. They range from the Lake District over practically the whole of Yorkshire and Derbyshire, and include many important areas of woodland in England, such as the Lake District, Yorkshire and Derbyshire, the Cotswold and Chiltern Hills, and southwards to the well-wooded counties of Hampshire, Surrey, Kent and Sussex. In reviewing the results obtained, the opportunity is taken to incorporate other information on the composition of woods, and on the relation of soil and climate to woodlands.

The Structure of a Wood.

The term wood is used here to include all areas covered with trees, and, leaving out of account for the present whether the wood is natural or planted, it may be useful to consider the vegetation which goes to make a wood. From the silvicultural point of view the trees are the important part of a wood; from the outlook of game preservation the undergrowth is often the more important element; but from the botanical point of view canopy, shrubby growth and the low ground-vegetation are all equally important.

A wood in middle age or during the later period shows a series of layers of vegetation which, when perfectly developed, are as follows:—(1) Canopy of trees, (2) shrubs, (3) ground-vegetation. Frequently each of these may show a fairly well-marked upper and lower layer, thus:—

(*a*) Upper canopy, consisting of the taller dominant trees—oak, ash, beech, Scots pine, larch, etc.

[1] "The Woodlands of England," by C. E. Moss, W. M. Rankin, and A. G. Tansley. Reprinted from *The New Phytologist*, vol. ix., April 1910, 36 pages. Copies (price 1s. 1d.) may be obtained from W. G. Smith (Hon. Sec. Central Committee for British Vegetation), 13 George Square, Edinburgh.

(*b*) Lower canopy of trees which do not naturally attain to the same height – birch, mountain ash, holly, field maple, aspen, etc.; in the case of rejuvenating woods this lower canopy may consist of the dominant trees in various stages of growth.

(*c*) Upper layer of shrubs—hazel, elder, hawthorn, blackthorn, etc.

(*d*) Undershrubs or low woody plants which persist as undergrowth during winter—bramble and rose or ling and blaeberry.

(*e*) Tall herbaceous ground-vegetation of plants which disappear almost entirely during winter—campion, dog's mercury, bracken, male and other ferns.

(*f*) Low herbaceous ground-vegetation—mosses, anemone, celandine, wood sorrel, etc.

The composition of the vegetation beneath the canopy depends on several factors, especially variations in light and soil-moisture. The plants are such as can bear some degree of shade, and all plants which require full illumination are excluded and must find their habitat away from trees. Amongst the herbaceous plants of a wood there is a process of sorting-out. Some species can live in deep shade, but the majority require at least a moderate amount of light if they are to survive. The character of the soil, wet or dry, light or heavy, leads also to variations in distribution. During the life of a wood the conditions of light and shade vary considerably from time to time. The rank and tall herbaceous vegetation of a wood of young seedling trees will in time become suppressed as the trees grow older and the canopy becomes denser. When the canopy is densest and shade is at a maximum the ground-vegetation will be at its minimum. If the trees are thinned and more light is admitted, the herbaceous and shrubby layers gradually increase, but so long as trees remain the vegetation will be that of a wood. This sequence of vegetation may be followed more readily in the case of short period coppicing. When the coppice is tall, the dense shade reduces the ground-vegetation and many of the plants are unable to flower. Increased illumination on coppicing enables the plants to recover, and in two or three seasons the ground is covered with sheets of flowers. This brings us to the important conclusion that although the vegetation of a wood varies from time to time, and the abundance of species is liable to considerable fluctuation, yet the number of species is fairly constant. If this is so the ground-vegetation must be

regarded as a feature to be noted in the study of woods. A good deal may be learned by observing it. Thus, if on examining a wood one finds beneath the canopy a dense vegetation with all the layers represented, it is fairly safe to assume that the canopy is open, that the soil is moist and fertile, and that ground game commits little damage. On the other hand, if the intermediate layers are absent, and the ground is bare or covered only by a low carpet of plants, this indicates a dense canopy or a dry, poor soil, or the ravages of rabbits or grazing stock.

The trees forming the canopy have a marked influence on the underlying vegetation. If the trees are of middle age and grow at equal distances apart, the greatest amount of light passes through a canopy of ash or birch, less light is admitted by oak, less still by elm and sycamore, least of all by beech. The larch amongst conifers allows most light to pass because it is deciduous and has no leaves from October to May. Scots pine casts shade till it is tall and aged, while spruce scarcely ever allows much light to pass. Where little or no light can pass through the canopy, as in the case of evergreens, there is little or no ground-vegetation. In the case of deciduous trees, it is usual to find a vernal ground-vegetation consisting of early-flowering plants, which appear above ground several weeks before the tree canopy unfolds, *e.g.*, anemone, primrose, wood hyacinth and celandine. These plants are provided with underground stores of food-material, and form their flower-buds during the preceding year, so that in a short time they flower and seed. The leaves follow and, utilising such light as is available, they prepare a food-store for next season. The kind of canopy exerts an influence on this later leafing period. Under an open canopy of oak or ash the leaves can remain active, and the later leafing bracken and other wood ferns can also maintain an existence. Under a canopy such as beech, which permits little light to pass, the activity of the ground-vegetation is so interfered with that the plants are stunted or succumb altogether.

The dominance of any particular tree depends naturally on climate and soil, but one finds everywhere evidence of man's operations. Under natural conditions the dominant trees are generally limited to one or a few species, but when planting is done any number of species may be present. The forester

classifies woods according to the trees present, but recent workers on British woodlands go further and classify according to dominant trees and the ground-vegetation. The advantage claimed is that while the distribution of the dominant trees may be interfered with by man, the ground-vegetation often does not alter, and may be taken as an indicator of the character of the natural wood before interference took place. One may even go further and claim that the vegetation of a scrub or moor may also indicate places formerly occupied by woods, and thus assist in determining the productive capacity of any given area in case of afforestation.

Present Condition of British Woodlands.

There is every reason to believe that in Britain there once existed great tracts of natural forest which occupied definite areas, and it would be of some advantage in afforestation if these areas could be traced now. The process of destruction is historically indicated. Where land was taken in for cultivation, the enclosures were made first largely in the forest area; later by draining areas of swamp, bog or fen, and to a limited extent by the intaking of grassy or heathery moorland. But the influence of man on the forest region had gone much further than the ploughlands. Sheep and cattle are allowed to range over tracts never ploughed, and by continuous grazing effectually check the growth of seedlings which naturally would have replaced the aged trees, which were either felled or allowed to decay. When it was also discovered that burning the moors favoured both sheep and grouse, the moor fire became an active agent in the destruction of seedling trees which might have provided natural forest.

What now remains of forest areas are mere scraps of woodland; some are merely ornamental, some are game-covers, a few are treated for the production of timber, and a very few scraps have been left in their primitive condition untouched by man or his pursuits. At first sight, it appears almost hopeless to piece together the scanty evidence relating to the grouping of British woods. But the authors of the "Woodlands of England" have treated this difficult problem with much success. They ask, "Have not existing woods been so altered by planting and in other ways that they no longer represent the native plant-communities,

but are rather to be considered as mere congeries of indigenous and introduced species?" It is recognised that there is little true virgin forest remaining, and that many existing woods are simply plantations made within the last 200 years on what was treeless moorland, heath, grassland or arable land. But "according to the conclusions of all the members of the British Vegetation Committee who have given any special attention to this subject, the great majority of the British woods come between these two extremes. They are neither virgin forest, nor plantations, but are the lineal descendants, so to speak, of primitive woods." These woods are described as semi-natural. It is also pointed out that the system followed on estates has been first to improve, not to replace, the existing woods. With this conclusion we are in agreement. The argument applies equally well in Scotland, especially to the oak-woods of Strathtay and other northern valleys; in the Lothians the woods are nearly always plantations, but in the Esk, Tyne, and other valleys there are semi-natural woods. This mixed character of woods is an obstacle of some magnitude to the beginner in botanical survey, but it is a difficulty which disappears with fuller education. It does not always follow that interference by man need influence the ground-vegetation. A somewhat lengthy abstract from the "Woodlands of England" will make this fairly clear. Types of woods can be recognised and arranged in a series leading from virgin forest to artificial plantation, as follows :—

(1) Primitive woodland which rejuvenates itself naturally, and in which felling has been quite occasional and confined to isolated trees.

(2) Native woods in which there has been little or no planting, but in which fairly regular felling takes place, the woods rejuvenating themselves naturally from self-sown seed, or in the case of the oak partly from the stools. The ground-vegetation of such woods is primitive, though after extensive felling, light-demanding plants often invade the clearings, but these species tend to disappear as the wood grows up again.

(3) Woods which are regularly planted up, after felling, with the species of tree originally dominant; this kind of wood differs little from the second type.

(4) Woods planted up, after felling, with a mixture of species besides the natural ones. Unless the planted species markedly

differ in light-demand from the natural ones, the artificial element does not materially alter the character of the ground-vegetation. If they do differ, the ground flora is necessarily changed to some extent.

(5) Woods entirely planted, after felling, with species distinct from the original ones, *e.g.* larch replacing oak. Here again the change in the flora depends on the character of the planted trees and their distance apart. The change may be very slight or very pronounced, but the relation of the ground flora to that of the natural woods on the same type of soil is generally quite evident.

(6) Plantations on arable land, grassland, or heath. These, when recent, are easy to distinguish from natural or semi-natural woodlands, because the ground flora is poor and does not consist of typical woodland species. How long it takes to colonise a plantation, so that it cannot be distinguished from a natural wood, is not as yet known.

The authors then proceed to point out that of these types the second and third are practically natural woods, and that in practice it is not so difficult to recognise woods of the fourth and fifth types as might be supposed.

Woodlands in Relation to Climate.

The results of botanical surveys in Britain indicate that climate and atmospheric factors have less effect on woodlands than is sometimes stated, but, on the other hand, soil factors are more important than is generally realised. The two sets of factors are, however, closely linked together. An interesting case is given in the "Woodlands" paper, and we think the observation is a new one. "The amount of water held by the soil in a given climate depends primarily upon the texture of the soil; but with a wetter climate, *i.e.*, with increased atmospheric moisture and with greater precipitation, especially a rainfall distributed over a greater number of days in the year, the average amount of water actually present in a soil of given texture is greater. Thus a 'light' or relatively coarse-grained soil, that would carry a 'dry' type of woodland in a relatively dry climate, may bear a 'damp' type of woodland in a very moist climate." On the whole, however, the variations in climate throughout Britain do not greatly affect the distribution

of the woods. Thus one finds the oak-woods of southern England repeated essentially in the same form in the Yorkshire Dales, in the south of Scotland and in the lower grounds of northern Scotland, though some of the plants of the ground-vegetation may be different. Again, some woods of Somerset are almost identical with woods in East Anglia with a drier climate, but in the Somerset woods, ferns are much more numerous than in East Anglia. It is hardly necessary to point out that in comparing the effects of climate over wide areas, the comparison ought to be made between woods at about the same altitude above the sea.

Turning now to the distribution of woodlands in belts at different altitudes, we find a greater difference, but this cannot always be put down to difference of climate, and, as described later, may be due to soil. Wind is, however, a climatic factor of great importance in forestry. Tree-growth ceases wherever the wind attains such a force that the formation of young shoots is prevented. The determination of this wind-zone must always be considered in forestry. It cannot be defined as so many feet above sea-level. The action of wind may be very marked on the coast itself, and on a hill range it depends on the topography. Hills can be grouped into long simple ranges or into hill-masses. The Pentlands, Ochils, and Sidlaws, and parts of the Pennines between Lancashire and Yorkshire are simple ranges which branch little and enclose only short river valleys. Representative hill-masses occur in the Lake District, in the Southern Uplands of Scotland and in the Grampians. Comparing these two types of hill-grouping, it will be found that the hill-mass is much more favourable for afforestation than the long simple range. The long narrow range has a narrow watershed ridge and steep broken slopes, because wind and atmospheric agents of erosion have full play; the result is that screes of loose stones or rocks occupy a large proportion of the ground, and are generally unsuitable for the growth of trees; the wind has also full play, and few places are sheltered enough for trees. On the hill-mass all this is modified, and a greater part of the area consists of branching valleys, rounded summits with broad intervening cols, and gentle slopes completely clad with vegetation. Here wind and erosion have less effect, the soil is less disturbed, and the primitive vegetation remains. It is also the case on a hill-mass

that all the zonal limits of plants are lifted up; this means, using local examples, that a tree-limit of 2000 feet may be expected in the Grampians where hills rising over 3000 feet are massed together, but on long exposed ranges like the Pentlands where the highest summits are barely 2000 feet, the possible tree-limit will rarely exceed 1000 feet.

Woodlands in Relation to Soil.

The geological features of soil need not be dealt with here, as they form the subject of a series of contributions by Professor Geikie in recent volumes of these *Transactions* (Vols. XX., XXI.). The results of the botanical surveys show that, while there is a distinct connection between types of woodland and certain geological formations, still geological change does not necessarily mean change in the woods. The really essential things which give rise to different types of woodland are thus summarised in the "Woodlands of England": "Briefly, we find that the alder-willow series of woods is characterised by a very high water-content, and that the other two principal series which we distinguish, the oak and birch series on the one hand, and the beech and ash series on the other, are related to the lime-content of the soil. When, however, either of these two series is subdivided, we find that the subdivisions are related to the water-content and to the humus-content of the soil. Further, the nature of the humus formed in the various soils has an important influence, and, finally, the available food (in the shape of mineral food-salts) may perhaps be decisive in determining the success or failure of certain tree-associations on sandy soils."

The amount of water depends, in the first place, on the rainfall, and in this respect Britain is well supplied, having 20-25 inches per annum even in its drier parts. But if rainfall alone is the only source of water, the place is not specially suitable for trees. The most favourable places for woods are found where the collected rainfall, after being stored amongst the underground strata, issues forth regularly in the form of springs. This water is a constant supply, and it also contains some dissolved mineral food-material. These conditions of water-supply are generally well marked on a valley-slope, since valleys are as a rule cut out of the softer rocks. Valleys are therefore specially suitable for tree-growth, and they have also the advantage of shelter.

For the same reason, the farmland of hilly countries is mainly confined to the valleys. The contrast between the valley and the higher plateau-country is frequently very marked, and many readers must have seen the arrangement of vegetation here described. On the plateau, heather moor extends for miles, growing on a gritty, sandy soil and supplied only by such water as falls from the atmosphere. The slow growth of the heather and other plants shows that only such plants can survive as require little food-material, yet here and there numbers of Scots pine have grown up from seedlings where moor-firing has not taken place. This vegetation extends to the edge of the valleys, but there becomes mixed with bracken, a plant indicating deeper soils. On the higher slopes trees are met with, chiefly birch, rowan and thorn, with occasionally a stunted oak; here the soil is still shallow for trees, and the water-supply is mainly aerial. Lower down the slope emerging springs indicate the supply of underground or telluric water, and this, combined with deeper soil and more humus, favours a better growth of trees and ground-vegetation, and we get a typical wood. At the bottom of the slope the soil is much deeper owing to the accumulation of fallen stones and soil, and humus rapidly accumulates as the soil is shaded, and well supplied with moisture from the springs emerging at different levels on the higher slope. In the bottom of the valley the water is conveyed away by the stream, or if not it collects and renders the soil unsuitable for the more important timber trees, but well adapted for swampy thickets of alder and willow.

Another feature in the soil-conditions and water-supply of a valley wood may be added here. If one stands at any point in a valley, it will generally be found that one bank is steep, while the other slopes more gradually. On the gentler slope, tree-growth is much better than on the steeper slope, and sometimes this is so marked that while one slope is almost treeless, the other is well wooded. The steep slope may be due to river erosion, but it also generally indicates that the strata of that side dip inwards, so that little or no water flows out. On the other hand, the dip or gentler slope weathers less rapidly, and soil accumulates and is supplied with water from outflowing springs, all the conditions being thus favourable to the growth of woods.

The Classification of Woodlands.

We now pass on to consider more closely the types of wood distinguished by the authors of the "Woodlands of England."[1] The primary grouping is into three series: (1) The Alder-Willow series, characterised by a very wet soil; (2) The Oak and Birch series, characteristic of siliceous soils with a low proportion of lime; (3) The Beech and Ash series, characteristic of soils which contain a considerable proportion of lime. These three series are as a rule easily distinguished from each other, but it must be understood that they may pass gradually into one another. Within the second and third series the woods are subdivided into other types which are called "associations."

(1) *Alder-Willow Series.*—These woods occur at low elevations in valleys and where water moves slowly. At one time they covered large areas in the larger vales, but as extensive drainage proceeded they were converted into arable land, heavy-soiled but fertile from the accumulation of deep fine clays with much mineral matter. At present the best examples of alder-woods are found in the Norfolk Broads, but smaller fragments may be seen in many places, especially where low-lying lands are liable to frequent floods. Alder and several species of willow are the most frequent trees, but some oak may occur, and ash is sometimes quite abundant. The ground-vegetation is characterised by the taller sedges (*Carex paniculata* and *C. pendula*), cuckoo flower (*Cardamine*), marsh marigold (*Caltha palustris*), forget-me-not (*Myosotis palustris*), yellow iris, queen of the meadow, tussock grass and reeds. In the Cleveland district of Yorkshire, we have seen these woods covering wet valley slopes on boulder clay, and there the alder is encouraged and periodically coppiced as it furnishes timber for clog soles and yields a good return.

(2) *Oak and Birch Series.*—The distribution of woods of this kind is on all siliceous (*i.e.* non-calcareous) soils, ranging from the stiffest clays, through the various loams, to the sands and gravels and soils derived from sandstones of various ages, as well as on soils derived from grits, mudstones, shales, and various acidic igneous rocks. As limestones and other calcareous

[1] This part is taken almost entirely from that paper, hence quotation marks can be dispensed with. Only a few plants of the ground-vegetation are referred to, the full lists being available in the original paper.

soils do not play a great part in the surface geology of Scotland, the oak-birch series of woods has a wide distribution. Considerable attention has been given to the distribution of the two oaks—the peduncled oak and the sessile oak. It has been found that the pedunculate oak (*Quercus robur* or *pedunculata*) is the more characteristic tree of southern England and the Midlands, while the sessile-fruited oak (*Q. sessiliflora*) is more typical of northern and western England. The reason for this distribution is traced to the soil, the main determining factor being depth of soil. The peduncled oak is characteristic of the deep-soiled clays, loams, and fine sands which are mainly found in the south and in the Midlands, while the sessile oak is equally characteristic of the shallow soils which prevail in the north and west. So far as Scotland is concerned, we have seen both oaks in the Lothians and in the Highlands, but their distribution has not yet been determined.

The distinction between these two native oaks has often led to controversy, and we reproduce here some conclusions taken from a recent careful analysis of the various native and introduced British oaks.[1] The author holds that the native British oaks may all be referred to *Q. sessiliflora*, *Q. robur* (*pedunculata*) and a hybrid between these species. *Q. sessiliflora* is distinguished by the presence of branched stellate hairs on the under surface of the leaf, and by the absence of leaf auricles; other characters, such as the length of the leaf-stalk and the absence of a stalk to the acorn, are liable to variation. The peduncled oak (*Q. robur*) has two turned-in auricles at the base of the leaf-blade, and the stellate hairs are absent; the long stalk to the acorn, the very short leaf-stalk, the flatter crown and the shorter bole are also characters, but they are liable to considerable variation. The hybrid oak has mixed characters, particularly auricles on the leaf-base and stellate hairs.

Although, generally speaking, the pedunculate oak frequents deep moist soils, and the sessile oak follows the shallower soils, it is not considered advisable to subdivide the oak-woods in this way. The ground-vegetation is regarded as a better guide. The primary division of the oak and birch series of woodlands is into—(*a*) Oak-wood association, (*b*) Oak-Birch-Heath association, (*c*) Birch-wood association.

[1] "British Oaks," by C. E. Moss, *Journal of Botany*, Jan. and Feb. 1910.

The oak-woods are divided into damp and dry associations. The damp oak-woods occur on clays, loams, and other moist, heavy soils. The pedunculate oak is the dominant tree, but ash may be present and, in Sussex and neighbouring counties, hornbeam is often abundant. An undergrowth of hazel is a good indication of a damp oak-wood. In the south of England, coppicing has long been carried on in the oak-woods, and besides oak and hazel, ash, birch, beech, hornbeam, alder, willow, and even Spanish chestnut are cut back periodically and treated as coppice. Oak-hazel coppice, with or without oak standards, is a widespread type of woodland, but it is regarded as derived from the damp oak-wood. The observations of the authors of the "Woodlands of England" give much information on the origin of this oak-hazel copse, and the effect on the soil of this mode of treating woods. One important conclusion is that coppicing has often deteriorated the soil for trees, because the natural humus-covering has been wasted through exposure without canopy. This process has gone so far in places that what was once woodland is now poor scrub, with whins and other not very useful plants. This may explain the well-known difficulty met with by foresters who attempt to convert coppice, which is no longer so profitable as it was, into timber-producing woods.

The undergrowth of the damp oak-wood is generally varied. Hazel, hawthorn, maple (*Acer campestre*), brambles and roses are typical shrubs, and the climbers ivy and honeysuckle are common. The ground-vegetation includes a number of plants partial to damp shady woods in general, such as primrose, red campion, wood anemone and celandine. The following appear to be almost confined to the damp oak-wood: male fern (*Lastræa Filix-mas*), broad buckler fern (*L. dilatata*), the lady fern (*Athyrium Filix fœmina*), the wood horsetail (*Equisetum sylvaticum*), and the large woodrush (*Luzula maxima*).

Typical examples of damp oak-woods and dry oak-woods are quite distinct, but between the two there is every stage of gradation, and on a single valley-slope in a hilly district, it is not unusual to find the dry type at the top of the slope with a more or less damp oak-wood lower down. The typical dry oak-woods are characterised by absence of ash, hazel and maple, but birch, holly and rowan are strongly represented. The soil is poorer in humus, and the herbaceous

ground-vegetation includes fewer species. In wood after wood of the dry type there may be little else than bracken, wood hyacinth (*Scilla*) and soft-grass (*Holcus mollis*). Wood sage (*Teucrium Scorodonia*), foxglove, tormentil (*Potentilla*), and the rock bedstraw (*Galium saxatile*) are also useful indicator plants, not always confined to woods. In some dry oak-woods, blaeberry (*Vaccinium Myrtillus*), ling (*Calluna vulgaris*) and the heath hair-grass (*Aira flexuosa*) form a characteristic ground-vegetation.

The oak-birch-heath association is the term applied to a scrubby wood common on light sandy soils in the south-east of England. Careful observations have been made on many of these areas, and there is reason to believe that in some cases they represent a stage of degeneration from the dry oak-wood to heath, as a result of constant felling and neglect. Oak does not seem to rejuvenate well, but birch comes abundantly from seed. In places beech has secured a hold, and by its deep shade clears out the ground-vegetation. Scots pine is another successful tree which spreads rapidly from plantations, so that considerable tracts of these southern English heaths are being rapidly converted into seedling pine-woods.

The birch-wood association is of more interest to northern readers. In the hilly districts of the north of England, the oak becomes rare at altitudes of about 1000 feet, whereas the pubescent birch (*Betula tomentosa*) ascends higher. The oak which is dominant in the lower valleys becomes stunted higher up, and the birch increases until it gives the tone to the higher woodland. The cause of this cannot be traced to soil conditions, and it appears to be an effect of climate. Rowan, hawthorn and some willows almost exhaust the list of trees and shrubs in the birch-wood. The ground-vegetation, as a rule, does not differ much from the adjoining moorland on the one hand, and the poorest type of oak-wood on the other; it may consist of wiry grasses, dry heather and blaeberry, or wet moor with peat-plants. We have seen fairly good examples of this type of birch-wood in the higher valleys of the Lowlands of Scotland. In the Highlands birch-woods are much more evident, and a special colour is allotted to them in the vegetation maps of Perthshire and Forfarshire.[1] The typical Highland birch, as seen by us

[1] "Botanical Survey of Scotland," by Robert Smith: II. Northern Perthshire, 1900; III. and IV. Forfar and Fife, 1903-4 (*Scottish Geographical Magazine*).

recently in Strathtay and Speyside, has a distinct pendulous and very graceful habit, and its leaves are somewhat triangular.[1] Both characters are distinct from the pubescent birch, which also occurs, but is not pendulous and has rounded leaves. In the Highland glens this birch-wood extends to a high altitude (2000 feet sometimes), and as the oak is strictly limited to the valley-bottoms it is seldom seen in the birch-wood. It seems therefore probable, that the Highland birch-wood cannot be regarded as a degenerate oak-wood, but is a type distinct in itself. The undergrowth is generally grassy, and shows little difference from the adjoining hill-grazings; in the woods we have examined, the canopy was open and sheep grazed freely through them destroying any seedling trees or shrubs, hence probably arose the pasture-like character of the ground-vegetation.

Pine-woods do not come within the scope of the "Woodlands of England," because it is doubtful whether any native pine occurs in England. In Scotland, pine-woods occur on non-calcareous soils as a natural woodland distinct from the almost universal plantation. Tradition has long held that the Black Wood of Rannoch, portions of Rothiemurchus and other Speyside forests, and parts of Deeside, such as Ballochbuie Forest, are directly descended from the primeval pine forests of Caledonia. Recent visits to Rannoch and Speyside tend to confirm this view, in our opinion. In both districts there are trees of great age surrounded by a considerable area with trees of all ages, thus confirming what one is told that no recent planting has been done. The Scots pine is the dominant tree more or less mixed with birch. The pines have a habit not common in plantations; they are pyramidal and retain the lower branches to a late age, and the foliage is distinctly grey, a feature mentioned by many foresters as peculiar to the true Scots pine in contrast to the darker foliage of the planted form. The ground-vegetation of these natural or semi-natural pine-woods is very rank, probably the result of an open canopy. Ling (*Calluna*), pink bell-heath (*Erica Tetralix*), blaeberry and its relative the red-berried cowberry (*Vaccinium Vitis-idaeus*) are in great profusion, and form high mounds over old tree-stumps. In Rothiemurchus, juniper is abundant in open places, and at

[1] No attempt is made to give this variety a name, until more is known about it.

higher altitudes the bearberry (*Arctostaphylos*) and crowberry (*Empetrum*) form large cushions. Humus is everywhere present, varying from a few inches to deep peat. In the undergrowth of these woods several small plants occur which are rare in most places, except in these old pine-woods, such as the winter-greens (*Pyrola*), chickweed wintergreen (*Trientalis*), and several small orchids (*Goodyera repens*, *Listera cordata*, etc.). The natural habitat of the pine-wood is in a zone above the oak-wood, and it competes with birch-wood for the higher ground up to about 2000 feet. It is well known that remains of birch and Scots pine occur extensively in the peat of the higher moorlands, which are now treeless. It is probable that many of these moors could again be afforested with Scots pine, spruce and larch, but one rarely sees any attempt to establish hardwoods in the natural area of the Highland birch and pine.

(3) *Beech and Ash Series.*—These constitute the third great group of the woodlands of England. During the earlier botanical surveys in Yorkshire, it was found that ash was the dominant tree in woods on limestone soils. This was confirmed later in the surveys of Somerset and Derby by C. E. Moss. Beech-woods are also known to be the natural woodland on the calcareous soils of the chalk.

The typical ash-wood is best developed on the massive exposures of the mountain limestone in England, which are highly calcareous. Oak is rare on this limestone, and the experience of foresters is that it does not grow well when planted, except in the more alluvial soils of the valley-bottoms. As regards moisture, the ash may be found on wet soils, through all degrees of moisture to a rocky knoll with a shallow soil. There is, however, a general belief that the ash prefers moisture, and it is possible that, in what appear to be dry soils, its deeper roots may find in the limestone fissures a constant supply of moisture.

Wych elm and hawthorn are common associates of the ash, and in some districts yew and whitebeam (*Pyrus Aria*). The ground-vegetation varies according to the water-content of the soil. In wetter parts wood-garlic (*Allium ursinum*), red campion and valerian are generally present; in slightly drier parts dog's mercury often forms continuous unbroken sheets; in dry parts ground ivy (*Nepeta glechoma*) frequently forms a carpet. These ash-woods are full of interest to the botanist, because there a

good many local plants occur which are not often found in oak-wood districts, *e.g.*, lily of the valley, stone-bramble (*Rubus saxatilis*), wood geranium (*G. sylvaticum*), and others.

The typical ash-wood is not hard to distinguish, but difficulties arise when we find that this becomes modified into a mixed ash-oak-wood on soils where the lime is much mixed with sandy material. In many respects the ash-oak-wood resembles the damp oak-wood, but frequently the ground-vegetation is enriched by the presence of species characteristic of calcareous soils, such as those just mentioned above. The following shrubs also indicate this type of wood: wayfaring tree (*Viburnum Lantana*), spindle-tree (*Euonymus europæus*), and wild clematis. The mixed wood of oak and ash is familiar to many foresters and may have arisen from seedling ash taking the place of the oak removed. In some districts open places in oak-woods soon become occupied by seedling ash trees; in other localities breaks are filled with seedling birch. The reason must be something more than the seeding. Ash and birch may both be dispersed from fruiting trees, but in the one case the ash survives best, in the other it is the birch. It would be premature at the present time to say that the presence of ash indicates lime, or that lime-content is the cause of ash being present; the outstanding fact is that on distinctly calcareous soils ash is a conspicuous tree in the woodlands.

The beech-wood association is another calcareous type found on the chalk escarpments and valley sides of south-eastern England, including the Chiltern Hills; beech-woods are also well developed on the Cotswolds. This area is regarded as the habitat of the native beech in Britain, because there it forms natural woods with a characteristic undergrowth. This tree grows quite well in northern England and in the Lowlands of Scotland, and may be the last tree seen in ascending many valleys towards the moorlands; it may even ripen its seed, and seedlings may be found, but it is generally held by botanists that in northern Britain the beech is always a planted tree. The authors of the "Woodlands of England" have confirmed this view after examining most of the well-known beech-wood areas. Under the deep shade, the ground-vegetation is meagre, oak is rarely met with, but yew is fairly frequent; ash varies considerably, but in some parts appears to be replacing beech where this fails to rejuvenate. The ground-vegetation, where it exists, includes dog's mercury,

wood sanicle, several violets (including *Viola hirta*), and several rather rare wood orchids. In ascending a chalk escarpment or valley side, one frequently observes near the summit a sharp change from beech-wood to oak-wood, while the plateau is covered with typical oak-wood. This is due to a definite change of soil, the "clay with flints" which forms sheets of varying thickness over the chalk, being typically non-calcareous. Typical oak-woods also occupy areas on the rolling chalk plateau of Hampshire, but though these areas are geologically mapped as "chalk," the woods are invariably found to be developed on non-calcareous soils overlying the chalk.

The notes on woods just given may gain clearness if we reproduce here the following summary from the "Woodlands of England":—

I. Alder-Willow Series: on very wet soils.

II. Oak and Birch Series: on non-calcareous soils.

(A) **Oak-wood Associations:** on non-peaty soils at low and moderate elevations.

(*a*) *Damp Oak-woods:* on clays, shales, loams, fine sands, and moist soils generally.

(*b*) *Dry Oak-woods:* on sandstones, grits, sands, and dry soils generally.

(B) **Oak-Birch-Heath Association:** on dry, coarse, sandy, and dry peaty soils (low elevations).

(C) **Birch-wood Association:** on non-calcareous soils at high elevations.

[The Pine-wood Association (of Scotland): on non-calcareous peaty soils at moderate and high elevations (up to 2000 feet).]

III. Beech and Ash Series: on calcareous soils.

(A) **Ash-Oak-wood Association:** on calcareous clays, marls, impure limestones, and calcareous sandstones.

(B) **Ash-wood Association:** on limestones.

(C) **Beech-wood Association:** on Chalk in the south-east of England, with a western extension on the Oolites of the Cotswold Hills.

(*To be concluded.*)

3. Forestry Education: Its Importance and Requirements.[1]

By E. P. Stebbing.

I propose to deal to-day with a brief exposition of the points on which the system of forestry education is based. I hope thereby to show what this University requires to place its Forest Department on thoroughly up-to-date lines, and thus enable it to turn out men as efficient and capable of managing woods as are the men trained in the various famous forestry schools of Europe.

It will be of interest, I think, to first glance briefly at the training to be obtained at some of the European forestry schools, and the facilities provided for giving it. We will then consider some of the things the student in forestry must know, and in this connection glance briefly at a few of the duties which confront the Forest Officer in the course of his ordinary work in India, concluding finally with a review of the present position of the University as regards forestry training and the steps which require to be taken to enable us to send out the class of British forester which is already required in many of our colonies, and for which we trust there will soon be a demand in the British Isles.

A few years ago, whilst on furlough from India, I made a tour of some of the forestry colleges and schools of Europe, my object being to study the lines upon which the continental system of education was based, and the methods they adopted to combine a proper proportion of practical work with the theoretical instruction given in the classroom. In the course of my tour I visited Eberswalde, Tharandt, Aschaffenberg and Munich Forestry Schools in Germany, the Imperial Forestry Institute at St Petersburg, the Agricultural and Forestry Institute at Vienna, and the fine French Forest School at Nancy. That tour was an education in itself. Briefly I may sum up the results of my observations as to the essentials for the tuition of forestry thus:—

1. A Strong Teaching Staff.
2. Good Museums.
3. A Forest Garden and Forest Educational Woods.

[1] Inaugural address delivered at the opening of the Winter Course in Forestry, at Edinburgh University, on 12th October 1910.

1. *The Instructional Staff.* The study of forestry so depends on a number of cognate subjects, such as botany, chemistry, geology, zoology, surveying and forest engineering, etc., that it is essential that the student should be given first-class courses in these matters. Excellent courses are given in all the continental colleges. There remains the subject of forestry itself, comprising the various branches of silviculture, forest management, forest valuation, forest protection, forest utilisation, the law of the forests and procedure and accounts. To lecture on these various branches the best continental colleges retain the services of at least three men, professors and assistants, many of the former having world-wide reputations in their various branches. These men are also often responsible for their own departments of work in the school forest garden and instructional forests. This work, as we shall see, falls under two heads. They deliver courses of lectures in the lecture hall, and they conduct the students on their excursions made into the woods to illustrate these lectures, and personally supervise every piece of practical work laid down for the student to do. Since the minimum time in which a student can finish the forestry course is two years, the professor requires at least one assistant to conduct a part of the lectures, for the junior and senior students are both necessarily attending courses at the same time, and one lot may be in the woods, whilst the other is in the lecture hall.

At the well-known forestry school at Munich, the home of a number of famous foresters, the various branches of forestry science are in charge of three professors. Prof. Mayer takes Silviculture, Forest Utilisation, Protection and Foreign Forestry; Prof. Endres, Forest Policy, Administration, Valuation and Finance; whilst Prof. Schüpfer lectures in Forest Management and Working-Plans, Estimation of Increment and Yield. Each of the professors is responsible for the excursions, laboratory and practical work of their various courses.

2. *Good Museums.* The educational value of a good museum is fully recognised. It need not be enlarged upon here. Forestry is peculiarly a science whose tuition on the one side and assimilation on the other is dependent upon two essentials:—a thoroughly efficient system of practical work, and up-to-date well-planned museums exhibiting in a simple and efficient manner the various details connected with forest work.

So important is the museum as an adjunct to the efficient teaching of forestry, that we find in all the continental forestry colleges that considerable sums of money have been spent on this part of the equipment alone, and yet, in some instances, although with treble the space available here in Edinburgh, the cry was often that more room was required. Where all is so good it is difficult to particularise, but as examples of efficiency in this respect, I will instance the museums at the Forestry School of Nancy in France, the Imperial Forestry Institute in St Petersburg, and the Forestry College at the University of Munich. The last named, so far as its building accommodation and museums are concerned, forms the nearest parallel to the position of Edinburgh University, and it will be of interest to briefly glance at the accommodation provided.

The Forestry College at Munich forms part of the university of the town and State, and considerable sums of money were spent a few years ago with the object of bringing it thoroughly up to date. The buildings devoted to forestry instruction are two in number, both situated in the grounds of the university. The old building contains the museums and rooms devoted to botany and zoology. The accommodation for each of these sections consists of a commodious lecture hall, professors' and assistants' rooms, packer's room, and two fine rooms for the museums. It is outside the province of these remarks to deal with the contents of these museums, but I will say that they merit the closest inspection of any forester who wishes to educate himself in this direction.

The new building, which was opened about the year 1900, is the most perfect institution of its kind that man could have devised. The whole of the inside fittings are of wood; highly polished parquet flooring being used throughout, whilst the rooms are handsomely panelled with various kinds of woods. The chemical, mineralogical, metereological laboratories, etc., are in the basement; forest surveying, mathematics, and forest wood museums on the first floor, and forest instruments, forest products, and models and diseases of woods on the next floor. Each of these branches or departments of science has its own museums—one or two rooms as are required—its own large lecture hall, with professors' and assistants' rooms, laboratories where required, packer's room, etc.

I am chiefly concerned here with the accommodation afforded

to the forestry branch, the chief branch of his work for the forestry student. A room each is devoted to the sections of forest surveying and forest mathematics, with adjoining professors' and assistants' rooms. A large room is devoted to exhibits of the different kinds of woods, with a fine lecture hall and professors' and assistants' rooms close by. On the next floor we have a hall devoted to the exhibition of the implements and instruments used in the woods for various forest operations, such as sowing, planting, trenching, pruning, felling, etc., a very complete collection. In this hall, which is a very large one, is also exhibited a fine collection of the products and articles fashioned from wood by the implements exhibited, *e.g.*, all stages in the manufacture of matches, fashioning of cart wheels, rakes, harrows, etc. The walls are hung with numerous photographs of felling operations, logging, planting, etc. This opens into another large room which is devoted to models and general forest products. We see here an almost unique set of models required for the extraction and transport of forest produce, such as slides, sledges, rope-ways, bridges, etc., etc. The collection of what are known as the minor produce of the forest, gums, waxes, edible seeds, tannin, etc., etc., is exhibited here. A fine lecture hall and professors' and assistants' rooms adjoin.

The above description will show that there is little fault to be found with the arrangements and space devoted to this wonderfully efficient forestry college. With such equipment there is every incentive to professor and student alike, not only to work but to undertake research work in the various branches of forestry. In the Bavarian University the State pays for the upkeep of the major portion of the Forestry Department, and in return the Government reaps the advantages derived from the very important research work and experimental work in which its professors, many with great European reputations, spend all their spare time.

3. *The Forest Garden and Educational Woods.* We come now to our third essential to the proper teaching of forestry, the forest garden and educational woods. It may be said at once that the subject of forestry cannot be taught by the professor, or assimilated by the student, unless efficient instructional woods are available to which the student can be taken during the lecture course, as well as during the practical course, to be

shown eye object-lessons of what he is told. He should be shown in the woods what he is told in the lecture room, and taught to observe for himself—that first and most important of the lessons of a forester. These first principles of the education of a forestry student are well understood on the Continent, and are adequately provided for.

I will give two instances out of many. The German Forestry Academy of Tharandt is situated not far from Dresden in Saxony. The school is provided with a forest garden and demonstration forest, forming a compact block in its immediate vicinity. The forest garden is situated on a hillside immediately behind the school. The hillside is terraced into beds which contain some 1800 different species of trees, shrubs, perennials and annuals of various kinds, both indigenous and exotic. This garden serves as a forestry and botanical garden and is an exceptionally fine one, covering an area of about 18 hectares. There is a forest nursery in the garden managed on most up-to-date lines. For instance, rare exotic seedlings, or those difficult to grow, are raised in seed-beds placed in brick cells covered with a wire-mesh frame-work which secure an entire immunity from the attacks of insect pests. Very few of the seedlings raised in these beds are lost. There are some glass houses in the garden in which experiments in connection with the grafting of conifers were being carried out at the time of my visit.

The school demonstration forests adjoin the forest garden and are kept up entirely for educational and demonstration purposes. They are situated in a hilly area presenting ever-varying conditions, aspects and variations in soil, thus allowing of a variety of object-lessons with different species and mixtures being presented to the student. For example, these woods contain spruce and beech with birch in mixture; spruce and silver fir, or the two latter with birch. Or again, there are woods of spruce, beech, Scots pine, silver fir, larch, maple, birch with maple, and various mixtures, ash (pure about thirty years old), alder (in wet valleys), oak, and a little *Æsculus*. There are some most interesting mixtures to be seen doing remarkably well, and forming an ideal of what demonstration woods should be. The steep slopes of the hillsides are worked under different silvicultural systems to the area of tableland above, where the woods are clear cut and naturally regenerated, or sown or

planted. Exotics are being largely introduced, and thousands of plants are sent out annually from the forest garden and nursery in the demonstration area into the forests all over Saxony. Fencing of young planted areas and other ways of protecting young plants from deer, etc., are to be seen in practice in the woods. Time will not permit of my dwelling upon this excellent educational demonstration area, but from his earliest course in the lecture room, the student is taken out week by week into the forest garden or woods, and with his own hands learns how to trench, sow, plant, thin, and fell and measure up his woods; he is taught to distinguish the different species of tree, and how they differ in their requirements of soil, light, moisture, etc.; he is shown on what the foundations of silviculture depend; and is gradually led, step by step and stage by stage, to understand and grasp both the theory and practice of the various branches of the lore of the woods comprised in forestry.

I should like to give another instance of this educational forest. The Imperial Institute of Forestry at St Petersburg is probably the largest forestry college in Europe. The students number 500, all training for the Controlling Staff. In addition there are 33 lower grade schools scattered about the country containing 15 students apiece, from which the ranks of the forest rangers and upper guards are filled. Attached to the Institute at St Petersburg are two educational forests, the one 14 versts (9 miles) from the capital, the other and larger 60 versts (40 miles) away. At each of them, buildings are maintained for housing the professors and students during their visits. Portions of every summer are spent by the students in these woods occupied in practical work. The woods are entirely under the management of the Director of the college, as is the case at Tharandt, and are managed on similar lines and solely for demonstration purposes. The Directors at both these places, as also the forestry professors (and this applies to many of the continental colleges), are all practical men who have themselves been through the mill of executive work, have themselves held charge of large areas of woods worked entirely on a commercial basis, and are therefore in a position to see that the instruction given to the students is such as will return full value to the State or proprietor who employs the men leaving their institutions.

This is a point which I think worthy of the most serious

consideration in this country. Too great stress cannot be laid on what are after all actual facts. The excellent and remunerative results of forestry in Europe, which we also wish to arrive at in the British Isles, are solely the result of the study of higher forestry both in the woods and in the laboratory. Practical foresters can only be successful in proportion to the knowledge they themselves possess, or which is imparted to them by those who know. We can learn from other countries a great deal, but the application of what we learn must depend on ourselves and must be carried out by ourselves.

We have now seen what the continental forestry colleges consider the essentials to the proper tuition of forestry as a science, and have shown how the student is gradually led, not only to assimilate the theoretical portions of the study in the lecture room, but to take with him what he has absorbed there and apply it practically in the woods. We have seen that these practical object-lessons must begin with the student's first lectures, that he must be taken into the woods at the beginning, and be shown step by step that what he is being told in the lecture room is not so much matter to be studied for an examination, and to be subsequently forgotten when his text-books and note-books are thrown aside after the "pass" has been gained. It has been said of the forester that he is always at school, from the moment he first enters the lecture room to commence his first course to the end of his life. And those of us who are foresters know this to be true. Our text-books and lecture notes remain our trusted friends to the end, and as we grow older and have had a more extensive practice and experience in forestry, we grow more diffident about expressing definite opinions and laying down the law on the subject of the life-histories of our friends the trees. For the tree is very much like the human being. He has his wants and requirements, his fancies for particular aspects and localities, for certain soils and degrees of light, moisture, heat and shade. All these the forester must know and study, and even then his fastidious friend will often discover something he dislikes, and will refuse to grow. The forester has to set to work to find out what this something is, and meanwhile all he has done is a failure. A failure that is unless he is a thoroughly trained scientific man. As such he will turn his failures to account, for he will place them on record so that he and others like him may set to work to get at

the reasons for the failure of a crop which, as far as human forethought was capable of doing, had been given every chance. How much sound practical knowledge and observation have been lost to the foresters all over the world by this regrettable neglect to place upon record their failures. Almost more valuable are they to record than the successes. To the forester far more valuable. This is one of the spots upon which the scientific forester can place a finger in the British Isles. Had one a full, or even a partial, record of all the failures of the past, how much simpler would be the task at present facing the nation of setting its forestry house in order.

But a knowledge of situation, soil, temperature and moisture requirements of the tree will not suffice the forester who wishes to bring his crop from seedling stage to the axe. He must be a doctor, and must be able to diagnose the diseases to which his trees are liable; or I will say that he must have knowledge sufficient to be able to recognise the first appearance of a disease, whether it be one of the fungus pests to which all tree-life appears to be subject, or one of the insect plagues, which, if left unchecked, may result in the loss of the major part if not of the whole of his crop. It would probably be impossible to estimate the minimum losses to the timber supply of the world from these causes alone. Dr Hopkins, the Forest Entomological expert of the American Government, has estimated the annual loss to America, from insect attacks to timber and forest produce, at something like 100,000,000 dollars.

There can be little doubt that the greater the ability possessed by the forester to recognise these dangers to his trees, when they first make their appearance, the greater will be the immunity of his crop from them. The greater number commence at a centre and spread from that point. If the forester is able to detect such a commencement and deal with it at once, he will stamp out the disease and save his woods. Surely then we would all rather have such a man in charge of our woods than one without the knowledge. We require the specialist in all these diseases to aid the forester, but the specialist must depend entirely on the forester for information on these attacks; for the foresters are many in number but the specialists few. How often is it that the specialist is called in only when the attack has assumed such dimensions that the difficulty of stamping it out is not only very great, but also very costly. And there is no

use in blinking facts. The responsibility rests solely with the forester in charge of the woods and nowhere else. If the forester has received an efficient training, he will have studied this branch of his profession under able specialists, and will have been shown as a student how to recognise the first beginnings of such attacks. He goes to his duties then, properly equipped, and if he neglects to report a bad plague before it is devastating his woods, he is failing in his duty to his employer. I speak as a practical forester myself who has had personal experience in this direction, for I have seen serious damage done in Europe, as well as in India (grave damage is being done at the present moment here in Scotland), which could have, in great part, been avoided, had those responsible possessed the necessary training to enable them to recognise what was taking place when it first began.

It may be asked, but what are the duties of the forest officer when you have turned out this highly-trained product? They will, of course, vary with the country he is serving in, with the character of his woods, with the reasons for which those woods are kept up, in fact with the thousand and one conditions which go to make up that whole—the work of a forester, one of the most varied and interesting occupations in existence to the lover of the open air and of nature. It may, perhaps, be of advantage to dwell briefly on a few pages from the diary of a forester in India, as they sum up duties which a forester will find awaiting him wherever he serves.

That tract of country in Eastern Bengal situated between Calcutta and Burma contains a wonderful variety of different kinds of forest, from mangrove swamps along the seaboard to hills of pure bamboo, alternating with a scrubby jungle growth, giving place to fine, dense, tropical forests in the mountainous ranges of the Chittagong Hill Tracts and Lushai Hills. A veritable botanist's paradise these dense forests, accessible only to small boats poling up stream, for there are no roads, and the whole of the forest produce is floated out. With the varied nature of the forests, and a dense population in the flat lands adjacent to the seaboard, come a variety of occupations, including a goodly proportion of the most harassing of a forest officer's duties—Court work. Pilfering of a few bamboos and head loads of sticks, or illicit grazing of cattle within the forest boundaries, was constant. These were minor offences, however,

mostly settled out of court. Encroachments on the Government reserve boundaries were more important. Wholesale stealing of large logs or dug-outs (boats), which were floated down from the forests to the revenue stations on all the large rivers (the rivers form the chief roads of this part of the world), there to be assessed, was rife—the Government marks being removed, which made the offence a serious criminal one. During the monsoon months, on dark, rainy nights, when the rivers were out in flood, and went roaring past the revenue station at twenty miles an hour, was the favourite time for such work. Once past the station all was fairly plain sailing. Every village on the river bank was implicated in this sort of thing. Tanks (small ponds) are as plentiful as plums in a cake in this part of the world, and the logs were taken from the river and sunk in these tanks where, safely hidden beneath the thick coating of slimy weeds which covered their surface, they could remain till the Day of Judgment without being discovered! The grave nature of these offences, when they could be brought home to the offender, usually means days on the bench beside the magistrate, explaining the intricacies of Indian forest law, if one is to make sure of obtaining a necessary and salutary conviction. The inspection of these revenue stations is also heavy work. In the busy season, several miles of rafts would be moored off them, consisting of logs of some scores of different species of timber, dug-outs, thousands of bamboos, canes, and a large variety of the minor products of the forest, all of which had to be checked and assessed by the station officers. Men capable of undertaking such work require a good preparatory training, and the man required to check their work must have a higher one. Other days will have to be spent inspecting the boundary lines of the Government reserves. The forest officer is entirely responsible for his boundaries, which may run into hundreds of miles. He must see that they are yearly cleared, and that his pillars or boundary posts are all standing in their proper positions. If he thinks any have been removed, he will have to check the bearings with theodolite and compass. Should he fail to do this, and allow a boundary to get into disrepair, so that it is not plainly discernible to the villagers, a prosecution for trespass or for cultivation illicitly encroaching on the boundary (a common habit of the villagers) will assuredly fail when carried into court, and will be followed by an outcrop of such offences. At another time, in

the locality I am describing, a number of large areas of forest, some consisting of pure bamboo, others of dense tropical forest trees had to be carefully inspected, with the object of the preparation of plans for their working. I have not time to deal with this aspect of the forest officer's work to-day. But a working-plan made for a wood practically lays down for a number of years the methods on which the wood is to be worked; the cuttings to be made; the roads, slides, tram or sledge roads, or rope-ways to be built to enable the timber to be got out; the areas to be sown or planted up; weedings to be done; in a tropical forest the areas over which the giant creepers festooning the trees are to be cut in order that they may be killed before the area is felled over a few years hence, for otherwise they will hold the tree in its position and it will not fall, though it may be cut through at the base, etc. The preparation of a plan of working for a forest is one of the most interesting and at the same time most exacting pieces of work which confronts the forester. The forester without the knowledge of how to properly prepare one, loses an incalculable amount of the interest his profession contains. Before preparing a working-plan, the forester must make himself thoroughly acquainted with the land tenure systems of the country in which his woods are situated, with the law of the country, with its botany so far as it applies to the woods, geological formation, chemistry of the soils so far as it affects his species of trees, etc. He must have an intimate acquaintance with the wants of the local people, with the local markets where he may dispose of his produce, and with those farther afield to which his large produce may be disposed of at advantageous rates. And all this knowledge he will have to acquire, in addition to an exhaustive examination of what the wood contains at the present time, before he can draw up his proposals for its future working. This may involve its entire reconstitution, and they must be so laid down in the plan that his successor, or successors, may carry out the prescriptions laid down without the danger of any deviations. For the plan will provide that no deviations whatsoever may be made by the forest officer in charge, without the direct permission in writing of the owner.

And this brings us to the management of woods for which a working-plan has been prepared. Higher forestry education is essential for the efficient working of such a plan, for even the

simplest requires a good deal of training and experience to avoid mistakes being made which can never be subsequently retrieved. When there is a large demand for the produce of a wood the plan is likely to be inevitably somewhat intricate. To quote an instance: I was in charge of the Darjeeling forests in the Eastern Himalaya some years ago. Darjeeling is a large civil station situated at some 7000 feet elevation. The population is considerable, and there are military cantonments both above and below the station. Out in the district, tea-gardens, all requiring forest produce, were situated on the forest boundaries. To supply this population with its requirements in timber, firewood, charcoal, grazing in the woods for milch cattle, and fodder for the horses, ponies and mules of the station, etc., required a very nice management of the forests. Every stick of timber and fuel could be sold without satisfying the demands. To ensure continuity of working, the forests are managed under highly scientific working-plans, for there are several plans in force in different areas, which have to be followed undeviatingly by the officer in charge. To manage such plans meant a great deal of heavy work for the staff; with the constant rotation of felling and planting, the latter work undertaken during the monsoon in a locality where the rainfall is over 140 inches; the upkeep of roads constantly liable to slips; the preparation years beforehand of export roads or sledge-ways or wire rope-ways for the extraction of the material from inaccessible localities; the constant friction with the cattle graziers in the forest, a wild, difficult class of men to deal with; and the usual petty pilfering inseparable from forest work in the east, kept the staff pretty well employed, whilst in addition to boundary inspection and fire protection work, the upkeep of the control forms and books in connection with the working-plans formed no light portion of the office work. Only a highly trained staff could undertake to cope with the management of such woods as I have endeavoured to picture here.

Now, woods may be managed or mismanaged without a plan. But no continuity in the working of a wood can be assured unless its management is based on a plan, and forestry without continuity of working is not forestry. I do not suppose there is a forester amongst us who is not well aware of this. I feel perfectly certain also that no one who has once been into the woods and seen and understood all that is to be learnt there, but

will agree with me that the more efficient the training the forester who has charge of those woods can be given, the more valuable will be his work, the more enjoyable will be his life, and the better grown and better kept will be the woods in his charge. And what does it all reduce itself to? Any forest officer will tell you that the more, up to a certain point, that is spent on the efficient supervision and working of the wood, the greater will be the pecuniary return. It is the sole aim of a working-plan, based on financial results; and we have seen that this is fully recognised on the Continent where they are not given to spending money without obtaining an adequate return; and yet they spend large sums on their forestry educational establishments! A full knowledge then of what a plan is and how it should be worked is one of the essentials we propose that the student taking our Degree course here shall go out into the woods armed with. He will still have much to learn, but we shall have, we shall hope to have, given him, along with our up-to-date forestry education, one of the most valuable gifts education can give to a man, the power of observing. A forester who has not this power were better employed elsewhere, for he will never be of any use in the woods. We shall also hope to have inculcated him with the faculty of taking responsibility and of acting in sudden emergencies. I have mentioned a few of the duties of a forester. I have not alluded to one of the most severe, that of fire protection. The danger from fire to the forest in the dry portions of a year is one well known to everyone. But what this danger amounts to in a hot country during the hot season, can scarcely be imagined by those who have not seen a forest fire raging along through walls of tall elephant grass with a fierce hot wind behind it. Whether a few square miles or several hundreds of square miles of valuable forest are burnt on such occasions depends almost entirely on the resource and quickness of decision of the forest officer on the spot. The prevention of fires or their limitation is often also entirely due to the personal qualities or influence or power of observation of the local officer. May I give an instance of the latter? There is in India a small bird known as the weaver bird, who constructs grass nests having the shape of a soda-water bottle, though often much larger, the entrance being near the base. This nest is slung to a twig of a tree by a few slender grass threads. The bird loves to live in colonies, and you may find as many as

twenty or more of these ingenious and beautiful nests hanging to the branches of a tree A few years ago a forest officer endowed with keen powers of observation discovered the origin of many, up to then, unexplained fires in parts of the Assam forests. A fire backed by a high wind would reach a broad boundary line, which had been carefully cleared during the cold weather, and would be there checked and beaten out. Yet it was often found that fires started, as if by themselves, in parts of the forest beyond, without having crossed the trace. The following simple explanation was discovered. Colonies of this little weaver bird built their nests in small trees situated on the outer edge of the forest near the boundary lines or fire traces. These nests were tenantless in the hot weather season. As a fire came up with a strong wind behind it, the dried grass nests caught fire, the few strands by which they were attached to the trees were burned through at once, and the burning nests, acting as so many fireballs, were swept by the wind many hundred yards away into the forest on the far side of the carefully swept fire line, thus starting fresh fires. It is now the duty of the men who clear the fire lines in the cold weather season, to search for all adjacent weaver bird-nests and cut them down and burn them.

One more illustration of a forest officer's work and I have done. He will find almost in whatever country and clime he may serve in, that he will, sooner or later, be faced with planting problems, with knotty points connected with the thinnings of his woods, and with still knottier ones in connection with the extraction of the timber. Now the forester must be able to grapple with all these, and he will only be able to do so efficiently in proportion as he has been trained to his work, and in proportion *bien entendu* as he has kept himself *au fait* with forest literature and the accepted opinions of the men of the day on forest subjects. Nowhere, perhaps, in the world have men had to face knottier problems connected with planting than in India. Here in Scotland I may be told there are worse ones. Well, picture to yourself a southern aspect in India exposed to the full sun of a long hot weather in a dry arid country, the soil composed of part rock, part sand, the surface sparsely covered here and there with a spiny growth of shrubs, which no known animal on the surface of the earth can grapple with, save the goat and camel; the area is exposed to constant denudation from landslips which

are gradually covering up the fertile, arable land below. The hillsides are still grazed over by numbers of goats and sheep who, in their search for such sustenance as the area provides, trample down what little growth exists and aid in the denudation work going on. The orders of the forest officer are to replant the area, an area known to have been covered with a fine forest a century or two ago. It is heart-breaking work, and requires a high skill combined with higher training to produce results in such places. And yet they have been produced, and that in spite of the assertions on all sides that no trees would ever grow there. I do not know that the forester is more optimistic than men in other avocations, but it requires a good deal of evidence combined with practical demonstration to convince the experienced, tried, practical forester that trees of some sort will not grow in any given locality below that of the permanent snow-line. The particular species tried time and again may not succeed, but others doubtless will.

These practical illustrations from a forest officer's life have been given with a purpose. They serve to show, I think, the nature of the training the forester requires if he is to be able to efficiently carry on his multifarious duties, and at the same time satisfy himself that the woods under his charge are, each one of them, getting exactly the treatment they require from year to year. They also emphasise the fact that the forester is learning all his life, that there is something for him to observe, some little secret of nature for him to pick up, every time he goes out into the woods. It follows, therefore, that it is never too late to improve one's education as a forester. That though one may have begun by only following a part of a course in forestry, only have taken the more simple and elementary branches, that it is always possible to go back from the woods to the classroom. The absence in the woods has not brought forgetfulness of what we learnt at our former course. Rather has it brought an increased power to assimilate the higher branches of the science of forestry. So many things explained in the classroom, we shall remember to have noted out in the woods as requiring explanation. Therefore, I would say to the student commencing his forestry course, take every advantage of what you are told in the lecture room, observe all you can in the woods when taken there for practical work, for in the future you will be able to turn this practical knowledge to use; even the very existence

of the woods in your charge may some day depend on your acting promptly on the lines you were taught as a student.

To him who has followed the elements of the science and then gone out into the woods to practise it I would say, forsake the woods for a brief spell, come back to the classroom, and the fuller outlook and wider sphere which will open out to you on your return will well repay you for your perhaps uncongenial labour at the desk. You will never regret the step.

And now I must briefly glance at our preparations here in the University to receive those of you who come back to us from the woods, to those who commence within these walls that apprenticeship to the life of a forester which I for one, believe they will never regret.

As many of you know the University grants a degree of B.Sc. in Forestry, the only University in Scotland or England to do so. That is our patent to you who come to us, the hall-mark which will warrant each man we send out as qualified to undertake the work of a forester. But we hope to equally hall-mark those who return to us for the higher course of training, and yet who will be unable to put in the three years of residence at the University which the degree requires. Those others who return I trust, will be equally marked by us on leaving when they have satisfied us that they are fully qualified. This is what I hope we propose to do. Let us now glance at our means of doing it.

To teach the science of forestry efficiently requires, as we have seen, three essentials:

1. A Sufficiently Strong Staff.
2. Good Museums.
3. A Forest Garden and Demonstration Forest.

1. *The Staff.* We have seen the strength of the staff which the European forestry colleges consider necessary. The staff for forestry tuition at Edinburgh can compare in all save one respect with that of any other university or college in the world. The point, however, at which it is at its weakest is one of the places where it should be strongest. I speak of the strength of the staff responsible for the forestry portion of the education, the most important part to the students.

So far as our first course in forestry is concerned we are all right. We could even manage the theoretical portion of the higher course, which it is proposed shall be given in the winter session, although it would involve the burden of delivering two

lectures a day in addition to the field work of the first course men. The staff breaks down entirely, however, when we come to consider the supervision of the very important practical work of the higher course men which must go hand in hand with their lectures. It is absolutely essential that this work should be personally supervised by the lecturer, an impossibility when he will have the first course men on his hand at the same time. If I am asked why one of the courses should not be given in the summer session, the reply is that the summer session is far too short to deliver either of the courses adequately. I propose that the summer session shall be devoted to practical work in the woods by both junior and senior students, but they will not be working together nor visiting the same woods, since what the juniors are being shown the seniors will have already seen. Further remarks under this head are unnecessary, I think, to show what is required if we are to educate men qualified to hold our degree in forestry.

2. *The Forestry Museum.* Thanks to the initiative and energy of my predecessor, this University is in possession of a forestry museum which can compare favourably with any that I have seen in the British Isles. I do not suppose that he for one moment considered that he had all the specimens he wanted to illustrate his lectures, but for a first course in forestry, and it was for this that he made his museum, it is an excellent one.

We have now to give the higher course in forestry, and are faced with the question of making large additions to the museum. There will be no difficulty I think in this, so far as the specimens wanted are concerned. The difficulty occurs when we consider the present space available. It will be quite inadequate. I think I may claim that I have made a close study of museums of the kind we are considering, and one of the first necessities of a museum to my mind is, to so arrange the exhibits that it may be possible for the student to examine those of a class together, and not find all sorts of different classes of objects mixed up in a promiscuous manner. With the former system the museum can assist greatly in education. In the latter, it only remains a weariness to the flesh, and sends one away tired and muddled with the variety of different objects we have been endeavouring to fix our attention upon at one and the same time. We have seen the space devoted to forestry museums on the Continent. I shall hope to approach

the University, in the near future, with a scheme for the provision of adequate space for our forestry exhibits.

3. *The Forest Garden and Demonstration Woods.* So far as woods of a high educational value go, Edinburgh is undoubtedly better situated than any other forestry centre, out of Scotland, in the British Isles. There are woods in Scotland, many of them known by repute, in which the student on his practical courses can learn a great deal. In fact, supplemented with some object lessons on the Continent, we may say that this part of the students' practical work can be fully arranged for. We have not had, however, in the past, either a forest garden or a series of forest demonstration woods similar to those I have described at Tharandt. We have not had areas to which the students can be taken constantly, during the theoretical portion of the training, so that this essential portion of the practical course can go hand in hand with the class work.

Now, students working for a forestry degree cannot be trained without the provision of such an area. Forestry, in the opinion of all practical foresters, cannot be taught at all without such an area. My predecessor made great efforts to obtain such an area. Professor Bayley Balfour placed the resources of the Botanical Garden with its very useful arboretum at his disposal. It will ever form, I trust, a most useful aid to our training, but Professor Bayley Balfour would not care to see twenty students trenching one of the banks of his beautiful gardens or preparing nursery beds on a lawn. And yet a forestry student must go through this practical work, or how is he to know whether the work is done well or ill when he has charge of woods in the future? Similarly we want to fell trees. Good-natured and public-spirited as our neighbouring proprietors of woods are, we can hardly expect to be constantly received with open arms, when our desire is to fell and measure up sample trees or show the students how to thin an area. For our higher training in some of these directions, I shall trust to avail myself of the many and generous offers I have received, to bring my students and make thinnings in woods which require such work done in them silviculturally; but for the practical work which must go hand in hand with the lectures, it is essential that we should have an area in the vicinity of the University under our own direct management, where we can make a good nursery in which generations of students will, in their day, prepare beds, sow,

plant, and transplant; an area where the students can be taught how to trench and drain; an area where they themselves will plant out young trees to form woods which they will be able to return to, and inspect, in years to come; and finally, an area where we can experiment with various species and mixtures, and undertake different methods of planting, with a view to doing our share towards solving some of the many pressing problems which await solution in Scotland.

Our forest garden and demonstration woods would fulfil several purposes, for we should welcome one and all who care to visit them, either to work in them as students, or to make use of any of our methods which have proved successful.

Such an area as I have described exists in the vicinity of Edinburgh, and I cannot press upon the University too strongly the vital importance which exists, that we should endeavour to acquire it at the very earliest possible moment. So far as the Forestry Department is concerned, it is one of the most important questions resting with the University for early consideration, for upon it depends, must depend, in the eyes of the practical forester, the whole question of the qualifications of this University to grant a Degree in Forestry which will be recognised as an asset of value in the forestry world.

4. An Attack by the Large Larch Sawfly, *Nematus erichsoni*.[1]

By A. W. B. Edwards, Hollie Bank, Thirlmere.

I will endeavour to describe what has been done by the Manchester Corporation, at Thirlmere, to cope with an attack by this pest.

First of all, they were advised to hoe the ground underneath the trees in the plantations which were badly attacked; also to gather the moss with the top layer of soil into heaps and mix it with hot lime. This operation was of course to be undertaken when the sawflies were in the cocoon stage. A small area was treated in this manner, but owing to the nature and situation of the ground it was found to be far too expensive.

Secondly, the crop on one plantation was felled, and the

[1] From a prize essay which want of space prevents our publishing in full.—Hon. Ed.

branches were burned on the ground during the last week in May, in the hope of destroying the emerging sawflies, but this was not quite a success.

The methods now adopted are, in the younger plantations, crushing by hand, and in those which are above reach and up to 20 feet in height, spraying. Handcrushing is most rapidly and economically done when the larvæ are about half-grown ; they will then be found congregated in masses, as many as sixty having been counted in one group, and these can be easily destroyed by a single closing of the hand, ordinary leather gloves being used by the operator. Where women's and boys' labour is available, this method will be found to be very effectual and economical.

Spraying, which is resorted to in plantations between 6 feet and 20 feet in height, is very effectual, and has been found to cost on an average about 6s. 1d. per acre where the stock was practically pure larch. This operation is carried out with Knapsack sprayers and a solution of arsenite of copper. The arsenite of copper is mixed in equal proportions with wheaten flour and made up into $\frac{1}{2}$-oz. packets, one packet being sufficient for four gallons of water, which is the capacity of the Knapsack sprayers in use here. The reason for mixing the arsenite of copper with flour is to make it adhere better to the foliage. As spraying has no effect upon the larvæ until after they have eaten of the poisoned foliage, care should be taken to thoroughly spray all the foliage. One application is generally sufficient for a season, as there is only one annual brood of sawfly, although, owing to the long period of emergence, which extends over several weeks, both full-grown and recently-hatched larvæ are frequently found on the same tree.

I am pleased to say that all the young plantations which have been treated by spraying or handcrushing, have made good growth during the past season, and are at present looking very healthy.

When the larvæ are three parts grown they are easily dislodged from the trees, and frequently after sudden showers of rain or strong wind they are to be found on the ground in great numbers. Some American writers recommend the shaking of the trees, in order to cause the larvæ to drop off; it is said that they will not get up the trees again, and they are thus starved to death. But this is not the case, as I have frequently seen the

stems of the trees literally covered with larvæ making their way up after having been knocked off.

This suggested another means of destroying large numbers of larvæ on trees which are too tall to be sprayed with the Knapsack sprayers. The means which I refer to is that of tar-bands. I experimented with tar-bands during the past season, and succeeded in destroying great numbers of larvæ. Archangel or Stockholm tar is required for the tar-bands, as gas tar is too thin and would dry too quickly. I use a draw-knife to smooth the rough bark on a belt of about 15 inches in width all round the trunk of the tree, at about breast-height, and another man follows and applies a liberal smear of tar to the prepared surface. The tar is more easily applied if slightly heated. In this manner, four men can treat some 700 to 800 trees, containing on an average about 7 cubic feet per tree, in a working day. The tarring requires to be repeated about once a fortnight, while the attack lasts, so as always to keep a moist surface of tar on the prepared part of the tree stem. If the trees are not too large, they can be smartly shaken by the hand previous to being tarred, when the larvæ will drop off like rain ; that is provided they are at least half-grown, for shaking has no effect while the larvæ are in the earlier stages. Trees too large to shake by the hand can be jarred by striking them with a wooden mallet having a piece of felt or sacking on the striking face so as to prevent damage to the bark. Jarring the trees in this manner ought to be done at least once a week, as it will be found that the larvæ will be in various stages of growth, and it is only in the later stages that jarring has any effect.

As birds are so beneficial, efforts are being made to protect and encourage them by feeding them in the winter and by distributing nesting boxes. Altogether some 300 nesting boxes have been placed in position. Out of 170 boxes placed in the woods during 1909, it was found that 81 had been occupied. The nesting boxes can be made very cheaply by the estate labourers during rough wet weather, when out-door work is at a standstill, and by using scrap from the sawmill the cost of the material is very small.

5. The Corsican Pine in Dorset.

By James M'Callum, Canford, Wimborne.

Thirty years ago the Corsican pine was proclaimed as the tree of the future, and was widely advertised as a substitute for larch. In these later years we hear little about it, but, nevertheless, under certain circumstances, it has much to recommend it.

It is a rapid grower, free from serious injury by disease or insect attack. The timber, when grown under suitable conditions, is tough, elastic and resinous, and it does not warp or split (Dorset people call it "mild"); and since it takes creosote readily, there is nothing to prevent its becoming a substitute for larch. Grown in dense canopy, it forms a round full stem, with little taper; and since its branches grow horizontally, or with a slight droop, they are rarely torn away from the stem by snow, neither do they rub and lacerate their neighbours in the way that Scots pines do. But these qualities are not maintained when the trees are grown in isolation; under such conditions they develop wide and branchy heads.

A deep root and a well-balanced head prevent their being easily uprooted by gales, and it is rare to find a leaning or crooked tree. The greatest objection to them is the difficulty of moving them successfully; even in the nursery they often fail unless great care is exercised in transplanting them. My own experience is that if the seedlings are transplanted at one year old, and are moved every year until ready for planting out, there is not much risk, unless the soil is of particularly bad quality, such as cold clay. It is also an advantage to plant them out early in autumn or very late in spring.

The following particulars refer to plantations on the Canford Estate:—

No. 1.—This is a mixture of pinaster, Scots and Corsican pines, with a few Austrians, planted 36 years ago. The pinasters have shot ahead and suppressed numbers of the others, as they always do on this soil, but they are all crooked and twisted, as they will not "stand up" here. The Scots pines have grown fairly well, but are now beginning to die off as the canopy opens out. The Austrians are merely shrubs. The Corsicans, where they got clear away, are

standing straight up, making shoots of 12 ins. to 15 ins. per annum, and even the suppressed ones are as green and fresh as when first planted, having green branches almost to the ground, the buds and main leader being healthy. And this notwithstanding that some of them have made only 9 feet of height-growth in 36 years, with a girth of $4\frac{3}{4}$ ins. at 3 ft. Now that the pinasters and Scots pines are getting bare and open, these suppressed Corsicans are beginning to shoot up, and one can trace the growths gradually lengthening year by year.

No. 2.—A plantation of Scots and Corsican pines planted on a very steep hillside, about 36 years ago. An even mixture, in strips 12 feet wide across the face of the hill, leaving 12 feet unplanted between the strips, a custom which used to be common here. The planting was done for shooting purposes, and not for timber—the result is instructive. The Corsicans average 50 feet in height, with a girth of $21\frac{1}{2}$ inches at $5\frac{1}{2}$ feet The Scots average 40 feet in height, with a girth of 17 inches at $5\frac{1}{2}$ feet. The Scots are dying off, while the Corsicans are still in full vigour, making growths of 2 to $2\frac{1}{2}$ feet per annum. The original planting distance was 4 feet by 4 feet, but many of the Scots have died out, leaving the distances irregular. Had the ground been planted solid instead of in strips, I am certain the Corsicans would have done even better.

No. 3.—A flat common, at one time under cultivation, with two small clumps of Scots and Corsican pines planted side by side, not mixed. These were originally planted as close as 18 inches, and the result is remarkable; they each occupy an area of about 300 sq. yards. Planted 35 years ago, the Scots average 30 feet in height, and 22 inches in circumference at $5\frac{1}{2}$ feet. They now average $7\frac{1}{4}$ feet apart, or 842 trees to the acre, and I have calculated the number of cub. feet per acre to be 3165 of measurable timber. The Corsicans average 40 feet in height, and 27 inches in girth at $5\frac{1}{2}$ feet. Average distance apart $6\frac{3}{4}$ feet, 932 trees, and 5243 cub. feet of measurable timber to the acre. At 6d. per cub. foot, this means an annual gross return of £3, 14s. per acre. The most remarkable circumstance is the present condition of both clumps. The Scots pines are nearly all in a dying condition, covered with dead snags, their leaders being all gone; while the Corsicans are still in the vigour of youth, and are cleaning their stems beautifully, some of the stems nearly touching and growing side by side

without injury. Several of these stems are 3 feet in circumference at $5\frac{1}{2}$ feet from the ground.

Under the Corsicans there is a coating 4 inches thick of leaf-mould on the ground. Under the Scots pines, on the other hand, there are only 2 inches of mould, and I believe part of that is the result of the Corsicans being so close at hand that some of their needles are carried under the Scots pines.

The pine plantations on this estate are mostly growing on the Bagshot Beds' formation, composed of a series of sands of various colour, with thin patches of clay in places; the natural herbage is heather, gorse and sedge.

Two soil samples of the district are as follows:—(No. 1) A cultivated field, depth of soil 9 inches, available phosphoric acid ·003, available potash ·004, carbonate of soda ·85. (No. 2) Heather land, depth of soil 9 inches, available phosphoric acid 0, available potash 0, carbonate of soda ·05—as will be seen, it is one of the poorest soils met with, containing very little organic matter.[1] Its water-retaining qualities are poor, and this in conjunction with the long hot summers we get here (sometimes we are months without rain), proves that the only tree that can survive is one that keeps its canopy and sheds a heavy layer of leaves annually, to keep the soil cool and moist.

6. The Douglas Fir.[2]

By W. H. Whellens, Comlongon Nurseries, Ruthwell.

On an estate in Surrey, on a north-easterly aspect, at an altitude of 420 feet, on light, sandy soil, with a subsoil of red sand containing much black ironstone, the author has grown Douglas firs which, eight years after planting, were in a very healthy condition. And in the park of the same estate, there stands a broken-topped tree, now 101 feet high, growing in a well-sheltered hollow, on light sand covered by a good layer of humus.

On an estate in Wales, at an elevation of about 700 feet, on

[1] From *The Soils of Dorset*, by John Percivel, M.A., University College, Reading.

[2] From a prize essay which want of space prevents our publishing in full.—Hon. Ed.

a well-sheltered site, with a northerly aspect, and on loamy clay, three of the trees, planted in 1888, showed the following dimensions twenty years later:—

No. 1.—Height 49 ft., girth at 4 ft. from the ground 3 ft. $3\frac{3}{4}$ ins.
No. 2.— ,, 46 ft., ,, ,, 2 ft. 11 ins.
No. 3.— ,, 43 ft., ,, ,, 2 ft. 10 ins.

They were planted in even mixture with larch, most of which have been cut out, leaving a good crop of Douglas firs which are cleaning their stems well.

Two instances where shelter has greatly benefited the Douglas fir may be mentioned:—In a young plantation on the same estate, a group of larch and Douglas fir was planted about seven years ago. The Douglas firs are very poor indeed, most of them are not much bigger than when planted. The larch are slightly better, the ground being more suited to them than to the Douglas. This group, with the rest of the plantation, has been "brushed" every year, all hazels having been cut down. Adjoining it on the east or lower side, and on the same soil, is a rough coppice of hazel with a few straggling oaks. About eleven years ago a number of Douglas firs, oaks, silver firs and larches were planted here and there throughout the wood, but the hazel underwood was allowed to grow. This has sheltered the young trees, which have grown exceedingly well. In 1908, at 9 years of age, the Douglas measured from 16 to 18 feet, oak 10 feet, larch 12 feet, silver fir 11 feet.

Although there is a difference of two years between the ages of the plants in the two groups, it is quite justifiable to say that the older group owes its splendid growth to the shelter provided by the hazel, and I recommended leaving them to grow on the younger portion to serve the same purpose, the heads of the plants to be kept free.

The other instance is in Coedyfron Wood. At the bottom of this wood is a flat piece of land about 4 acres in extent. This was once a "withy" bed, but had been allowed to get very thin. It was planted up with Douglas fir and spruce in the proportion of 3 spruce to 1 Douglas.

The willows that were left, although cut occasionally for basket-making, have served the same purpose as the hazel in the former plantation, and both the Douglas and the spruce are growing splendidly. Douglas firs have been planted regularly

for several years now on this estate, and they have invariably done well on the clay soils.

I will now try to classify the soils in the order in which, in my opinion, they are most suitable to this species.

1. *Loamy clays*, as found in the hollows on the estate. As is well known, this class of soil is the best for growing oak; this is shown by the large number of splendid specimens to be seen in the district. It is also, in my opinion, the best for Douglas fir, so that the question arises: Which is the more profitable crop to grow? First of all, the market must be taken into consideration as to whether the greater demand is for the hardwood or the conifer. If the demand is equal, which species will give the largest return on the capital laid out on the wood? According to Dr Somerville, the Douglas fir plantation at Taymount, in 1903, contained no less than 7977 cubic feet per acre, $\frac{1}{4}$-girth measurement, at the age of 43 years from the time of planting, while the highest figures for oak given by Dr Nisbet in the *Forester* are 6280 to 6890 cubic feet per acre. It thus appears that, even at 43 years, there is at least as great a volume of fir per acre as one can expect from a fully stocked oak-wood at the end of a long rotation. If the Douglas fir were grown on an 80 years' rotation (which experts think will be the most profitable) it would, at present prices, give a return as large an an oak-wood at 120 years, and with 40 years to spare, in which time a second crop of Douglas fir would be half-way towards maturity. Therefore, with a demand equal to, or greater than, that for oak, it should be more profitable to grow Douglas fir on loamy soils.

2. *Limy soils.*—This soil, judging from the few trees that I have seen growing on it, seems to be almost equal in merit to the clays and loams of Montgomery.

3. *The lighter clays.*—Here the Douglas fir seems to do better than any of the other commoner conifers, and should be planted in preference to them.

4. *Sandy soils.*—As a rule, this class of soil is thought to be unfavourable to the growth of the Douglas fir; but the condition of the trees in the plantation in Surrey seems to contradict this. I have thought that perhaps, in the later stages of its life, the growth of the tree would be unfavourably affected; the specimen in the park goes against this idea, but it is well favoured by a warm situation and a plentiful supply of humus collected in the hollow where it stands. The question

of demand should determine whether to plant Douglas fir in preference to other conifers, but I think a profitable crop of Douglas may be looked for even when planted on sandy soils.

5. *Peaty soils.*—It is too early to judge of the results in the young plantation on the estate, but this year, as an experiment, I have planted a group, partly on peaty soil of considerable depth, and partly on an adjoining gravelly bank. It will be well sheltered from the prevailing wind, although placed in rather a frosty locality.

6. *Gravelly soils.*—These, from my experience, seem to be the most unsuitable for the growth of Douglas fir, although if the position were well sheltered and the trees planted pure, they might give rather better results than those I have seen.

7. *Situation.*—As to situation, the Douglas is very exacting. It is almost imperative that the tree should be well sheltered, as it suffers greatly at all stages from gales, and also from frost in the earlier years.

In frosty localities, I think that any natural growth of birch or hazel might well be left as a slight protection till the trees have grown sufficiently to be out of danger. Indeed, in the absence of natural growth, it would be advisable to mix a few birch in the plantation; but care must be taken to prevent the birch twigs from lashing the tender young shoots of the Douglas fir. Warm, well-sheltered hollows above the frost-line are the best places to plant this species, and the trees should even then be planted late, so as to avoid late spring frosts as far as possible; The end of April or the beginning of May seems to be the best time for planting them.

I have a strong belief in the possibilities of underplanting with Douglas fir, more especially where the overcrop is not too dense, for instance when leaving a thin crop of oak for a second rotation.

A mixed oak and larch plantation in Montgomeryshire was doing very badly. The larches were very badly diseased and the soil was unsuited to them. The oaks were mostly very branchy. I cut out all the larches and the worst of the oaks, leaving only the cleanest and best of the stems, about 45 to 50 to the acre.

My scheme, which was to underplant these with Douglas fir, is being carried out by the present forester, and I am anxious to hear of the success of the experiment. The oaks were

about forty years old, so the two species should reach maturity at the same time

In conclusion, I may say that in my opinion, although Douglas fir should be largely planted, those responsible for the management of woods must not make the mistake that was made with the European larch by planting it here, there, and everywhere, without regard to its requirements as to soil and situation, just because it is a profitable tree to grow. For, if a disease entered, it would get a firmer hold of the trees planted on unsuitable soil, and from these it would spread to other plantations, as *Peziza Willkommii* has done in the case of larch.

At present the greatest insect enemies of the Douglas fir are the "Pine Weevil," which seems to prefer it to its "name tree" the Scots pine, and *Megastigmus Spermatrophus;* and it is sometimes severely attacked by the fungus *Botrytis Douglassii.* It is the duty of all those interested in forestry to do their utmost to keep these evils in check.

Pure planting is the best method of raising this tree, as there is no species that will keep pace with it in height-growth so as to suppress the side-branches, which we all know is necessary to produce good timber. But yet, in the event of a disease attacking the species, will not the same objection apply to the pure planting of the Douglas fir as applies to the pure planting of larch?

Lastly, if success is to be looked for with the Douglas fir the ground-game must be kept well under, as rabbits and hares will both attack it.

7. Observations on the Annual Increment of Spruce and Scots Pine.

By J. H. Milne-Home.

During the growing season of 1910 monthly observations have been made of the increase in girth of certain selected average trees in different plantations, and the results obtained may perhaps be of interest.

The increment measurements were taken by means of malleable lead bands $\frac{1}{2}$ inch in width, and about the thickness of thin cardboard. The bands were attached to the trees by means of L-shaped staples, one end of the band being made fast, the other end remaining loose, and merely supported on the staples. A vertical scratch with a knife at the exact point where the loose end of the band overlapped the fast end, served to indicate the starting-point of the season's growth, and the gradually widening space as the stem expanded could then be readily seen and measured. The observations were taken in sixteenths of an inch, but in order to avoid fractions they have been transposed in the table of results into decimals of an inch. An identification number was put upon each band used. The possibility of using Pressler's Increment Borer for making the observations was considered, but discarded as unsuitable for continuous observations on the same trees, more especially for the monthly records.

The three plantations regarding which particulars are given are situated in the south-east of Dumfriesshire.

Plantation K is 37 years of age, and was formed from poor hill pasture. The ground slopes slightly to the south, and the elevation is about 500 feet, in an exposed situation. The top soil is about 9 inches in depth, consisting partly of peat and partly of a poor yellowish sand, merging into a hard subsoil of similar colour. The land is said to have been very wet when planted, and the number of open drains confirms this. The soil is now, however, fairly dry, wherever the leaf canopy is good. The plantation is 36 acres in extent, consisting partly of Scots pine almost pure—where the observations have been taken,—partly of almost pure spruce, and partly of an admixture of the two species. There is a sprinkling of larch, birch, alder and oak throughout. The soil is manifestly much more suited to spruce than Scots pine, and where a mixture occurs, the former is rapidly suppressing the latter.

Plantation D is about 32 years of age, and is situated on ground which has probably carried timber crops for well over 100 years. The aspect is east, at about 300 feet elevation, with fairly good shelter. There is a fairly good surface soil of humus and loam 12 ins. to 14 ins. deep resting on a hard sand subsoil. About three-fourths of the crop is spruce, the remainder being birch with a few Scots pine and larch. The birch are more or less accidental, and are not reckoned in any calculations.

Plantation I has a northern aspect on a fairly steep slope, at about 300 feet elevation, and is well sheltered. The age of the crop varies somewhat, but may be taken to average 40 years. The soil is fairly good—a yellowish sand, 15 ins. to 18 ins. in depth, with a good surface covering of humus, merging into a harder, stiffer subsoil of the same colour. The crop is mainly spruce with some Scots pine, larch, birch and oak.

The percentage rate of growth calculated from the figures obtained has been ascertained by Schneider's formula, viz., Percentage $= \frac{400}{n \times d}$; n being the number of annual rings in the last inch of radial growth, and d the diameter of the tree under the bark. n has been ascertained by dividing the average annual increase in circumference by $\frac{7}{22 \times 2}$ in order to obtain the increase in radius, and then dividing the figure so obtained into one. This method, of course, assumes that the size of the annual rings has not altered during the last few years, and it may be liable to error owing to this assumption. d has been calculated from the circumference, making a suitable allowance for bark.

Plantation K.

Scots Pine.—Observations of five trees

No.	Circumference over bark 1st May 1910	Increase in circumference in inches during					Total	
		May	June	July	Aug.	Sept.		
1	16″		·062	·250			·312	$d = 5{\cdot}25''$
2	21″		·062	·188			·250	$n = 17{\cdot}95$
3	23″		·125	·375			·500	$\frac{400}{5{\cdot}25 \times 17{\cdot}95} = 4{\cdot}24\ \%$
4	20″		·125	·250			·375	
5	18½″		·062	·250			·312	
Average	19·7″		·087	·263			·350	Estimated number of stems per acre 710.
%			25	75			100	Average height 27′.

Plantation D.

Spruce.—Observations of five trees.

No.	Circumference over bark 1st May 1910	Increase in circumference in inches during May	June	July	Aug.	Sept.	Total	
1	26″	·062	·312	·188	·250	·250	1·062	$d = 6{\cdot}5''$
2	19″	·062	·188	·250			·500	$n = 8{\cdot}82$
3	26″	·188	·250	·250	·250	·062	1·000	$\frac{400}{6{\cdot}5 \times 8{\cdot}82} = 6{\cdot}98\ \%$
4	17″	·062	·250	·062	·125	·125	·625	
5	18½″	·062	·062	·188	·062		·375	
Average	21·3″	·087	·213	·187	·138	·087	·712	Estimated number of stems per acre 450.
%		12	30	26	20	12	100	Average height 38′.

Plantation I.

Spruce.—Observations of five trees.

No.	Circumference over bark 1st May 1910	Increase in circumference in inches during May	June	July	Aug.	Sept.	Total	
1	45″	·125	·250	·125	·188	·062	·750	$d = 10{\cdot}5''$
2	30″	·125	·188	·125	·062	·062	·562	$n = 9{\cdot}15$
3	32½″	·375	·375	·250	·250		1·250	$\frac{400}{10{\cdot}5 \times 9{\cdot}15} = 4{\cdot}16\ \%$
4	34″	·125	·188	·062		·062	·437	
5	37½″	·125	·188	·062	·062		·437	
Average	35·8″	·175	·237	·125	·113	·037	·687	Estimated number of stems per acre 280.
%		26	35	18	16	5	100	Average height 45′.

Scots Pine.—Observations of five trees.

No.	Circumference over bark 1st May 1910	Increase in circumference in inches during May	June	July	Aug.	Sept.	Total	
1	32″	·250	·250	·062	·125		·687	$d = 8{\cdot}75''$
2	29″	·125	·188	·125	·062		·500	$n = 10{\cdot}70$
3	37½″	·125	·250	·125	·125		·625	$\frac{400}{8{\cdot}75 \times 10{\cdot}70} = 4{\cdot}27\ \%$
4	30″	·250	·188	·125	·062		·625	
5	33″	·125	·250	·125			·500	
Average	32·3″	·175	·225	·112	·075		·587	Estimated number of stems per acre 280.
%		30	38	19	13		100	Average height 34′.

As might be expected there is considerable variation in the growth of individual trees, and after another year's observations it will be possible to ascertain whether these variations are constant.

One of the most striking results obtained is in Plantation K, where the whole increment growth was made in the months of June and July, whereas in the other plantations growth extended from May to September. It is not unnatural that on a poor, cold soil the commencement of the season's growth should be delayed by three or four weeks as compared with more favourable situations. It is not so apparent, however, why growth should stop in July, when there would appear to be still another four or six weeks of favourable conditions as regards temperature and moisture.

It will be noticed in Plantation I, where the spruce and Scots pine are the same age and growing under identical conditions, that the growing season of the latter seems decidedly shorter by fully a month.

The results obtained from a single season's observations are perhaps not sufficiently definite or accurate to enable exact conclusions to be drawn. It may be of interest, however, to compare in each case the estimated growing stock, the mean annual increment, and the current annual increment, as revealed by the measurements taken. The figures given represent, in every case, quarter-girth measurement over bark.

Plantation	Species	Age	Estimated present growing stock	Number of stems per acre	Average diameter	Mean annual increment	Present % rate of growth	Current annual increment
			cub. ft.			cub. ft.		
K	Scots Pine	37	1200	710	6·2″	32½	4·24	51
D	Spruce	32	1320	450	6·8″	41	6·98	91
I	Spruce	40	2800	280	11·5″	70	4·16	116
I	Scots Pine	40	1730	280	10·4″	43	4·27	67

In every case, it will be observed, there are too few stems per acre, and the density might be better. This seems to be partly due to thinness in the original crop, and partly to subsequent overthinning. There is no record of what has been obtained in thinnings, but in the case of Plantation I, at any rate, the mean annual increment would be somewhat larger if thinnings were taken into account. The results obtained are

on the whole encouraging, especially as regards spruce, and tend to show that with crops of better density a high annual increment may be looked for even on soils of inferior quality. If work on somewhat similar lines can be carried on in future years, it should eventually become possible to construct reliable Yield Tables made in Britain instead of Germany.

The rainfall during the growing season of 1910 was as under :—

	Inches.	No. of days on which rain fell.	Heaviest fall in 24 hours.
May	2·510	15	·370
June	1·980	13	·570
July	6·100	13	1·530
August	8·730	23	1 200
September	·860	8	·280
	20·180	72	

The summer was on the whole a fine one with a fair amount of warmth, except in the month of August which was exceptionally wet and sunless. September was unusually dry, but it is more than three years since less than an inch of rain fell in any month.

8. Continental Notes—France.

By A. G. Hobart-Hampden.

We may appropriately begin these notes, drawn as they are from French forest publications, by quoting the late M. Charles Broilliard, the very eminent French forester who died during the past year. He writes of the re-establishment of forests in France, where, as here, people are much exercised on the subject. It is true that the proportion of woodland is very much greater in France than in the United Kingdom, but in France the results of deforestation are very disastrous, as witness the great floods which at frequent intervals cause such devastation —more especially in the south along the banks of the rivers rising in the Pyrenees. Lately, too, we have heard of terrible floods in the Seine. In regard to this last case it is possible that some people are spoiling a good case by attributing to disforestment more than can fairly be put down to it. The basin of the Seine is not unusually bare, though Champagne might have more forests with advantage. The s opes are not great enough

to cause sudden freshets, but when several months of continuous rain occur a bad flood occasionally takes place after the ground has reached its saturation point and can hold no more water, and this point is reached even in wooded basins. But it is evident that with forest to act as a sponge this saturation point is much more slowly reached, and there is of course no question that the more forest that exists the less is the danger of flood, and also of the silting up of rivers (as in the case of the Loire and certain Russian rivers).

M. Broilliard states that between 1815 and 1870 the State alienated some 881,500 acres. He strongly advises the purchase of woodlands wherever possible, and says such a purchase is a good investment. Germany and Belgium are steadily doing this, while in Norway and Sweden the area of State forests has greatly increased in late years. Nor is it necessary to buy woodlands in large stretches only. Indeed, the more scattered the State woods are, the more will the example of sane working be visible, for though the State is not good at commercial enterprise it is the best forest proprietor, with the best means at its disposal of ensuring a sound method of treatment, and, it may be added, of taking a long view of things. It is the fact that when there is a strong forest administration neighbouring proprietors copy its methods.

Originally the laws against clearance of forest in France were strict, but unsuccessful. Curiously enough when this constraint was relaxed, and when, simultaneously, the State ceased to alienate its forests, things improved, and private owners began to afforest to some extent. Still, a law for the protection of mountain slopes is a necessity, and the law of 1882 on this matter has just been altered. When mountain slopes are so barren and so situated as to constitute a danger to the country lying below them they may be taken over by the State and afforested, but only after the passing of a special law in each case. If the proprietors agree to afforest under State control their land is not expropriated, and they are also assisted by the State. In the case of areas belonging to Communes (parishes), public establishments and associations, when the State controls the work it pays at least two-thirds of the cost of reboisement. Information as to the practice in neighbouring countries may, in certain directions, be of use to ourselves, as we are considering the formation of State forests.

Afforestation is much helped forward in France by societies similar to our own. The parishes which lie in the mountains receive the assistance of these societies more particularly, and are strongly urged by them to plant. Some figures quoted in circulars issued to the mayors of parishes by the society known as the "Touring Club" are surprising. It appears that some parishes already own woods which bring them in very good and steady revenues—£400, £800, £1600, and even £2000 a year, apart from such things as free firing given to the inhabitants. Of course there may be exceptions, but nearly everywhere the parish woods, worked as they are under State control, are a sound and constantly improving investment.

The Central Society for the afforestation of mountains, which has its headquarters at Bordeaux, has actually succeeded in persuading some of the Pyrenean parishes (notoriously ignorant and backward though they mostly are) to plant. These poor parishes have been accustomed to allow the grazing on their lands of migratory flocks and herds, as well as of their own animals, and to remove trees to make room for grass. The result has been that the soil has dried up, and the hillsides have been degraded to such an extent as to spoil the grazing. The above-named society has rented certain areas, forbidden migratory grazing upon them, and planted trees; and in a very short time it has so much improved the grazing for the local cattle that neighbouring parishes have commenced to follow its example.

In France and Algeria there are 364 Scholars' Planting Associations, and, though only a recent departure, they have already created 920 nurseries and planted 7,042,700 trees. If these societies continue to grow and to work as at present, in a dozen years they will have planted 131½ million plants. In Norway, too, school children plant trees. In Germany it is believed to be the rule to teach children elementary notions of silviculture in the public schools. Could not this be done here in schools under the Education Department, to prevent from the beginning, and universally, the ignorance which has had such bad results? Want of understanding is at the bottom of nearly all opposition to forest measures, and the writer of these notes can affirm from personal experience that whenever educated people come into sufficient contact with the work of a forest service to understand its methods their sympathy increases.

The late report dealing with afforestation in the United Kingdom was severe in relation to private lands to be afforested, recommending expropriation. One feels that expropriation is a very hard measure, and only justifiable for extreme reasons. It goes dead against all one's ideas of personal liberty. It is thought that example is better than precept—and especially precept of a sort that would take a man's woods out of his hands to work them as the State chooses. As mentioned above, M. Broilliard has noticed that the example of State management is followed by private proprietors in France, and the same thing is seen in India. As to afforestation by private owners, perhaps the new Budget arrangements as to taxing undeveloped land may induce afforestation of bare land, but inasmuch as afforestation amounts to a public benefit, and is not carried out without some sacrifice, in view of the long years that have to pass before any financial return is obtainable, it would be but just to give the public benefactor some direct help also—say by remitting taxes during the period of waiting. Once the forest is made, and worked in a regular sequence of crops, it reaches the same position as agricultural land, and should no doubt be taxed in a similar manner—but till that condition is established it is not fair to tax it. If the private proprietor himself asked the State to take over his woods and place them under the "régime forestier," let the State be ready to undertake the task, having its expenses refunded. The American forest service has strongly taken up a line of this kind, and in France the forest associations help with expert advice. On the Continent, although private proprietors are not bound to submit their woods to Government control, all parishes and public establishments must do so. This rule appears to be very general among continental nations; nor would sentiments of liberty be so much affected by thus treating British municipal woods as they would in the case of private properties. Our small parishes do not own woodland nor, very often, land suitable for afforestation, and it is thought that wealthy municipalities might be trusted to work their woods wisely, provided always that Government forests were in existence to afford an example.

Government then, one would think, should most certainly buy woodland and waste lands for afforestation, steadily year by year, and should also be ready to help private effort, but let us keep clear of annoying interference with private properties.

This would connote the formation of a Government Forest Department, extended *pari passu* with the extension of Government woodlands, and this should be a service recruited in the same way as all the great forest services of the world.

We may cite the case of Belgium, a country most progressive in all ways, as according with the views as to expropriation given above. The Belgian Government put to its Forest Council the question—"What shall be done to prevent abusive treatment of private forests?" The Council strongly opposed interference with the rights of private property. All restrictive measures would discourage initiative, which ought, on the contrary, to be encouraged. Such measures would be most vexatious, and would entail onerous duties of surveillance by the State. But it might be possible to induce some proprietors to voluntarily submit their woods to Government control, although it is unlikely that many would do this, since it would be something of a sacrifice. "To bring it about," says the reporter of the Council, "it would be necessary to assure certain compensation to such proprietors, as exemption from taxes, etc." Accordingly the Council reports, *inter alia*, as follows:—"The Superior Forest Council is of opinion that the law cannot restrict the right of property of forest proprietors. It recommends that the State should extend the national forest estate. It considers that the extension of private forests should be encouraged by the diffusion of forest instruction and practical manuals, by the formation of experimental areas under Government direction, by advice given *gratis* to proprietors, and by the distribution at cost price of plants and seeds."

Mexico has now joined the States that have taken up the idea of forestry. An engineer named Quevedo is the originator of this movement, and a young French forester has been appointed to the work. One of the things which brought the question up is a somewhat new one in this connection. It was found that as the environs of Mexico city are very bare, dust was very troublesome. Naturally, woods around the town would mitigate the nuisance, and their formation has been begun.

A local improvement of the kind can undoubtedly be effected, and no doubt the heat in the immediate neighbourhood can also be mitigated. But M. Roger Ducamp, the head of the Forest Department in Indo-China, who has personally seen and described several places on the globe where the results of

deforestation have been terrible (*e.g.*, in Persia and in Macedonia), holds that the effects of deforestation are felt at great distances. He draws attention to the heat waves that have latterly affected various places. He states that the intensity of the sun's rays does not vary, taking the statements of astronomers as his authority, and that therefore the heat waves are due to circumstances on the earth itself. Thus bare spaces become very much heated by the sun, and communicate heat to the air in contact with them, and the hot air rises in great columns to the upper atmosphere. To fill the void so caused cool air from better protected places flows in, moving tangentially to the earth's surface. But it appears that the hot air currents above mentioned, on reaching the rarer atmosphere above, are curved over and, still heated, come down to the earth again. Naturally, there are numerous variations, but, broadly speaking, this is how heat waves come about—so that the evil done in the way of deforestation in one country may affect even distant countries.

On the other hand, M. Lafond states that there is an astronomic law, called the law of the "Undecennial cycle," which lays down that every eleven years the intensity of the sun's rays reaches a maximum. This, he says, causes excessive evaporation and subsequent increased precipitation. 1906 was a year of maximum solar intensity, to be followed by wet years, decreasing, however, till about 1913, when a dry period will set in.

At Pontvallain (Sarthe) a M. Marion owns a piece of land of 120 acres, which formerly was very marshy and did not bring in more than 3s. an acre, insufficient to pay the taxes. It was the worst land on his property; now it is the best, and brings in £6 per acre for hay and £6 to £8 for wood. This transformation has been brought about by draining with large open drains, and planting poplars 4 metres apart, and at $1\frac{1}{2}$ to 2 metres distance from the ditches. The planting consisted in cutting poplar sticks, like peasticks, and driving them into the ground about half a metre deep in holes made with an iron bar. This very successful experiment might, it is thought, be of use to others in places where poplar has a value, while if poplar has no direct value it will nevertheless greatly improve the land by its power of absorbing water. Moreover, other species of local value, and possessing the quality of absorbing water in quantity, might possibly be found.

A writer in the Quarterly Journal of the Society of Franche Comté and Belfort gives a note on the forests of Norway. The net result of his observations is that the forests are very thin and the trees small, that the felling is very considerable, but that reafforestation is also progressing well. The value of the exports of wood is some £5,200,000 a year. The State forests are less valuable than the private forests, but since 1870 the State has been buying forests, or land for reboisement, and has thus acquired some 382,000 acres of the former and 7700 acres of the latter. The State encourages afforestation in various ways. Thus 39,000,000 trees had been planted in the six first years of the century—7,000,000 of them by school children. Besides encouragement of afforestation there is also discouragement of over felling, and in several districts a minimum girth for felling is laid down, subject to penalties for infringement.

There is also a long report on the forests of Norway in the *Revue des Eaux et Forêts*, from which we gather the following additional facts:—The forests run up to 70° latitude, and more than half of the State forests are north of latitude 65°, while many are at high altitudes. Thus, while the net returns of forests belonging to public establishments are more than seven shillings an acre, those of the State forests are not much over fourpence. Private proprietors own 85 per cent. of the woods, and the best of them. The number of private proprietors is relatively small. They have foresters of their own, who receive higher pay than the Government officers but have larger areas to control. Rights of user are numerous everywhere. We at home are fortunate to be free of such things, for they are a great tax on woodlands and impede satisfactory working. At 3300 feet all tree vegetation ceases. While the sea makes for warmth, the latitude and altitude make for cold. More than three-quarters of the surface of Norway is rendered useless by rock, ice and marsh, and there is much peat land. The soil is thin and generally poor. The chief tree is the Scots pine, which grows tall and large and of good quality; it reaches latitude 70°. The spruce grows tall, but is only of medium quality; it is found to 67°. Birch (*Betula verrucosa* and also *B. alba*) is very common; it extends far north and reaches the highest altitudes attained by tree growth. These three trees form, broadly speaking, the forests of Norway, but alder and *Sorbus aucuparia* are also extensively found. The

mountain and the Weymouth pines, the Nordmann, the Douglas, and the Sitka firs, and *Picea alba*, have been introduced, and do well in certain situations. *Picea alba* is used for shelter-belts; Sitka is used on drained land, but its very superficial roots (says the report) render it frost-tender. This does not seem to agree with one's usual notion that it is capable of standing much exposure. The author states that the mixture very commonly met with, of Scots pine, spruce and birch, is very good. If the felling has been badly made, one or other of the species will fill up the blanks; and if well made, it is possible to localise each species in the station best suited to it, and so to get the most out of the area. The combination of spruce and Scots pine is so common that it is very usual to mix the stems, which are then bought locally as if they were identical. The methods of treatment are—either clear felling without replanting and trusting to neighbouring woods for natural regeneration, a method that has had bad results; or the leaving of twenty to forty seed-bearers per acre till the regeneration is complete, an excellent method for the pine, but unsuitable for the easily thrown spruce; or the Group method; or ordinary Selection. *Peridermium pini* and *Fomes annosus* cause damage in the warmer parts near the sea, and red rot is common in the spruce. Very little road making is done, because export is carried on over the snow as far as the rivers, down which the wood is floated. A great deal of drainage is done with good results. A 47-year-old tree is mentioned of which the section showed 40 years for less than a quarter of the radius, and more than three-quarters of it for the remaining 7 years that followed the draining of the soil. The exploitable age of the Norwegian State forests is based on the time required to produce the greatest volume, which makes for simplicity. The rotation is thus from 60 to 100 years, corresponding to from 6 to 12 inches diameter (at chest-height, it is supposed). Working-plans are rare in the private forests, and one supposes that the millions of pit props that come to us from the Baltic must come from private forests. However, some may come from thinnings in State forests, which are correctly made. In passing, one may be excused from wondering why we should not grow at least a fair proportion of our own pit props. There is in fact no reason against it.

The transport of timber to the rivers is done in a variety of

ways—by sledge, by "rieses" (prepared tracks down a hillside), wire ropeways, etc. On the water the work is done by special transport companies, and the timber is either floated loose in rocky rivers, or in rafts in smoother waters. On the lakes enormous agglomerations of timber, cabled together, are towed by tugs or otherwise. Sometimes in rocky rivers the stream is turned (as is done on a far larger scale at the falls of the St Lawrence), or reservoirs are formed to obtain a strong head of water, or occasionally the stream bed is even lined with poles, forming a clear passage free of obstructions. In this case the passage is broad at the top and narrows downstream. This causes the timber to travel very rapidly, so that it becomes necessary to check the speed at the point where the timbered passage ends. To effect this the poles forming the frame at the end section are raised a little so as to let the water through between the poles, thereby causing the floating timber to scrape along the bottom. A similar system is adopted in the Carpathians. Here it is a case of rafts with men aboard. The passages sometimes turn, and the men are armed with poles to fend the rafts off the sides. They are also shod with spiked shoes, since it is a very slippery business. The passage generally ends in a deep pool, into which, of course, the raft would plunge headlong were not precautions taken. These consist in hingeing to the last section of the timbers of the passage a platform of poles floating at its other end on the surface of the pool, so that the plunge of the raft is checked. Arrived at its destination, the timber is worked up by the most complete system of sawmills and factories, of which the development is something extraordinary. It is said that one has but to look at a catalogue and make one's choice of the pattern, when they will immediately deliver to you a timber cottage complete, which has only to be pieced together.

In 1906, the statistics show that Norway exported 71,624,156 cubic feet of wood, round or otherwise, of which a quarter was planed; 505,628 tons of pulp; 3627 tons of matches; and paper worth £920,000. Great Britain takes more than two-thirds of all this. Then come Belgium, France, Australia, Holland, Germany and Denmark. Can the Norwegian forests, in spite of the praiseworthy efforts at reboisement now being made, stand such a drain as this? One is inclined to think that one of the most important steps for Norwegians to take would be to grow their

spruce closely, and so get more out of their forest area than it supplies at present. In view of the statement that the woods are thin this step would probably multiply the outturn per acre many times over.

Difficulty is often experienced in removing long stems growing on steep ground. Generally, they have to be cut to relatively small lengths, which entails loss. Unless the number of stems is large it will not pay to make a road, while "rieses" (as used in the Tyrol) or sledge roads also require made roads of a kind. They cannot be used for very long timber, and not at all in very rocky ground. In the Pyrenees they have lately conquered the difficulty, and rendered forests on slopes which are almost precipitous exploitable by means of ropes. After the stem has been cleared of branches, two ropes, ordinarily of thin steel wire, are attached to one end and then passed round standing trees in the vicinity. The log is then let down gradually, but much skill is required in the letting out of the ropes. Very heavy stems, or even two stems joined end to end, can be lowered down the steepest places. The aim is to make the timber travel continuously without check on obstacles and without getting out of hand. The steel wire rope cannot be worked directly by hand, but needs one or two small steel levers of a special pattern to be attached to the tree round which the rope is passed. These levers have a half ring or claw through which the rope runs, and are alternately slightly lifted or dropped as is found necessary for giving out or holding back the rope. Lengths of 100, 200, or 300 yards are thus used, and since this means a considerable weight when the rope has to be brought up-hill, a small wheel and axle for winding it is attached to a tree at the top of the slope.

It is useful to make exact observations of the course of a fungoid attack, and we find a careful note on an attack of *Lophodermium Pinastri*, by M. Maire, the Director of the forests of Eu and Aumale. He observed the attack at three points in his coniferous woods, and describes it as follows:—No. 1—a clear-felled compartment of 15½ acres was sown with Scots pine seed from Austria, in 1898, with perfect success. The attack began in 1904—so badly that the place looked as if it had been burnt. The leaves first turned yellow, then red, and then all fell. No stems died the first year; only a few the second; many the third; a few the fourth; and very few the fifth. Altogether

about half the total number of stems have been affected, and these are situated in the damp parts of the area. Austrian pine and European larch planted in the vacant spots succeeded well. No remedy of any kind was adopted, and the trouble has now passed. The growth during the attack became progressively less till it stopped altogether. No. 2—48½ acres felled and sown as in the case of No. 1, and with equal success. Again the attack began in 1904, and again was damaging in the damp spots. Here the trouble was light but continuous, and it is now also passing off, but not completely, for there was a recrudescence in April 1910 after heavy rain. The gaps have been successfully filled with spruce and Douglas. No. 3 was a place 4 kilometres from No. 2. The attack has but just started. The crop is fairly old and very vigorous, having been sown in 1891 with Scots, Corsican and Austrian pines. The Scots pine and many Corsican have suffered, but no Austrian.

This account of an attack, bad though it was, may be considered encouraging, for it shows that so long as the plants are suited to the spot, they can throw off fungoid attacks of themselves; in fact artificial remedies are practically hopeless in woods of any extent. An example in this connection may be of interest. The present year, as may have been noticed, has been, at least in parts, a very severe one for fungoid attacks, and the plants affected suffered badly. A considerable number of Douglas were planted, half of them inside a wire-net fence, inside a wood, and half, unfenced, in gaps in a beech-wood. The first were possibly rather more in the open than the latter. Hares having got at some of the unfenced plants, a liquid preparation was put on them as a protection, but it was applied too heavily. All the plants started to grow vigorously, but after a time *Botrytis Douglasii* appeared, and soon raged through the unfenced groups, in addition to which the shoots of the year were terribly damaged by an insect (thought to have been a weevil). Inside the fence, although instances of the fungus did occur, practically no harm was done either by fungus or insect. The difference between the fenced and the unfenced plants is extraordinary. It would seem that outside the wire the excessive application of the liquid used to keep off the hares weakened the plants, so that they fell a prey to both insects and fungus, whereas the plants inside, to which nothing was applied, were vigorous enough to save themselves.

9. The Forest Nursery Station, Indian Head, Saskatchewan.[1]

By JAMES KAY, Tree-Planting Inspector.

When travelling across the prairie provinces, one cannot fail to be struck with the bareness of the immense tracts of prairie. Manitoba and Eastern Saskatchewan are sparsely wooded with natural clumps or "bluffs" of aspen poplar, which is the predominant species; while Balm of Gilead, Manitoba maple, ash, elm, and others, are found in sheltered valleys and along river banks, with many shrubby plants, such as dogwood, hazel, choke-cherry, saskatoon, and many others. White spruce (*Picea alba*) is found thinly scattered over the light sandy soils, and is also found intermixed with Tamarack (*Larix Americana*) in the swamps. In Western Saskatchewan, the country is practically treeless. It was generally believed that trees would not grow on the prairies, as those who made the attempt usually failed to get them to grow satisfactorily. But it has now been proved that if planting is gone about in the right way, trees can be successfully raised on the prairie. Failure was mainly due to ignorance of the conditions affecting tree growth, to the selection of wrong species, and to mismanagement after planting. The soil of the prairie is for the most part a deep black loam, the accumulated remains of herbage which has grown year after year for centuries, and after decay has gradually become merged in the soil.

To give some idea of the rate of growth of young trees in such soil, after treatment of the sod by "backsetting," as described in my previous note, I measured cottonwood which had made annual growths of over 7 feet; Russian poplar, willow, and maple of over 6 feet; elm and ash of from 3 to 4 feet. These figures indicate how quickly shelter can be obtained, if care has been exercised in thoroughly preparing the soil, and in the selection of suitable species. It has been proved that plants grown from seed taken from trees acclimatised to prairie conditions are hardier than plants from seed procured from lower altitudes or from farther south or east. Seed obtained from southern latitudes has, in most cases, proved unsatisfactory. Plants grown from such seed are unable to withstand our rigorous winters;

[1] For a previous note on this subject, see Vol. XXIII. p. 67.

they do not ripen the new growth before "fall" frosts set in, and, consequently, they are for the most part cut back to the ground each year for two or three years, many being killed outright. This freezing back renders the trees which survive bushy, and disappointing as timber trees.

Intending planters have to send in, before the 1st of March, their applications for trees required during the following year. It is necessary to look ahead a bit; the nursery stock has to be grown in advance, and the names of applicants have to be entered on the Inspector's list, in order that he may visit them during the summer.

Distribution begins as soon as the frost is sufficiently out of the ground to allow of the bundles heeled in during the previous "fall" being lifted easily. This does not occur before the beginning or middle of May, when all that has to be done is to haul them to the packing sheds, where they are put up in numbers varying with the size of the plantations they are to go to, tied up with twine, packed in damp moss, sown up in burlap, weighed, and despatched to their several destinations, all expenses being borne by the Government. The farmer thus receives his trees absolutely free of charge; all he is asked to do is to have the land ready, to plant the trees as directed, and to look after them for three or four years. Planting is done with the spade, plough, or dibble. The cost of planting with the spade runs to from 8 to 10 dollars per acre, with the plough it costs from 6 to 8 dollars; and dibbling costs about the same as ploughing. The plough is resorted to in most cases, being the simplest and speediest method, but old planters prefer the spade. They claim that, although work is slower than with the plough, the results are better. Dibbling is only permissible for cuttings or small plants with a tap-root. The Manitoba maples are sent out from the nursery at the age of one year, ash, elm, and cottonwood at two years; willows and Russian poplar are propagated from cuttings. Many farmers grow crops of potatoes, turnips, beet, etc., between the rows, and this helps to defray the expense of cultivation for the trees.

Planters have to sign an agreement whereby they undertake to fence the plot, to trace a fire line round it if necessary, and to cultivate the soil and tend the young trees for at least three years. By that time, with proper care, the trees will effectually shade the ground, and choke out any weeds which may have

sprung up. The plantations are established principally as wind-breaks. Ample width will prevent the blowing away of leaves and twigs, which thus decay where they fall, and yield a mulch of humus which assists to retain moisture in the soil; but a narrow plantation is of little use, as it gives practically no shelter during the winter months when it is most required. Planters are advised to keep their plantations 30 to 50 yards away from the buildings, the greater distance, or even more, being preferable.

Snow is driven through the trees and becomes banked up on the inner side; but if the plantation be far enough away, this will not impede movement about the buildings; and besides, when the spring thaw comes, the yards and roadways will be found dry and in good condition. Many of the earlier planters neglected this precaution, with the result that during years of heavy snowfall their buildings became buried, and they suffered much inconvenience. The space between the plantation and the buildings can be used for root-crops, alfalfa (lucerne), or calf pasture. The accumulated snow adds considerably to the soil-moisture of the plantation during the dry season.

The trees suffer most in the spring during the alternate thawing and freezing of the snow, which, on sinking, drags down, breaks, or tears off their branches, and even their leading shoots. In some cases, a snow-trap, formed by a double row of willows, is placed at a distance of about two chains in advance of the plantation; this catches the snow, and much reduces the damage done to the trees.

As has been said above, shelter is the principal object; but when once this has been secured, planting for other objects can be considered, and a farmer who wishes to raise a wood-lot for firewood and fencing material, can be supplied with trees and tree seeds for that purpose; but he may be able to dispense with seed assistance, for, at an early age, the maple bears seed, which can be gathered and sown, while cuttings can be obtained from the cottonwood, the Russian poplar, and the willows. The Government distribute as much seed as can be spared, each year, and thus help on the good work materially; but, in isolated cases, farmers are now growing many of their own trees from seed, and the farm nursery will, I fancy, become an adjunct of many prairie homes in the near future.

The early plantations are beginning to show up, and are becoming quite a feature of the landscape on the prairie. In

Western Saskatchewan one can drive for days on end, and see no trees, except those provided by the Forest Department growing around some prairie home.

One of the principal efforts made by the Government in this matter is their system of inspection. Before they start on their tour, the Inspectors are furnished with a list of the applicants in the districts assigned to them. Their duty is to visit each applicant. If a farmer has already received trees, the Inspector is to see that they have been cultivated, kept clear of weeds, and otherwise properly tended; and he is also to note the percentage of trees living. If satisfied with what has been done, he will arrange to supply more trees, should they be required, and he will give advice and answer any questions concerning the welfare of the plantation. Happily, insect pests, and fungoid diseases are of rare occurrence. If the applicant is a new one, the Inspector has to note his method of preparation of the soil, whether by "backsetting," summer fallow, or root crop. The two latter methods are the best preparation. If properly done, backsetting entails a vast amount of labour to render it a suitable method of preparation; but, notwithstanding this, in their anxiety to obtain shelter quickly, many farmers attempt to prepare their ground in this manner. No trees are supplied by Government for "fall" or spring-ploughed stubble land. The plot is measured, and an estimate is made of the number of trees required to stock it. A rough sketch is then drawn, the distance from the building, the character of soil, and the species best suited for the ground are noted. The farmer is instructed how to lay out his ground to advantage, keeping an eye to future developments; and told the best, cheapest, and easiest way to plant, cultivate and manage, and care for the plantation generally. It has been found that trees will not grow if planted on land formerly used as a corral for cattle, they merely exist, making no growth, or die right off. Planters are advised to root-crop land in this condition repeatedly before planting; trees can then be raised successfully. Alkali spots also occur, chiefly in low-lying localities; the soil is impregnated with an alkali salt, namely, magnesium sulphate or magnesium carbonate; most species absolutely refuse to grow on such soil, though ash and willow make a feeble attempt to get on. Draining and manuring seem to be the only remedies. If the conditions are satisfactory, the applicant is requested to sign

the usual agreement form. If he declines to do so, he receives no trees, and his name is struck off the list.

The approximate proportion of trees living in existing plantations is about 90 per cent. of those planted, which is very satisfactory considering the conditions under which they are grown. Many or most of the settlers are quite ignorant of tree culture, and numbers of them never tried farming till they came to Canada; but perhaps they do better on that account, since, as a rule, they faithfully follow the instructions given to them. As has been said above, trees are grown here under very trying climatic conditions, and that the plantations show such excellent results, speaks volumes for the system followed by the Government; too much credit cannot be extended to the gentlemen who started this good work, and are carrying it through so successfully. It is proved that, with thorough preparation and cultivation of the soil before and after planting, good substantial plantations can be grown in a short time irrespective of climate and at a moderate cost.

Many species of exotic conifers are now being raised in the nursery, and, later on, it will be interesting to note how they stand our climate. Three larches, namely, the European, the Siberian, and the American, are all growing. The Tamarack does well in the nursery; it is absolutely hardy, and grows in any kind of soil (except alkali). It makes a long annual growth, and is not killed back by frost. The European larch also does well, but, with our late spring, it comes too early into leaf; and rabbits have a partiality for it. It will be interesting to note how the Siberian larch will do here; at home it generally did well the first year, but in the second year it came so early into growth that the late spring frosts killed it out. Scots pine, Jack pine, Norway spruce, White spruce, Blue spruce, Mountain pine, and many others, if covered with snow for the first few years during the winter and spring months, make good growth, and give promise of being welcome additions to the species ordinarily sent out to the farms. They will be better adapted for the purpose of wind-break than the deciduous broad-leafed species, owing to their retaining their foliage during the winter months. The greenness of their foliage during winter is also a pleasing feature. A limited number of conifers will be distributed this spring, for the first time, to men who have had some experience of planting, and have some ready-made shelter

to give them. Conifers are expensive to raise, and it would be folly to give them away indiscriminately. They do best when planted with a nurse (for instance with Tamarack), or when sheltered in some way for the first few years till they get fairly established. When they are young it is advisable to have them covered with snow during the winter and spring months, as otherwise the parts of the trees which project from the snow are browned and die, and the plants are thus ruined.

Hardy shrubs and perennial flowers grow and flower here, but are not distributed. Among these may be named, Siberian pea (*Caragana arborescens*), flowering currants, dogwood, Tartarian honeysuckle; such Lilaces as the common, the Persian, and Joseka's; various Spiræas (*Spiræa Van. Houtii*, *S. Bellardii*, *S. Arguta*, *S. opulifolia*); the Japanese *Rosa rugosa;* trailing juniper; such perennial flowers as irises, delphiniums, poppies, columbines, pæonies, and many others. Apple-trees, crabs, and plums, are grown only in isolated instances, but these early pioneers have proved that they can be grown if given shelter, and if the planting of these fruit trees becomes general, this would add materially to the attractiveness of the country. Small fruits are grown in abundance, viz.—gooseberries, currants of sorts, raspberries, strawberries, and all give large crops. Pumpkins, squashes, cucumbers, citrons, tomatoes, and all the ordinary vegetables are grown with success. But the best results are obtained when shelter is provided. People are realising this, and from the largely increased applications received each year, it is evident that they are becoming fully alive to the advantages of having good substantial wind-breaks around their homes.

10. The Annual Excursion.

By Sir JOHN STIRLING-MAXWELL, Bart.

I.

The Annual Excursion of the Society took place this year at the end of June. The party, numbering sixty-eight, stayed at Banavie, near Fort William. The programme had been prepared by the Excursion Committee to illustrate with some completeness the possibilities of afforestation on a large scale in the Highlands. Plantations were visited of all ages and on various soils, and at altitudes varying from the sea-level to 1500 feet.

Mr J. T. Annand has kindly contributed the following notes dealing with the general objects of the excursion and the plantations visited on the first day, 28th June.

"With the question of afforestation so prominently before the public mind, it was fitting that this year's excursion of the Society should be to some district where the results of recent extensive afforestation could be seen, and the Excursion Committee are to be congratulated on the choice they made. For not only was this object well attained by their programme, but the members had also the opportunity of viewing, in one locality, perhaps greater tracts of land suitable for tree growth than could be seen in any other part of the country. Opportunity was also afforded of obtaining a great amount of first-hand knowledge in regard to the limits of altitude within which timber may be profitably grown, on ground presenting a great variety in quality of soil and in exposure of surface. For, as has often been pointed out, it is quite impossible to lay down any general rules on these matters which could be applied with safety. Within the bounds of the British Islands, or even within Scotland, we have not merely one climate but many climates to deal with. Differences in rainfall and temperature during the growing season, the varying configuration of the country, the frequency and force of wind storms, the amount of snowfall—all these have a modifying influence on tree growth, and tend not only to restrict the altitude at which timber of any sort may be grown, but also to limit and fix the species which may be grown with most profit. In afforestation there is another important question to be constantly considered, viz., the determination of what system or systems of planting are most likely to give the best results in each particular case. If timber-growing is to leave a

margin of profit, the initial works must be carried out not only efficiently but in the most economical manner possible. The system of planting the hillsides and mountain slopes, which has hitherto been most practised in Scotland, is that of notching-in, sometimes seedlings, but oftener transplanted nursery-grown trees of considerable size. Many woods have been successfully established in this way, and a very striking example of such success was seen at Ardverikie, where, by this system, Sir John Ramsden has laid the foundation of a forest of over 10,000 acres. With a loose open soil and favourable surface conditions, notching-in can generally be practised, but that it is in every case the best, or even, in the long run, the most economical system, is more than doubtful. There have been many failures of which we have full details, and probably many more of which we have no record at all.

"In most of the German states, where artificial regeneration of the forest is practised, or where new land is being afforested, the greater part of the outlay consists of what is spent on soil-preparation. But this somewhat expensive soil-preparation enables the continental planter to use with safety a very small and very young plant which has been raised at trifling cost, and enables him also to stock very barren land which could not otherwise have been planted. The system hitherto generally practised in Britain has been to spend a great deal in bringing forward comparatively large plants in the tree nursery and to spend practically nothing in soil-preparation. To Sir John Stirling-Maxwell and his foresters, Messrs Simon Cameron and Donald Grant, is due the credit of demonstrating in a very practical manner how success may be attained by adopting continental methods where accepted British methods resulted in almost entire failure.

"The forestry work which is being taken in hand by them at Corrour is of interest from this point of view. It is a beginning in the necessary pioneer work which the State should have long ago undertaken on an extensive scale in many parts of the country, in order to determine what land could be successfully stocked with paying crops of timber, and to what extent such land could be taken up without unduly interfering with existing interests. The planting operations are carried on around two centres—one at Fersit, near Tulloch railway station, and the other at Loch Ossian. Each

centre presents its own peculiar problem. At Fersit, where the soils are good and the altitudes are moderate, there is every prospect of good crops of timber being obtained. But the question of winter grazing for the deer has to be taken into account, and if all the lower ground were permanently enclosed, the value of the higher ground would be very seriously reduced. For this reason, provision is to be made in the scheme of future management for leaving at least one-third of the forest land in the lower grounds open to grazing by the deer. As the land contains a good proportion of bracken-covered soil, the scheme tentatively provides for the use of larch chiefly for the drier ground and of Sitka spruce in the moister portions, it being considered that these two species will give the best timber results, and permit of the opening of the forest enclosures to pasturage by the deer at an early period. Similar problems appear in connection with sheep grazings, and the question arises whether, in the portions of land selected for afforestation, it might not be desirable to set aside some of the low-lying grazing ground entirely for pasturage, in preference to allowing animals to graze in the woods at certain stages of the rotation.

"The chief objection to combining grazing with forestry is that where grazing is practised, the most intensive systems of forestry must to a certain extent be ruled out. If grazing within the woodlands is to have much value a certain openness of canopy is necessary. The best woodland grazing will certainly be obtained underneath the light shade of the larch, but one may doubt whether it will always be possible to maintain a healthy growth of larch under such conditions and without the aid afforded by admixture with some soil-improving species. On the other hand, if the best soil conditions are maintained by a complete shading of the ground surface, the value of the grazing will be reduced to a minimum. There is, however, no need to be unduly pessimistic about such details, and time will show what modifications may become necessary to meet such cases.

"The Loch Ossian planting centre, the only one which the members of the Society had time to visit, differs in several respects from that at Fersit. Where there is good soil, planting may often be successfully carried out at high altitudes and on exposed sites. In well-sheltered localities, fair results may often be obtained where the soils are comparatively poor. But where high altitudes and other unfavourable climatic

conditions exist along with the worst possible soil conditions, the task of successfully establishing a forest cover becomes a very difficult one indeed. And this is just what one finds at Loch Ossian. The lowest altitude, the level of the loch, is 1269 feet above sea-level. The area to be covered here consists of barren peat interspersed here and there with 'knobbies' of rather better mineral soil. The peat varies in depth, and where it is shallow a hard 'pan' or impenetrable layer frequently occurs comparatively near the surface, between the peat and the mineral soil. When such unfavourable conditions are considered, the results achieved at Loch Ossian are all the more remarkable. The chief facts brought out in this very interesting and extensive planting experiment are :—

"(*a*) The unsuitability of Scots pine as a timber tree for such high altitudes.

"(*b*) The absolute failure of notching-in as the planting system, under the conditions obtaining at Loch Ossian.

"(*c*) The great success attending the Belgian[1] method of planting by means of the trowel spade on the upturned turfs, so far as it can be judged from four years' growth.

"As has already been remarked, the notching-in method of planting, even under the best conditions, does not lead to uniformly good results. Where climatic and soil conditions are so unfavourable as at Corrour, notching-in has been proved to be wholly unsuitable. The system introduced from Belgium by Dr Augustine Henry's advice, namely, that of planting on upturned turfs, follows the continental principle of devoting the largest proportion of the outlay to preparation of the forest soil, and permits the use of smaller plants, which adapt themselves more readily than older transplants to change from a favourable to an unfavourable environment. Another great advantage of following this system is the facility with which the roots of the plants can be placed in an uncramped, natural position. By the notching-in method, unless very great care is taken by the planter, the roots of the plants are apt to be doubled up and twisted to such an extent that the root-system is often permanently damaged, the growth of the whole plant is severely checked, and the foundation is probably laid for fatal attacks by root-fungi and other parasitic enemies.[2] No

[1] See *Trans.*, Vols. XX. and XXIII. [2] See *Trans.*, Vol. XXIII. p. 111.

doubt the Belgian method could be applied to many other conditions of soil besides peat—stiff, wet clay for example. It may be worth noting that a similar method of planting is recorded as having been adopted for stiff clay soils in the Forest of Dean and in Chopwell woods, Durham, in the beginning of last century. In a quaintly written book,[1] published in 1825, William Billington, who had the superintendence of the planting of 11,000 acres in the Forest of Dean and 900 acres at Chopwell, gives his experiences. He found ordinary methods of planting the clays on the level quite unsuitable. Water lodged in the holes made, the soil cracked and opened during summer and exposed the roots, with the result that a large percentage of plants died. The rank growth of grass also smothered many others which survived the transplanting ordeal. Billington therefore adopted the method of planting on inverted turfs. His method of procedure was similar to that followed at Corrour, only his turfs were of necessity thinner than the peat turfs. He sums up the results in the following words :—

"'Thus the raising of the holes and draining the ground were done at nearly one expense, and by this method the ground is left a great deal drier, no water being capable of settling about the roots of the plants, affording at the same time a stratum of soil as thick again as the original; and by being laid down a few months before planting the two swards rot, and the sod becomes firmly fixed so that they can be planted with the greatest ease without disturbing the soil; part of the roots will also be within the original surface, and the rich soil produced by the rotting of the two swards affords a fine pabulum for the roots of the plants during the two first years when they stand in so much need of it, preventing also their being loosened and thrown out of the ground by the frosts or winds, as the soil about the roots is always dry and kindly, the same as if planted in the driest soils. . . . The effects were so great that I could safely recommend the plan to be acted upon in all wet ground, as it can be done at nearly the same expense as draining, the plants thriving exceedingly well, and the other advantages always incalculable.'

"The trees mainly used for planting at Corrour are introduced species. The Scots pine, as already noted, proved a complete

[1] A copy of Billington's book may be seen in the library of the Literary and Philosophical Society, Newcastle-upon-Tyne.

failure owing to its suffering so severely from snow-break. It may be suggested that the tendency for planters at the present day is to depend rather too much on exotics, to the exclusion of better known native trees. It seems fairly certain, however, that at Corrour, success can be obtained only by the use of exotics. The trees giving most promise are the Sitka, the Norway and white American spruces in the peaty soils, and the upright mountain pine on the 'knobbies.' Larch and *Abies nobilis* have also been successfully used in some instances. If a suggestion might be made, the Cembran pine seems worthy of an extended trial, as a shelter tree, on the 'knobbies.' It is a tree of slow growth, but it seems to grow quite as rapidly at high altitudes in its native regions as in more favoured localities. It is easily raised from seed.

"Credit is due to Sir John Stirling-Maxwell for forcing on the notice of planters in the most practical manner possible, by means of his extensive experiments, this comparatively cheap[1] and highly superior method of planting ground where soil and climatic conditions are unfavourable.

II.

The second day's excursion, 29th June, was made by train and carriage to Ardverikie on Loch Laggan. Sir John Ramsden was, to his great regret, unable to come north to receive the members. He deputed that duty to Mr Grant Thomson, who has for many years been his silvicultural adviser. Mr Grant Thomson, with Mr Fraser, factor, and Mr Alexander Fraser, forester, met the members at the gate and gave them a hearty welcome.

Mr Grant Thomson has kindly contributed the following notes on the visit:—

"Sir John obtained possession of Ardverikie, by purchase, in 1871. At that time the whole estate contained only a few hundred planted trees in addition to some natural birch. Sir John at once began to take steps to improve and beautify the property by planting. From 1873 onwards, operations have continued; and up to the present time 34,000,000 plants have been used, and over 10,000 acres covered with a thriving crop.

[1] *Cost of planting on turf at Corrour.*—Planting at 3 feet apart this spring, the cost worked out at 25s. per acre for draining and turning the turfs, and 16s. 8d. for planting, making in all £3, 1s. 8d. per acre, excluding the cost of the plants.

"The route followed by the Society when visiting Ardverikie, while arranged to show as much of arboricultural interest as was possible in the limited time, could not embrace those extensive areas in the more remote parts of the property that have been successfully covered with crops of Scots fir. But members were able to see the conspicuous success with which different kinds of conifers can be grown in the Highlands, giving beauty and variety to the landscape.

"Sir John Ramsden had kindly drawn up a useful memorandum [1] regarding his planting operations, supplemented by notes prepared by his factor, Mr Sweton Fraser, and this was in the hands of members. Mr Grant Thomson and Mr Fraser were of service in giving information to members throughout the day's excursion.

"On arriving at the entrance lodge at Kinloch-Laggan, the party was met by Mr Grant Thomson and Mr Sweton Fraser, factor, the former of whom gave them welcome in Sir John Ramsden's name. Driving along the approach as far as Kinloch Road, they left the vehicles and ascended the road to the left, in order to see a very successful crop of Scots firs, planted in 1882. No one could wish for a healthier or denser stretch of woodland than is here visible. A number of the trees near the roadside were raised from seed from the old Caledonian Scots firs on the Binion Hill to the west of Ardverikie House.

"After entering the carriages, the drive was continued. The road here runs through a forest of ornamental trees, Douglas fir, *Abies nobilis*, silver fir, *Abies nordmanniana*, etc., and as all the vehicles were open carriages, a good view was obtained as the excursionists drove along. One fine *nobilis*, a mile and a quarter from the mansion, known as 'Sir John's Tree,' is about 58 feet in height and 5 ft. 2 ins. in girth at 5 feet up. At Ardverikie House an excellent lunch was provided by the hospitality of Sir John Ramsden.[2]

"After luncheon a visit was paid, partly on foot, partly

[1] Printed below, p. 81.

[2] Mr Grant Thomson, in the course of some remarks which he made as chairman, alluded to the visit of Queen Victoria and the Prince Consort to Ardverikie in the autumn of 1847, when they had planted a Scots fir and a larch, which are still flourishing. He also mentioned the interesting fact that Sir John Ramsden and himself, who are the two oldest members of the Royal Scottish Arboricultural Society, had between them planted over 70,000,000 trees.

by driving, to Loch Earba (pronounced Loch Arb), a small lake about a mile long, three miles distant from Ardverikie House, and at an altitude of 1142 feet above the sea,—travelling through woodlands all the way. The hills on the two sides of the loch are clothed with hundreds of acres of prosperous woods, planted up to altitudes of about 1500 and 1700 feet, the woods on the south side (which were first passed) being about 34 years of age, and those on the north a few years younger. The crop is a combination of Scots fir, larch, spruce, etc., either mixed or in clumps. On the north side the silver firs have enjoyed great freedom from disease. With the partial exception of some trees planted in peat about a mile from the mansion (which Sir John Ramsden described in his memorandum as 'the very worst piece of ground I have ever planted') these woods are admirably healthy, and form an object-lesson in what can be done to afforest the Highlands where the surface is suitable. Even where peat is found, if it is only a few inches deep, though the plants take some time to get hold of the subsoil, yet when they manage to do so they make steady progress.

"The last two miles of the round were accomplished on foot. At the north end of the Binion the party left the road in order to inspect with greater care a number of *nobilis* trees which are here especially worthy of observation. All over the estate admirable specimens of this sturdy and rapidly-growing conifer are to be found. It was interesting to observe that underneath the trees healthy seedlings were springing up naturally (as also below the Douglas fir and Lawson's cypress), an indication of the suitability of the soil and climate to their successful growth.

"On returning to Ardverikie, tea was hospitably provided by Sir John Ramsden ; and the carriages were then re-entered for the drive to Tulloch. Unfortunately, time did not permit a visit to the nursery, which is about $3\frac{1}{2}$ miles from the mansion, and which contains numerous beds of healthy seedlings and young plants. Special mention may be made of the fact that there are about 30,000 seedlings of *Abies nobilis* grown from seed collected from trees on the estate. The densest and best established plantations were too far from Ardverikie to be visited in one day, and were reluctantly left unseen. But, on the whole, the second day's excursion showed how much can be done in suitable parts of the Highlands, with adequate capital and intelligent superintendence, to cover wide areas with a thriving

crop of trees, which would not only gratify the landowner and the passing visitor by adding beauty, variety, and interest to the landscape, but would also be a source of revenue to the country in the future, when the long-threatened 'timber famine' makes its appearance."

Sir John Ramsden had kindly supplied the members with the following Memorandum on his planting at Ardverikie.

"At Whitsunday 1871 I entered into possession of the Ardverikie Estate. The erection of the deer fence of galvanised iron and wire, 6 feet high, was begun forthwith. This fence, running along the top of Druim na Beiste, and of Craig Hur, by the west end of East Loch Earba and down to Loch Laggan between the two Binions, encloses about 3670 acres, including Kinloch Wood, East Loch Earba, the East Binion, the north face of Craig Hur, and about 5 miles in length of the southern shore of Loch Laggan. The completion of this fence, and the shooting of 800 hinds bred on and always belonging to this great extent of ground, occupied the whole of the year 1872, and it was not till 1873 that a beginning was made in planting the ground thus enclosed.

"The ground first planted was that between Ardverikie and the Laurick Burn, and on both sides of the old road leading up to Loch Earba. Some of this ground beside the road is peat moss; is the very worst piece of ground I have ever planted, and it will be seen that to this day the firs have made no progress whatever. Fortunately the area of this bad land is not extensive, and as you approach Loch Earba the improvement is very marked. For several years after this enclosure was completed nearly all our energies were devoted to planting it up, and for some years in succession we planted out an average number of two million trees, chiefly Scots firs, in every season. The plantation which extends for 5 miles along Loch Ericht side was also planted during these early years. Of all the trees I have planted, the *Abies nobilis* has proved by far the most satisfactory. Its growth and vigour are magnificent. It seems to enjoy immunity from disease, and from insect and animal pests. Neither squirrels, nor black game, nor caterpillars touch it, and along Loch Laggan side you may see disease spreading from *nordmanniana* to silver fir, while a *nobilis* standing between them remains perfectly healthy. The Douglas fir is just as hardy and just as vigorous, but it cannot stand the wind. At

Ardverikie, in places exposed to the west wind, you will see the Douglas fir scourged by the wind till nothing remains but a miserable and almost leafless stick, while close beside it the *nobilis* stands erect and healthy and equally furnished with branches on every side.

"For further particulars I refer to the following notes which have been prepared by Mr Fraser, my factor, at my request:—

"1. *Date of first plantation.*—The first plantation was formed in 1873.

"2. *Area.*—From 1873 to this date, 10,400 acres or thereby have been planted, and in doing this 34,000,000 plants have been used, giving an average of 3276 plants to the acre.

"3. *Elevation.*—Loch Laggan is 817 feet above sea-level, and the plantation is alongside the loch. Loch Earba is 1142 feet above sea-level, and the plantations in the neighbourhood of both lochs are doing exceedingly well. Along Loch Earba side Scots firs and larch are doing well up to an altitude of 1500 and 1700 feet.

"4. *Species.*—The greater part of the Ardverikie plantations consists of Scots fir, larch, and spruce mixed. There are two plantations of pure larch, each of about 500 acres. One is at Loch Ericht side, at an altitude of 1160 to 2400 feet, and the other on Meall-an-Domhnaich, in Glenspey, at an altitude of 1000 to 1700 feet. Both plantations have a southern exposure. When the plantations were from 6 to 8 years old, a number of the plants became diseased and died out. A fair proportion, however, recovered, and are now doing exceedingly well, leaving a crop of about 1000 trees to an acre.

"On the lower ground and along the roads a number of ornamental trees have been planted, and they are doing exceedingly well. These consist chiefly of *nobilis*, Douglas fir, *grandis*, and silver fir trees.

"5. *Method of planting.*—The notch system, and at an average distance of $3\frac{1}{2}$ feet to 4 feet apart, using chiefly 2-year 1-year for the Scots fir, larch from 12 to 16 inches, and spruce from 9 to 12 inches.

"6. *Source of plants.*—A number of plants have been reared from seed in the estate nursery, but the greater portion was raised by buying 1-year 1-year and 2-year seedlings, and laying them in the nursery for a year before planting out. A quantity of plants were also bought and planted direct on the ground.

"7. *Draining.*—About 400 miles of drains have been made throughout the plantations, on an average of about 3 chains to the acre. The drains are cast about 18 ins. by 12 ins. by 18 ins. deep, and cost from 2s. 6d. to 4s. 6d. a chain.

"8. *Roads and paths.*—The extent of carriage roads made since Sir John purchased the property is about 40 miles; they are generally from 8 to 10 feet wide—and cost from 3s. to 5s. a yard to construct. *Walks.*—About 45 miles of walks, at a cost of 9d. to 1s. 6d. per lineal yard, have been made. The walks in the plantations are generally from 4 to 5 feet wide, and the pony tracks through the forest 3 feet wide between the borders.

"9. *Number of men employed.*—There is now an average of 40 men employed, but between 1872 and 1890 the number was quite double this.

"10. *Length of fencing.*—There are 40 miles of 6- and 7-lined wire fences, and about 35 miles of deer fence with 9 and 10 lines of wire. The ring fences consist principally of heavy iron standards placed at 6 feet apart, with 9 and 10 lines of No. 6 wire. The fences enclosing the smaller plantations are supported principally with wooden posts (larch and tarred); the posts are placed at 6 feet apart. The cost of the lower fences is from 1s. to 1s. 6d. a yard, and of the higher from 1s. 6d. to 2s. 6d. a yard.

General Remarks.

Nursery.

"In 1872, immediately Sir John acquired the property, a nursery was begun; and in 1873, 400,000 1-year 1-year Scots fir plants were laid in lines, and for the following 25 to 30 years the numbers varied from 100,000 up to 2,000,000 plants. The practice adopted was buying 1-year 1-year or 2-year seedlings, the former being always preferred when obtainable. The home nursery proved most beneficial, as it hardened the plants and considerably reduced the deaths in planting out.

"In addition to the rearing of the young plants bought in from outside sources, a considerable number of plants were raised from seed obtained from cones of the old Caledonian fir trees on the Binion (near Adverikie), and eighty to one hundred thousand trees from this seed are now growing into timber on the estate.

"In more recent years seed of some of the rarer varieties growing on the estate has been taken and sown in the nursery,

more especially *Abies nobilis*. At this moment there are 12,000 2-year 2-year, 10,000 2-year 1-year, and 7000 seedlings of *nobilis* growing in the nursery.

Altitude.

"The lowest altitude of the plantations on the estate is 800 feet, and the highest about 2000. The bulk of the area planted lies at from 900 to 1800 feet. At from 900 to 1300 feet the quality of the soil generally is of a rich alluvial nature where *nobilis*, *grandis*, Douglas fir, silver fir, and spruce, etc., flourish. At from 1300 to 1800 feet the soil varies much. In many places there are from 6 ins. to 9 ins. of peat with hard gravelly subsoil. Where peat exists, the plants take some time to get hold of the subsoil, but once they do get their roots down they make steady progress.

Growth.

"The average yearly growth, say for 30 years, of Scots fir up to an altitude of 1500 feet is from 8 to 10 inches.

Larch . . .	about 12 inches.
Spruce to 1300 feet altitude .	. 12 ,,
Nobilis to 1200 ,,	. . 15 ,,
Grandis ,, ,,	. . 15 ,,
Douglas ,, ,,	. . 15 ,,
Nordmanniana to 1200 feet altitude	9 ,,
Silver fir to 1400 ,,	6 in. to 9 ins.

"From an altitude of 1500 to 1800 feet the growth is considerably less than it is lower down.

Cost.

"The cost per acre of planting is made up as follows:—

Price of plants	. .	£1	14 0
,, labour	. .	0	12 0
,, draining	. .	0	6 0
,, fencing	. .	1	0 0
		£3	12 0

Sawmill.

"Last year a sawmill driven by water-power was erected, and there were sawn from thinnings from the plantations this year 2000 larch posts, 500 rails, and a quantity of boards and battens."

III.

The third day was spent at Invergarry, to which the party travelled *via* the Caledonian Canal. On the way several plantations were passed which were fairly well seen from the deck of the steamer. Mr Malcolm kindly contributed the following notes on those at Invergloy, Letterfinlay and Corriegour.

"These plantations extend continuously along the public road between Spean Bridge and Invergarry for about 6 miles. They may average about 600 yards in breadth, which will make their extent from 1300 to 1400 acres. They consist almost exclusively of larch, Scots fir and spruce, the two first predominating. They were planted in or about 1876 by the late George Grant Mackay, who at one time was in business in Inverness as a civil engineer, and held the office of road surveyor for Inverness-shire. Mr Mackay was afterwards well known as a buyer and seller of Highland landed estates. He was a man of great energy and much ability. He fenced and planted this area in about two years. Letterfinlay was a large and excellent sheep farm, and commanded at one time about £800 of rent. Planting all the front and lower portion of the estate extinguished the grazing value, and practically the shooting value also, and there being no other income, Mr Mackay's affairs led to the estate, with its extensive young plantations, being sold. Not selling as a whole, it was disposed of in three divisions, Invergloy, Letterfinlay (proper), and Corriegour, and is now held by separate proprietors."

Mr George Bailey of Invergloy kindly sent the following note on the large plantation at that place :—

"Invergloy Wood (450 acres) was planted in 1876 and 1877, four-fifths with larch, and the remainder with spruce and Scots pine. The soil is very rocky, with a few inches of loam above mountain clay. The trees on mountain clay have made better progress than those on peat. Those facing north-west have grown faster and better than those facing south. They have grown well up to 700 feet, but are much smaller above that level. Douglas has done well. Larch suffered from disease 20 years ago, but disease has now almost disappeared and the trees have recovered."

Mr Bailey kindly invited the members to take tea at Invergloy on their way home, but they were compelled to decline his

invitation for want of time. On reaching Laggan Bridge, the party disembarked and were met by Captain Ellice, Mr George Malcolm, factor, and Mr M'Lean, forester.

The following plantations were visited and are here described from notes kindly supplied by Captain Ellice and Mr Malcolm :—

1. *North Laggan Plantation.*—Larch and Scots pine, planted 1877 and 1878. The attention of the party was called to a part of this plantation below the road, where the larch had suffered so severely from disease that Mrs Ellice condemned it to be cut down in 1893. The forester, Mr M'Lean, asked that he might be allowed to thin it. He obtained leave to do so, and the remaining trees have made an astonishing improvement. The members examined the stump of a tree which Captain Ellice kindly had felled for them. It showed 10 years' good growth, then 5 years' stagnation caused by disease, followed by a remarkable increase of timber since the thinning to which reference has above been made.

2. *Well of the Heads.*—This plantation, formed in 1865 to 1868, has thriven well.

3. *Craiglea*, planted about 1820. The remains of a splendid plantation. Mr Malcolm observes that "this old wood has been as valuable as a gold mine to the estates of Glengarry and Glen Quoich, for, till recently, all supplies of timber—larch, fir, and spruce—necessary for estate purposes, have been obtained from it. At what date this wood began to be drawn upon for useable timber is not known, but it has afforded a steady and sometimes extensive yield for at least 60 years. Fifty years ago it contained a fine crop of magnificent larch, some specimens of which remain. Within this period it has been subjected to several very severe losses by gales. In 1865, no fewer than 4000 trees were blown down. There was another extensive windfall in 1881. From these windfalls, as well as from several sales of lots of larch on the root, large sums have accrued to the estate." In the lower part of Craiglea, there are some fine specimens of exotic conifers —a *nobilis*, planted in 1866, is now over 90 feet high, and the ground round it is thickly covered with seedlings.

After leaving Craiglea, the party traversed the policies of Invergarry House, where they were particularly struck with a fine healthy specimen of *Abies nordmanniana*. They then repaired to the hotel where they were kindly entertained at lunch

by Captain Ellice. After lunch they walked up the glen through the natural birch woods, and the plantations of larch, Scots pine and spruce which border the river. Some notably tall larches growing on a steep bank—the "Dark Brae"—behind the factor's house, excited great interest. Their height, not easy to measure, was calculated by a variety of instruments, and was brought out at anything from 120 to 140 feet. Unfortunately time did not permit of a visit to the natural forest of Scots pine on the south side of Loch Garry, but Captain Ellice was so good as to present each member of the party with a photograph and the measurements of the remarkable Scots pine which grows near the Laddie Burn. This tree measures 70 to 80 feet in height, and 16 ft. 3 ins. in girth at 5 feet from the ground. It has been rather thin in the crown for the last few years, but is still in a fairly healthy condition.

After visiting the Falls of Garry, the party returned by the other bank of the river. On the way to the steamer they passed a section of natural wood cleared in 1907 and replanted with various conifers. It is to be regretted that time did not admit of a more minute examination of this plantation, which has been extremely well designed and very carefully and successfully carried out. A few of the best hardwoods have been left, and advantage has been taken of the slight shelter they afford to start some conifers, such as Douglas fir and Menzies spruce, which might otherwise have suffered from frost. Each species is planted in the soil best suited to it and all are thriving admirably.

IV.

On the fourth day, the members visited Achnacarry, where they were received by Lochiel, his factor Mr Charles Mackenzie, and Mr Charles Coupar, forester. Mr Mackenzie kindly provided the members with the following notes on the woods to be visited:—

Notes on Lochiel Estate Woods.

"The woods on Lochiel estate extend to about 7000 acres, and are mostly natural Scots pine, oak and birch, the remainder being plantations, which are chiefly of larch with a few groups of Scots fir throughout. The larch thrives exceedingly well on soil which is at all suited to it, but the Scots fir does not grow

so well. Larch disease, excepting where the tree is in unsuitable soil, or in an unsuitable situation, is not at all troublesome if the woods get proper treatment.

Clunes Wood.

"This, which is the first to be visited, is a plantation about 50 acres in extent and 41 years old. There is at present an average crop of about 340 trees per acre on the ground, with a height of 52 to 58 feet. It was planted practically as pure larch in the drier ground, the wet parts having been planted with Scots fir. The wood was thinned very irregularly, part of it having been thinned many years ago, but other parts not being touched. As a result, the thinned part contains some fairly heavy trees, while, where no thinning was carried out till too late, the trees are very light and slender. A small section of the wood to the east of Clunes Pier is interesting as showing the effect of keeping the trees too thick on the ground. Here there are about 440 trees per acre, and these have a height of from 60 to 65 feet. The crowns of the trees are all exceedingly small, being only 12 to 13 feet long, and the average annual increment is also small. The trees are now so slender in proportion to their height that it is difficult to know how to treat them, because, if they are thinned, they sway so much that the buds get lashed off, and many of the trees get interlocked. About 150 trees per acre were removed three years ago, and the section is now left as an experimental plot.

Tor a Mhiult.

"This wood was the second to be inspected. Its extent is about 90 acres, and it comprises about 60 acres of 64 years of age, and 30 acres 40 years of age. The plantation is almost pure larch with a few spruce, oak and birch. In the lower part of the wood there is a considerable number of naturally grown beech. All over there is an average crop of about 250 trees per acre, and these have all remarkably long clean stems of an average height of 75 to 80 feet.

Natural Oak Wood.

"The natural oak woods extend along Loch Arkaig side and Loch Eil side, and are approximately 1700 acres in extent. These woods are of various ages, from about thirty years

upwards. Very few of the trees are as yet of a profitable size, but all have fine long clean stems and promise to become valuable. The timber is of excellent quality with very little sapwood.

Lochiel Old Forest.

"This forest is the finest of the few remaining natural Scots pine forests in Scotland. It extends to about 1500 acres, running for 6 miles along the mountain slopes. The trees are nearly all very old, mostly from 200 to 300 years, and many of them are of an immense size. The largest tree in the forest has a circumference of 18 ft. 4 ins. at 5 feet high. The heaviest of the trees are in Glenmallie, about 5 miles from Achnacarry. A few are now dying and dead, and although some are still growing well, the forest has long since ceased to make a profitable growth. The timber when sawn is of splendid quality, being very close in the grain and resinous, and resembling in outward appearance good pitch pine more than Scots fir. When used for estate purposes it is found to be very durable. This timber was largely used in the construction of houses 100 years ago, and among the houses where it was so used was the present house at Achnacarry, where the joists and doors were all constructed with it, and they still remain as good as ever. Telford, in 1827, reported this timber as being finer and more durable than the best Baltic timber. Natural regeneration is not proceeding to any considerable extent. There are a great many seedlings showing in some parts of the forest, but it is only in certain small areas that they promise to grow to any size. In other parts the dense herbage on the ground, and the deer grazing, effectually destroy them.

"At Gusach, a little farther up Loch Arkaig side, there are the remains of another large forest of the same class. This wood was cut down 100 years ago, but there is still a sufficient seeding crop on the ground, and in some spots the seedlings are doing well. The extent of this part is about 900 acres.

Beech Avenue.

"At Achnacarry Castle there is an interesting and historical beech avenue, which was planted in 1745 by the Lochiel of the day. At this time Lochiel, following the fashion of that day, had been preparing to plant a long beech avenue. He had all

his plants in readiness, but shortly after he had made a start, word was brought to him that Prince Charlie had landed and commanded his presence. Lochiel "heeled" in his seedlings in a trench along the river side to await his return, and hurried off to meet the Prince. He never returned, and the trees still remain where they were then put, and now form a beautiful walk by the side of the River Arkaig.

Sequoia Gigantea.

"There is a tall *Sequoia* (*Wellingtonia*) *gigantea* in the garden. Its height is 100 feet.

Coille Ros Oak.

"This is a very old tree, and well worth a visit. It has a girth of 23 feet at 5 feet from the ground.

Gairlochy Plantation.

"This plantation is 316 acres in extent, and is 26 years of age. It is mostly larch with Scots fir here and there throughout. It is most interesting, as showing the elevation to which planting may be profitably carried in the locality, and how the trees are affected by exposure at the different heights. The lowest part of the wood is 180 feet above sea-level, and the highest in the south-west corner is a little over 800 feet, the north-west corner being a little over 700 feet. All over, the trees have been planted about 100 feet too high, and, the north-west corner being more exposed than the other, the trees there are not doing any good 100 feet lower than on the less exposed side. In the upper part of the wood, the trees are standing in the lines as they were planted, and have more the appearance of having been planted three years ago than twenty-eight years. It is worthy of note, however, that in any sheltered hollows, even at the higher altitudes, where the soil is suitable, the trees do wonderfully well, the larch doing rather better than the Scots fir. There are several large areas in this plantation where the trees have quite died out, owing to the soil not being suited to the stems planted. The effect of soil and situation on the healthy growth of larch is also very noticeable. In many places larch has been planted on most unsuitable soil, and most of the trees there have died out, while those that remain are badly diseased.

Quite close to these diseased trees fine healthy groups of trees are to be found.

"The lower part of the wood was thinned a few years ago, and the remaining portions were gone over in 1908. In the lower part there are now about 440 trees per acre, having an average height of about 40 feet."

This was a most interesting day, but it was impossible to see everything in the time, as the distances are considerable. In the morning the party visited Clunes Wood, Tor a Mhuilt, and the natural oak wood, and inspected the new nursery where some promising seed beds of Scots pine were much admired. After an excellent lunch, kindly provided by Lochiel at Achnacarry, the members divided into two groups, one proceeding to examine the natural wood near the east end of Loch Arkaig and the Gairlochy plantation, the other going in Lochiel's yacht three miles up the loch to take a hurried view of the larger natural pine forest. Some of the latter party were so much absorbed in making measurements of these splendid old trees, that they narrowly escaped being left behind, and Mr Buchanan, who rightly insists on strict adherence to the time-table, suffered torments of anxiety.

In the evening the members dined together at the Banavie Hotel, where Lochiel, Captain Ellice, and Mr Charles Mackenzie were their guests. The usual toast list was dispensed with, and in its place a debate was held after dinner, on the Survey which the Society has undertaken to make. The discussion was of great value in bringing to light points which must be kept in view if the Survey is to be, as the Council intend, a complete study of afforestation in Scotland, and the Council are grateful to the members who took part in it. Next morning some of the party went south by a morning train, while others spent the day taking a run to Mallaig by the West Highland Railway.

It was generally felt that the excursion had been a great success, being both instructive and pleasant to the members. Their stay at the Banavie Hotel was most comfortable. Mr Buchanan and his committee and Mr Galloway earned every one's gratitude by their well planned arrangements. The members were received wherever they went with the greatest kindness, and were fortunate in spending each day under the guidance of proprietors, factors and foresters, who have a genuine love and knowledge of silviculture.

The following is an Alphabetical List of the Excursionists :—

Sir John Stirling-Maxwell, Bart., *President;* Thomas Ainslie, Glenesk, Penicuik; J. F. Annand, Armstrong College, Newcastle-on-Tyne; J. M. Arthur, Airdrie; Dr Borthwick, Edinburgh, *Hon. Cryptogamist;* John Boyd, Inverliever, Argyle; John Broom, Bathgate; Thomas Bryden, Ayr; Charles Buchanan, Penicuik, *Convener;* Henry M. Cadell of Grange; R. W. Cowper, Sittingbourne, Kent; David Crabbe, Byreburnfoot, Canonbie; John Croll, Broughty Ferry; James Cruickshank, Port Erroll; John G. Cunningham of Letham, Fife; William Dallimore, Kew Gardens; William Dawson, Marischal College, Aberdeen; James Deas, Bonnyrigg; A. C. Forbes, Rothdrum, Co. Wicklow; Robert Forbes, Kennet, Alloa; Arch. K. Foulis, Edinburgh; Robert Galloway, Edinburgh, *Secretary and Treasurer;* Sydney J. Gammell of Drumtochty; George P. Gordon, Eskbank; R. F. Graham of Skipness, Argyle; James Grant, Raith; Donald Grant, Fersit, Tulloch; James L. Gray, Elginhaugh, Dalkeith; J. H. Milne-Home, Irvine House, Canonbie; Geo. J. Imrie, Keir, Thornhill; David Logan, Saltoun, Pencaitland; Duncan M'Ainsh, Crieff; S. MacBean, Erskine, Bishopton; John M'Grigor, Ayr; J. W. Mackay, Evanton, Ross-shire; Charles J. S. MacKenzie, Carr-Bridge; James MacKenzie, Carr-Bridge; William MacKenzie, Novar; John M'Kerchar, London; Alexander M'Rae, Dundrum, Co. Tipperary; W. H. Massie, Edinburgh; John Methven, Kennoway, Fife; Robert P. Milne, Spittal Mains, Berwick-on-Tweed; William Milne, Foulden, Berwick-on-Tweed; Cyril Moiser, Heworth Grange, York; Macolm Morgan, Crieff; A. B. Motherwell, Airdrie; James W. Munro, Edinburgh; James W. Newton, Edinburgh; Edward B. Nicolson, Edinburgh; James Pearson, The Cottage, Airdrie; James Lyford-Pike, Edinburgh; Colonel A. Purvis, Kinaldy, Stravithie; D. Robertson, Dunrobin, Golspie; Henry T. Robertson, Airdrie; H. Rutherfurd of Fairnington, Roxburgh; Thomas Sharpe, Monreith; James Smith, Birr, King's County; Adam Spiers, Edinburgh; E. P. Stebbing, Edinburgh University; James Stoddart, Bonnyrigg; Walter C. Stunt of Lorenden, Kent; James Whitton, Glasgow; William Wilson, Auchinleck; John Moncrieff Wright of Kinmonth, Bridge of Earn; William Wyllie, Aberdeen; R. M. Young, Newlands, Glasgow.

11. Trees in Cities.

An interesting article on the trees which will thrive in London appears in the *Times*, and from it we extract the following :—

The choice of trees for town planting is severely restricted, owing to certain adverse conditions which have not to be taken into account in the open country. Chief among these conditions are :—excessive drainage, which renders the soil dry and inhospitable ; the scorching heat caused by the reflection of sunlight from pavement and masonry ; and lastly, an atmosphere loaded with the waste products of coal combustion. In most continental cities, where wood is chiefly burnt, it is only the first two of these conditions which seriously affect tree growth ; but where coal is the universal fuel, as it is in the towns of the United Kingdom, only very few species of trees can maintain vigorous growth. Coal smoke acts inimically upon vegetation in two ways—mechanically and chemically. Mechanically it clogs the pores of the plant by depositing upon them a coating of solid carbon of soot ; chemically it destroys the leaf tissues by sulphurous acid.

Its presence deprives sunlight of some important properties ; for, although the rays may beat upon the streets with almost intolerable heat, town-dwellers are never sunburnt, showing that the chemical rays have been intercepted or altered. These adverse conditions are intensified in proportion as the town extends, until, as has happened in London, there is not a single tree native of our humid climate which can be used for street planting, and we are compelled to employ a very few exotic species.

Moreover, London is built mainly on the low-lying shores of a muddy estuary, naturally very subject to winter fogs, which though innocuous in themselves to arboreal life, become highly deleterious when charged with solid carbon, carbon dioxide and sulphurous acid. In the public parks and larger squares, where the heat is not so intense nor the radiation so rapid as among the houses, several species may be grown which would perish in the streets ; but even so, it would be hopeless now to plant young trees in the belief that they would ever attain the stature of the elms and Spanish chestnuts in Hyde Park and Kensington Gardens. The old trees there and elsewhere in London attained maturity before the atmosphere had become so heavily charged with deleterious matter as it is now.

The great Cedar of Lebanon, which died about fifteen years ago in the Chelsea Physic Garden, and was suffered to remain for several seasons, a melancholy spectre, until the corpse teemed with wood-lice and other concomitants of corruption, was planted there in the reign of Charles II., when Chelsea was a quiet waterside village amid green fields and hedgerow timber. Plant a cedar or any other conifer there now, and, admirably as the garden is kept, it would defy the skill of the curator and his staff to keep it alive. And, as with cedars and all other conifers, whereof the resinous exudation makes them peculiarly impatient of impure air, so with our native or naturalised trees; it is useless to attempt planting oak, beech, ash, sycamore, horse-chestnut, sweet chestnut, lime, or elm, for none of these can pass through adolescence undeformed, and most of them will die in infancy.

Now, as to the material for keeping London leafy. Practically there are but four kinds of forest trees to work with; of humbler growths we will speak presently. These four are the Oriental plane, the Ailanthus, the Robinia or false acacia, and two or three species of poplar. The behaviour of the plane as a street tree is certainly remarkable. Patient of extreme drought about its roots, and escaping the searing winds of British spring-time by leafing very late, it avails itself of the excessive heat in London to ripen its annual growths, which it can only do imperfectly in our more northerly counties. It rids itself of the impurities which winter fogs deposit on its bark by shedding its skin and appearing each year in bright, new covering of satiny texture. As for soil, it is as little exacting as any living thing can be, subsisting even upon the jumble of brick-bats, old tins, and paper rubbish which form the staple of the Victoria Embankment.

The Tree of Heaven (*Ailanthus glandulosa*) is as valuable for street planting as the plane, but is far less often seen in good condition, owing to neglect in training it to a single leader. The name of "Tree of Heaven," usually given to it, is really the name of a loftier tropical species, called in the Amboyna language *aylanto*, that is, "tree touching the sky." A native of China, the Ailanthus revels in our sun-baked streets, but it is not until late in summer that its fine pinnate foliage attains full luxuriance, It is dicœcious, and only the female trees should be used for street planting, as the flowers of the male plant exhale a disagreeable rammish odour in hot weather. The value of Robinia, which we call acacia and the Americans call the locust tree, consists in its

lovely verdure, which persists throughout the most scorching summers. No tree is better suited for planting in a street, for it is of moderate size and stands pruning well.

As for the poplars, we must rely on exotic species, such as the Carolina, the balsam, and the black poplar, for our native Abele is intolerant of smuts on its cottony foliage, while the aspen is a true mountaineer, and hates town life. It puzzles one to understand why these trees take so kindly to the arid soil of London, seeing that their natural haunt is the water-side. Their foliage remains fresh in virtue of a peculiar formation of the leaf-stalk, which is flattened laterally along part of its length as if it had been pinched when soft. This causes the leaves to hang vertically, instead of being horizontally exposed to the sun, and gives them the tremulous motion whence comes that soothing murmur so grateful in sultry noons.

The erect-growing Lombardy poplar, a variety of the black poplar, succeeds very well in London when given a fair chance.

That concludes the short list of forest trees which have been proved able to grow vigorously in modern London; for it is doubtful whether the evergreen oak could be reared to maturity in the present condition of the town, although they once throve there. In Chelsea Physic Garden, the grounds of Marlborough House, and elsewhere, a few specimens of moderate size may be seen. Think not that the fine elms in the parks can be perpetuated. What are there will fulfil their span, which is near its close, but they cannot be replaced until fireplaces are constructed to consume their own smoke.

Among trees of humbler growth, the following are mentioned as being grown successfully, chiefly in open parks and gardens:—mulberry, *Catalpa bignonoides*, laburnum, red and white hawthorn, almond, *Cotoneaster frigidus* from Nepál, and the gingko or maidenhair tree.

With passing comment on the fine bushes of *Arbutus Andrachne* in Battersea Park, the promising appearance of the young liquidambers in St James's Park, and the probability of success with some species of *Sorbus* in the other parks, two or three forms of vegetation which specially accommodate themselves to cultivation in towns are mentioned. These are:—*Hibiscus syriacus*, *Clematis montana*, Wistaria, *Clerodendron trichotomum*, *Aucuba*, privet, and the New Zealand daisy bush (*Olearia Haastii*), which last has proved one of the easiest subjects for town culture.

12. Forestry in Japan.

An interesting account of the progress in forestry made by the Japanese is found in a little book which has just been issued by the Bureau of Forestry at Tokyo. Its 127 pages are written in English, and they are accompanied by twelve full-page illustrations, while an appendix gives the coinage, weights and measures of Japan, with their British equivalents.

From the book we learn that attempts at exploitation were made as early as the beginning of the ninth century, and that from the middle of the seventeenth century considerable attention has been devoted to the protection and administration of the forests, which contain about 600 species, some scores of them being of economic value. But, as might be expected, there has been much reckless felling of trees and consequent reduction of the forest-covered area, the present extent of which is estimated to be as follows:—

Ownership.	Square Miles.
The State	69,808
The Imperial household	8,582
Temples and public bodies	13,518
Private proprietors	25,397
Total,	117,305

This area, which represents 67 per cent. of the total area of Japan, including Formosa and Sagalien, comprises 3545 square miles of Protection forests. In addition to the above there are waste lands, a portion of which will ultimately become forest, and which are thus owned:—

By the State	1544	sq. miles.
By the Imperial household	525	,,
By temples, public bodies, and private proprietors	6473	,,
Total,	8542	,,

A Temporary Forest Regulation was issued in 1875; another Regulation, concerning demarcation, appeared in 1884; and a Special Forest Law was passed in 1899. But the first serious attempt at systematic working was not made until 1890, when the demarcation and survey of the State forests was commenced,

and measures were undertaken to regulate their exploitation. The area of forest actually surveyed is 14,685 square miles; and the area for which, up to the end of 1907, working-plans had been drawn up was 4894 square miles.

Although some of the privately-owned forests are efficiently managed, the great majority of them are not. But the State now encourages private proprietors by giving them seeds or seedlings, free of charge, and public bodies may be assisted by grants of money; the State also establishes model forests and nurseries, and provides courses of lectures in important centres. Control over private forests is secured by the Forest Law of 1897, and expert officials are employed to supervise all State-aided work. Progress has kept pace with the increase of facilities afforded by the State for the learning of systematic forestry, and private proprietors are now beginning to follow rational methods of management. Exceptional merit in forest development is publicly recognised.

In 1882 there was but a single forest school, but now there are no less than forty-seven of such institutions. Two of these are special forest schools attached to universities, four are attached to agricultural and forest colleges, while forty-one form departments of Industrial schools of higher or of lower grade. These institutions, together, have turned out 1325 graduates. There are also Industrial Auxiliary schools, at some of which forestry is taught, and thirty public agricultural schools give some lessons in forestry, though they have not organised regular courses in the subject.

Scientifically conducted investigations and experiments were first undertaken in the year 1878, at a State experimental station situated in the suburbs of Tokyo, and in connection with it thirty-six acres of land were purchased. But systematic experimental work is also carried on in four specially selected divisions of the State forests, it having been found expedient to conduct certain classes of investigations locally.

But it soon became evident that the forest industry could not be adequately developed by the State alone, and no less than twenty forest associations or societies have been formed in various parts of the country, some of them being subsidised by the local governments. The most prosperous of these is the Japan Forest Association, which was founded in 1882, and, with a Prince of the Blood as its president, now

has 4000 members. The object of the society is to develop and improve the forest industry; and to this end it publishes a magazine giving information on practical and theoretical questions relating to forestry, answering queries, and reviewing professional books. It holds monthly meetings at which lectures are given and discussions on them are permitted. An annual general meeting is held at some important centre, when, after the transaction of business, the Association proceeds on an excursion to some neighbouring forests, in order to "enlighten the members through both ears and eyes, thus conducing not a little to the development of the forest industry in the various localities visited." All the Forest Associations exchange reports of their proceedings.

There are also Forest Co-operative Societies which aim at the preservation of their members' forests in good condition, or at their restoration, should this be necessary, and also at their utilisation to the best advantage. Some of these societies endeavour to facilitate the transport of timber by constructing or repairing roads, and by removing obstructions from beds of rivers which are, or might be, used for rafting timber; while some of them undertake measures of precaution against flood and fire; and some draw up working-plans and enforce their prescriptions, in case of failure undertaking necessary work and recovering their outlay from the owner. Sometimes they take over the finances of groups of forest properties, and pay over the surplus revenue to the respective owners.

Each such society must confine its activities within a specified area of country. All are controlled by a special law, enacted in 1907, which demands the existence of certain local conditions before such a society can be formed. All owners of forest within the prescribed area are compelled to join it. These societies also take measures to promote the interest of the timber trade, and to correct abuses in it:—by examining produce to prevent fraud or carelessness, by establishing uniformity of measure and of preparation, by assisting new traders to establish themselves conveniently, by forming timber depôts on land and on water, by compiling trade statistics, by controlling and protecting workmen, and in other ways.

There are Credit Co-operative Societies and Sales Co-operative Societies, while other such societies undertake to provide tools and implements to their members.

In our country, since the year 1885, no less than one Royal Commission, two Departmental Committees, and one Select Committee,[1] have taken voluminous evidence and reported exhaustively to the Government on the subject: but our Society has not yet succeeded in inducing either landowners or the Government to take the measures which are necessary for the development of our forest industry. May we venture to hope that the notable example set by the Japanese may have the effect of awakening them to the great national importance of the forest question? F. B.

13. Enhanced Value of Canadian Timber and Wood-Pulp.

The following extracts from the *Times* are given as showing the increased value, due of course to diminishing supply, which the wasteful practices of former years are conferring on Canadian timber and wood-pulp. Species, such as hemlock, jack-pine and spruce, which, until recently, were neglected, are now coming into general use for purposes for which pine has become too expensive. These developments cannot fail to affect the cost of timber and pulp imported to this country across the Atlantic. It is consoling to know that in Canada, as in the United States, the preservation of natural resources has become a fixed object of public policy. HON. ED.

THE EXPORT OF PULP-WOOD.

The determination of the Quebec Government to prohibit the export of pulp-wood cut on Crown lands, must affect many American mills devoted to the manufacture of paper which secure their raw material from Quebec. The province of Ontario also prohibits export from public lands, and New Brunswick will do likewise. The mills of the United States have thousands of miles of pulp-wood limits in Quebec, Nova Scotia, and New Brunswick. In some cases the pulp-wood is shipped twelve or fourteen hundred miles to the mills at American industrial centres. One result must be to transfer

[1] 1. Select Committee of the House of Commons, 1885. Reported in 1887.
2. Departmental Committee on British Forestry, 1902. Reported in 1903.
3. Departmental Committee on Irish Forestry, 1907. Reported in 1908.
4. Royal Commission on Coast Erosion appointed in 1906, scope enlarged to include afforestation in 1908. Reported in 1909.

manufacture to Quebec, and this, no doubt, is the chief purpose of the legislation. It would seem to be natural that the mills should be at the source of supply.

One object of the Payne tariff, which imposes a duty of $6·10 (£1, 4s. 5d.) a ton on pulp-wood shipped from Canadian provinces which maintain prohibitions on export, was to force modification or repeal of these provisions. Instead, Quebec and New Brunswick are adopting the prohibitory policy to which Ontario gave effect some years ago. At Laurentide, in Quebec, there is an extensive plant for the manufacture of paper, in which much American capital is invested. Naturally, this and other paper mills in Canada favour the new policy, and generally Canadian opinion opposes the export of pulp-wood, nickel, and other raw materials of manufacture. The effect of Quebec's action must be to increase prices of paper to American consumers.

In Canada, as in the United States, the conservation of natural resources has become a chief object of public policy. The adjoining country has been guilty of prodigal waste of its natural resources. The example and the agitation fostered by Mr Roosevelt have had effect in the Dominion. The Provinces are conserving timber, introducing scientific forestry, guarding water powers, and asserting a more absolute ownership of minerals, while a spirited national policy of conservation under Mr Clifford Sifton has been inaugurated.

Quebec will not only prohibit the export of pulp-wood but will also increase the stumpage dues by 60 per cent., and raise the ground-rent from $3 to $5 per square mile. Ontario also has under consideration a revision of the terms under which pine limits put under lease many years ago are held by the lessees. It is not unlikely that the question of contract rights in Quebec pulp-wood limits may also be raised by the American holders. It is understood that the prohibition on export will not come into effect until 1st May, so that wood cut during the last winter and not yet delivered may be sent to its destination.

Ontario Timber Dues.

The Ontario Government has increased the dues on pine logs from $1 to $1·50 per 1000 board feet, on square timber from $20 to $50 per 1000 cubic feet, and on hemlock by 25 cent. per 1000 feet. The ground-rent, which was raised from $2 to

$3 per mile twenty-three years ago, is now advanced to $5, and the transfer fee has been raised from $1 to $5 a mile. The net result of these increases, probably, will be to add $300,000 (£60,000) to the Provincial revenue.

There are over 24,000 miles of timber territory under license in Ontario. Of this total 12,000 miles was licensed before Confederation. Many licenses were granted before the passing of the Crown timber regulations, which provided that all limits should be sold by auction and should by equity be non-terminable. It is estimated that there are 7,000,000,000 feet of red and white pine standing on licensed territory, besides large quantities of jack-pine, hemlock, and spruce. Hemlock is coming more and more into use for purposes for which pine is too expensive, while jack-pine is rapidly increasing in value owing to its adaptability to railway purposes. Millions of ties are now manufactured of jack-pine timber, and spruce has become almost as valuable as pine itself. One main object of the new regulations is to terminate leases which were made many years ago over districts in which timber is almost exhausted. But until the lumberman surrenders his interest, they cannot be opened for settlement or for re-afforestation. It is also desired, by increasing the transfer fee, to discountenance the traffic in leases and to compel lumbermen to use areas under license for lumbering rather than for speculative purposes.

The total Provincial revenue from woods and forests for the last ten months has been $885,892 (£177,178). The revenue from timber dues alone was $529,422 (£105, 884). Last year, according to the official report, 329 fire rangers were employed on licensed lands at a cost to the province of $46,621 (£9344). Henceforth the total cost of fire ranging will be borne by the licensees.

14. The Forestry Exhibition at Dumfries.

The tenth annual exhibition of Forestry, organised by the Society in the Highland and Agricultural Society's Show-yard, was held at Dumfries from 19th to 22nd July 1910. The committee were successful in bringing together a comparatively large and interesting collection of exhibits, and they were also fortunate in procuring a site near the main entrance to the show, which made the exhibition more accessible and attractive to the ordinary visitor, and secured for it a large share of attention.

An outstanding feature of this show was the large and excellent assortment of home-grown timbers in the competitive section. The specimens of both broad-leaved and coniferous timber were of such excellence that they could not have failed to convince all who saw them that our soil and climate are capable of producing timber of unrivalled quality.

The competitors in the timber sections were:—Mr J. Ernest Kerr of Harviestoun, Dollar; the Duke of Buccleuch (Langholm Estate); the Marquis of Graham; Mr Maxwell of Munches; Mr Barbour of Bonskeid; the Duke of Abercorn; the Earl of Mansfield; Mr Younger of Benmore; and Sir Herbert Maxwell of Monreith.

Mr Fred Moon, Bowmont Forest, submitted reports, with specimens, of damage done by the pine weevil (*Hylobius abietis*) and by *Strophosomus coryli*. Farm gates were exhibited by the Duke of Buccleuch, Mr James Cruikshank, Port Erroll, and Mr Alexander Lowe, Lockerbie House. More ornamental gates were shown by Mr Lowe and Mr Robert Cowan, Hoddom. Self-closing wicket-gates were also exhibited by Messrs Cowan and Lowe and the Earl of Mansfield; and the two last named competed with full-size sections of rustic fencing. Mr Hugh R. Munro, assistant forester, Murthly, was the only competitor who entered a collection of fungi. Amongst new or improved implements or instruments exhibited were: A wire strainer, by Mr Robert Cowan; photographs of tackle used to get timber out of a glen on to the public road, and a machine nursery hoe, by Mr Fred Moon; also a gate-opener, by Mr W. H. Whellens, Comlongon Nursery. In the competition for any approved article either wholly or mainly made of wood, Mr Lowe exhibited a rustic summer-house; Mr Alexander Pollock, Tarbolton, three pairs of rustic oak garden vases, and Mr

Thomas Sharpe, Monreith, a neat box made of finely marked Scots pine grown in Strathspey.

In the non-competitive section, the Society exhibited a collection of micro-photographic slides of plant tissue; while the Forestry Department of the West of Scotland Agricultural College sent a large collection of tools and implements (mostly German) used in forestry; botanical and technological specimens of our common woodland trees; hand specimens of the chief kinds of British timber; and examples of damage to larch by Black game. The Duke of Buccleuch sent from his Langholm Estate a cross section through the butt of a Douglas fir, showing its age and rate of growth; creosoted and uncreosoted fencing-posts of different woods, with respective weights and cost of treatment, and a sample of the creosote used (with its analysis); while from his Drumlanrig Estate he sent Scots fir and spruce stobs, treated with naphtaline, which had stood in a fence for fifteen years; also a field gate, and plants of the Colorado and the Pacific varieties of the Douglas fir. Mr Thomas Sharpe, Monreith, sent specimens of the timbers of hardwoods and conifers in a frame, a wire strainer, a planting spade, a chain saw, and specimens of black oak taken from lake-dwellings. The Marquis of Graham showed a board of Austrian pine, 7 ft. by 2 ft. 8 ins., cut from a tree seventy-four years old; and Professor M'Intosh, Nevay Park, Meigle, sent sections of larch timber which was grown on Nevay Hill, and is noted for its durability. Mr John Munro, Kingswood, Murthly, sent a collection of cones and foliage of different kinds of conifers; Mr Robert Cowan, Hoddom Castle, showed cones of Corsican pine; and Major Carruthers of Dormont, sent a spruce tree showing abnormal "warty" growth. Mr Matthew Feaks, Benmore, exhibited a collection of hand specimens of timber grown on the Benmore Estate, and examples of *Peziza Willkommii* on young Japanese larch. The Duke of Roxburghe displayed a collection of photographs showing a forest railway, sawmill and plant, and a woodyard. Mr Kenneth M'Douall of Logan, Stranraer, showed two larch trees, each about thirteen years old, taken from the same plantation, and contrasting the different effects produced by shelter and by exposure to high winds. Sir John Stirling-Maxwell of Pollok, Bart., President of the Society, sent specimen plants of Sitka spruce, Norway spruce and Scots pine, both notched and planted, showing the advantage, at high elevations

and on peaty soil, of planting on inverted turf, which is the method recently adopted by him on his Corrour Estate. Mr W. H. Whellens had an interesting exhibit of the larvæ of *Nematus erichsoni*. Mr David O'Brien, clog manufacturer. Dumfries, showed timber of which clog soles are made, and of clogs in different stages of manufacture. There was also on view a very complete collection of bobbins and bobbin wood. Messrs J. Heine, Söhne, Halstenbek, Germany, exhibited a collection of seedling and of transplanted forest trees and hedge plants.

The judges of the exhibits were Dr A. W. Borthwick, Hon. Cryptogamist to the Society; Mr William Wilson, timber merchant, Auchlinleck; and Mr G. U. Macdonald, overseer, Haystoun Estate, Peebles. Mr J. H. Milne-Home was convener of the local committee, while Mr John Learmont, nurseryman, Dumfries, rendered valuable service to the Society by taking charge of the exhibits. The prize list will be found in the Proceedings of the General Meeting held at Dumfries in 1910.

NOTES AND QUERIES.

Landowners Forestry Co-operative Society.

Members may be interested to hear that the Landowners Forestry Co-operative Society, to which some allusion was made at the last annual meeting, is now in working order. The new society has begun with about two hundred subscribers, who are nearly all members of the Royal Scottish Arboricultural Society, and it is expected that the membership will very rapidly increase. An office has been opened at No. 122 George Street, Edinburgh, and Mr George Scott Elliot has been appointed secretary. The new society will in no sense compete with or overlap the Royal Scottish Arboricultural Society, and desires to work in close association with it. It is concerned solely with trading operations which could not properly be undertaken by the larger society, such as the purchase and exchange of seeds, plants, implements and fencing materials, and the sale of timber. The society proposes to circulate a monthly bulletin among its members, dealing with prices and matters of

business, but any information of general silvicultural interest that may come in its way will be offered to the editor of the Royal Scottish Arboricultural Society *Transactions*. It is hoped that the new society will, among other things, do a great deal to improve the relations between proprietors and the home nurserymen, which leave much to be desired at present. If orders on a large scale are placed well ahead with the home nurseries, there seems to be no reason why plants should not be obtained in this country at prices which will compare favourably with those of foreign nurseries, and the growing tendency to place large orders abroad be thus checked. It is also believed that by organising sales of timber in regular succession in any timber-growing district, the crop may, to the advantage of all concerned, be reaped and utilised more regularly, and therefore more economically than it is at present. Mr Scott Elliot, who is himself a member of the Royal Scottish Arboricultural Society, will be glad to give full information to any members who may desire it.

JOHN STIRLING-MAXWELL.

[A society with similar objects has been formed in England. It is styled the English Forestry Association.—HON. ED.]

PROGRESS ON THE INVERLIEVER ESTATE.

From the Official Report for 1909-10.

During the past year a block of about 400 acres was enclosed with a sheep and cattle fence. The draining of the area to be planted during the year was completed, and on parts of it on which the bracken growth was very vigorous this was cut twice and in places three times. The winter was unusually severe and planting was very much retarded, yet by the end of May 1910 about 190 acres were planted up with the following: 171,000 larch, 120,000 Scots pine, 283,000 spruce, 45,000 silver fir, 35,000 Douglas fir, and 20,000 Sitka spruce. Of these, 590,000 plants were purchased, and the balance was taken from the nursery at Ford. Unfortunately, in spite of the steps taken to keep them down, hares and rabbits did serious damage during the hard weather, and next season some of the area nearest the lake will have to be replanted, and protection afforded by wire netting where necessary. Black game also have done some damage.

In the nursery at Ford another part was taken in hand,

cultivated, cleared of large stones and partially cleaned. As noted above, over 80,000 plants were taken from the nursery and planted out. This season the following seedlings were purchased and have been lined out: 90,000 larch, 200,000 Scots pine, 200,000 spruce, 20,000 Sitka spruce, 10,000 Douglas fir, and 10,000 silver fir. They are looking fairly well. In addition, seed of the following species has been bought and sown: larch (native and Tyrolese), Scots pine, spruce, Sitka spruce, Douglas fir, silver fir, *Tsuga Mertensiana* (*Albertiana*), *Abies grandis*, *Thuja gigantea*, *Sequoia gigantea*, and *Cupressus macrocarpa*. The germination, with the exception of the native larch, is fair.

At the request of the West of Scotland Agricultural College four experimental plots, each divided into six sections containing different species, have been set apart and treated with different artificial manures. The object is to test the effect of these upon the growth of the plants.

Durability of Highland Scots Fir.

A correspondent writes to *The Scotsman* as follows:—"At the east end of Kingussie there is being demolished an interesting relic of the past. Waterloo House, erected in the year of the memorable battle, recalls many memories, but nothing does it bring at the present moment more prominently before the public than the extraordinary value and endurance of the primeval forests of Great Britain. In this erection no wood was used but Glenfeshie Scots fir, squared with the axe, and it is worthy of note that even now, after the lapse of practically a hundred years, not only the rafters but the sarking even is in a substantial state of preservation. The core or centre of each scantling is perfectly sound, and almost as hard as ebony. Some landowners in the Highlands, such as the late Earl of Seafield, who, through his commissioner, the Hon. T. C. Bruce, planted many millions of Scots fir and spruce all over his Strathspey estates, have been far-seeing in this respect, with the result that in a few years an abundant and lucrative asset will be available. In the extensive glens in the Abernethy forests old timber of a remarkable age existed, and from these trees seedlings were grown which produced the valuable forests now in full growth.

Visits of Foreign Professors to Scotland.

All the members of the Royal Scottish Arboricultural Society, and especially those who took part in the Bavarian Excursion of 1909, will be glad to know that our genial and distinguished guide, Professor H. Mayr, of Munich, paid a very welcome visit to Scotland during the month of September. Fortunately, during the week of the visit, the weather conditions were perfect. Mr William Dawson and Dr Borthwick accompanied the professor on a rapidly organised tour to Perthshire, Aberdeen, Elgin and Inverness, in the course of which Murthly, Scone, Durris, Brodie Castle, Bins-ness and Novar were visited.

In the following month Dr Shirasawa, Chief of the Bureau of Forestry of Japan, paid a visit to Scotland. On his arrival in Edinburgh, on the 3rd of October, he was received by Professor Bayley Balfour who conducted him over the Royal Botanic Garden; thence, accompanied by Mr R. Galloway and Dr Borthwick, he paid a visit to Dalkeith Park, Newbattle Abbey, Arniston and Penicuik. Next day Dr Shirasawa was met in Aberdeen by Mr William Dawson, and accompanied by him to Durris. By the gracious permission of His Majesty the King, obtained through the good offices of Professor Bayley Balfour, the distinguished Japanese forester was enabled to see the thriving plantations at Balmoral, and the fine old pine forest of Ballochbuie. A visit to Murthly on the journey south completed his Scottish tour.

Larix Occidentalis.

A member of the Society hopes to have a few thousands of 2-year-old seedlings of *Larix occidentalis* for distribution *gratis* next spring; he would be glad if any members who care to try a few of them would give their names to the Secretary, with the address to which the seedlings are to be sent.

It was noted at Kew last summer that the common larch was badly attacked by aphis, while *L. occidentalis*, growing in mixture with it suffered little, if at all. In the seed bed the latter is weaker and more tender than the former species, but later on it grows quite as fast.

Attack of Lime Trees by Larvæ of Winter Moth.

Mr William Elder, writing from Thoresby Park, Nottinghamshire, states that, recently, he has had letters from several gentle-

men in the South of England, asking how to treat their lime trees, which are attacked by the larvæ of the winter moth (*Cheimatobia brumata*), which devour the foliage in early summer.

Mr Elder adopts the following measures:—About the end of October, he winds a hay-band three or four times round the bole of the tree at about 1½ feet from the ground, and he then smears it with "tree lime," which can be obtained from Messrs Shaw & Son, Worksop. None of the trees so treated have been infected, and for the past two years he has seen but little of the pest on those which were not treated.

Seeds of North American Conifers.

With much regret we have to announce the death of Mr Angus Cameron, whose generous offer to supply Scottish proprietors with seeds of North American conifers was intimated in our last issue.

Grant to Ireland from the Development Fund.

The Development Commissioners have decided to recommend a grant of financial assistance from the Development Fund for forestry purposes in Ireland.—*Times* (Parl. Debates) of 24th Nov.

The Biltmore Forest School, U.S.A.

The following statement is extracted from the Director's announcement for the current year:—

1. All lectures and all school work are meant to convey such information only as is capable of immediate exploitation in the American woods; science is not taught with the view to the training of scientists; it is taught with the sole view to the training of practical workers.

2. The topics treated in the classroom are invariably and immediately worked upon in the woods, the students taking a hand, as far as possible, in all woodwork, engineering work, road work, and sawmill work.

3. The term "forestry" is interpreted at Biltmore in the broadest sense possible, so as to comprise all technical work in any way connected with the forest . . . indeed all timber cruising, logging and lumbering; all work at the sawmill, at the

planing mill, etc.; also all work connected with the inspection, the distribution, and the sale of lumber.

What is, indeed, the meaning of "*American Forestry*" unless it comprises any and all work connected with the *American Forest*?

In October 1910 the class, 58 strong, sailed from New York for Europe, and the last day of that month found them comfortably settled at Darmstadt, whence, as a centre, they are to work the surrounding country during the winter.

Rabbits.

From a pamphlet by M. Henry, of the French Forest School, we learn that for some years past rabbits have swarmed to such an extent in Mecklenburg, and have done such serious damage to forests there, that the public authorities of the province have been obliged to adopt stringent measures for their destruction. Mecklenburg-Schwerin is said to be one vast warren, and beech trees a hundred years old have been completely barked to a height of one foot from the ground. M. Henry observes that a rabbit, from the age of six months may, yearly, give birth to seven litters of from 3 to 8 young ones; and that, consequently, a couple of them might within the space of two years have as many as 1800 descendants, while, within two additional years their number might be increased to 1,274,840. He says that, in Australia, rabbits have become climbers, easily mounting trees to gnaw bark from their trunks and branches.

Felling Trees by Electricity.

The question of felling trees by other means than the axe has for a long time occupied the attention of sawmill engineers. Reciprocating saws driven by steam have been in limited use for many years, and answer fairly well in easy situations and where the trees are regular, but in hilly and difficult positions, owing to the constant moving of the steam plant necessary, they have not proved always commercially successful. To get rid of this difficulty many attempts have been made. In one case electricity was used to heat a copper wire to a white heat, and this was made to practically burn through the trunk of the tree; but, owing chiefly to the accumulation of carbon, resin, etc., on the heated wire, it has hitherto proved a commercial failure.

Recently, however, horizontal reciprocating saws driven by electric motors have been used for tree felling, we believe with very great success. In this case electric power can be generated at any desired point, and carried by means of wires to any place in a wood or hillside that may be necessary with very little loss. The tree-feller usually consists of a horizontal reciprocating saw arranged with a long stroke, and working in suitable guides, the working parts being made light but very strong, so as to be capable of being readily moved from tree to tree. The saw is driven from a crankshaft, but, in lieu of fast and loose pulleys, an eletric motor is coupled directly to the shaft and speeded down to the correct number of revolutions. The form of motor employed should be designed to give a high output with as light a weight as possible. For this purpose a four-pole type of motor, with slotted drum armature, is often used.

In addition to rapidity of work, a tree-feller has a great advantage over the axe in being capable of cutting the tree close to the ground, and thus saving a considerable amount of timber and, at the same time, in many cases it saves the cost of blasting the stumps.

As regards the cost of electric power for this particular work, it will pay well in most cases to generate it by steam, but, of course, where water power is available, it should be made use of, as an immense economy is at once effected, and the current can be carried any reasonable distance without much loss.

Where many trees have to be felled, especially in isolated and difficult situations, we now look for considerable development in this connection.—*Indian Forester, from Timber Trades Journal.*

Preservative against Wood Splitting.

The firm of Daniel Lorach, of Mulhouse (Alsace), has, after many years' experiments, introduced into commerce a most efficacious means for the prevention of wood splitting under the style of "Preservative against Wood Splitting," which possesses the following great advantages:—

It can be applied in the most simple way by means of a brush, drying immediately into a homogeneous surface, and at the same time it is both elastic and resistant, thus taking the place of the bark.

It can be used just as efficaciously with freshly hewn trees as

with planks of all descriptions. If a block of any valuable wood (say £10 worth) measuring 12 feet in length and 2 × 2 feet in width, is split at both ends to the depth of only 4 inches, the loss amounts to 11s. 1½d. Now, it is claimed that if this preservative is used and both ends are coated with the same (which means in this case an outlay of 2½d.) the saving effected on one single log amounts to 10s. 11d. Considering that thousands of logs lose part of their value through splitting at the ends, it is obvious that an enormous economy could be effected.

As it penetrates but very little into the surface of the timber, and as it does not injure the wood in any way (but on the contrary keeps it in good condition), there are no drawbacks to fear. It has already been used in manufactories of agricultural implements, in the construction of mills, in match manufactories, shipbuilding works, forestry work, etc., etc., with the greatest success. We had the opportunity a few days ago of inspecting logs that had been treated by this preservative, and similar wood in its natural state, the former had not a crack in it, whilst the wood that had not undergone the preserving process was split at the ends in all directions.

Our readers can obtain further particulars of the London agent, Mr A. W. Christin, Peninsular House, 4 Monument St., E. C.—*Indian Forester, from Timber Trades Journal.*

Effect of Moisture on Wood.

In his Report on the trade of Philadelphia for 1906, Mr Consul Powell states that the United States Government forest service has, during the last three years, been making a thorough study of the influence of moisture on the strength of wood, and that the chief points presented by the study are:—

1. The relation of moisture to strength follows a definite law which can be graphically expressed. Proper drying very greatly increases the strength of all kinds of wood, the amount of increase in strength depending upon the species and the dryness. The increased strength given to green wood by thoroughly drying it is so great that it will surprise many. For example, the strength of a piece of unseasoned red spruce may be increased over 400 per cent. by a thorough drying at the temperature of boiling water. Strength decreases again, however, as the wood re-absorbs moisture. Air-dried wood protected

from the weather and containing 12 per cent. of moisture is from 1·7 to 2·4 times stronger than when green, varying with the species. Stiffness is also increased by drying. These conclusions, however, are drawn from small-sized pieces not exceeding 4 by 4 inches in cross section, such as are used in the manufacture of vehicles, tools, etc. Large timber requires years of drying before the moisture is reduced to the point where strength begins to increase. It must also be taken into consideration that more or less checking always occurs when large timber dries; and if this checking is excessive it may cause weakness to counterbalance, partially or entirely, the strength gained in drying. Consequently it is not safe to assume that the average strength of large, so-called seasoned timbers is much greater than that of green or wet ones.

2. The *fibre saturation point* of a number of species has been determined. This point, which varies with conditions and species of wood, designates the percentage of water which will saturate the fibres of the wood. It has been found that under normal conditions wood fibre will absorb a definite amount of moisture, beyond which the water simply fills the pores of the wood like honey in honeycomb. Only that water which permeates the wood fibre has an influence upon the strength.

3. Prolonged *soaking* in cold water does not reduce the strength of green wood below that of its fibre saturation point, provided it remains in perfect condition. When wood has been dried and is resoaked it becomes slightly weaker than when green.

4. Wood *soaked in heated water* absorbs moisture because the amount of water which the fibre will contain is increased. This causes a reduction in strength and stiffness, as in wood that is heated or steamed for bending.—*Indian Forester*, *from Indian Trade Journal.*

A New Larch.

Mr W. F. Wight, in the last quarterly issue of the *Smithsonian Miscellaneous Collections*, describes a new larch, *Larix alaskensis*, which has been found on the Upper Kuskokwim, Yukon, and Tanana rivers, in Alaska, where it forms a small tree attaining a maximum height of 40 feet, with a trunk 8 inches in diameter. It differs from *L. dahurica* and *L. laricina* (*pendula*)

by its shorter leaves, but more particularly by its cones, which are very small, the scales being long in proportion to their breadth, and abruptly contracted towards the base, while the ovate acute bracts of the cone are about one-third as long as the scales. It is to be known as the Alaska larch.—*Indian Forester, from The Field.*

Retirement of Mr Grant Thomson.

The retirement of Mr Grant Thomson from active life is a notable incident in the records of Scottish forestry, to which his contribution has been tens of thousands of acres of businesslike plantations. Few men with so much responsibility, facing so many difficulties, leave the trace of so few mistakes. Bold in the conception of his vast undertaking, he was careful in its execution, so that probably no British wood manager has neglected or wasted less of the capital at his disposal; for in spite of his efforts being hampered by the exigencies of game, grazing, climate, and economy, he has shown as no one else has shown how the energy, method, and resource of a dominant personality could transform heather into timber, and utilise the Highland soil to the best private and public advantage. His mental and physical force, and the experience gained during his long working day, enabled him to accomplish his task with comparatively little of that outside help which we are now accustomed to look for and to rely upon. In his time there was no available training in wood management and no useful object-lessons in British silviculture. Mr Grant Thomson had, it is true, the advantage of exchanging views with experts of the Indian Forest Service, who led their pupils to Speyside and Nancy before relegating them to the German Forstmeister. Of such opportunities he took full advantage, and was able to introduce his visitors to his system of natural regeneration on a scale larger than had hitherto been attempted. This was the crowning achievement of his career, for this system of natural regeneration was his chief legacy to the managers of existing woodlands in Scotland, together with the example of large areas reclaimed by afforestation.

But it is not solely as a silviculturist that Mr Grant Thomson is known to troops of friends. He is as much at home in London as on the Grampians, and would have been as remarkable

a figure in most other walks of life. On his retirement he carries with him the respect, admiration, and affection of a whole host of his fellow-countrymen. Jealous of the time he knew so well how to employ, he yet spent it freely for the good of others; and if he did not suffer fools gladly, his fairness to all men, his love of his country, his pride in his profession, and his force of character, all combined to make him the leading figure on Speyside, one never to be forgotten by any silviculturist making his pilgrimage to that Mecca.

Mr Grant Thomson has especially earned the gratitude of Highlanders as a leader in the regeneration of the North by the demonstration of how a whole countryside of waste land can be utilised and made to afford the maximum of employment. Nowhere is there more undeveloped land than in the Highlands, and nowhere a richer soil for silviculture—all that is necessary is that the example before us should be followed by the individual or the State. And had there been more Grant Thomsons we should have heard less call for interference by the State.

R. M. F.

OBITUARIES.

The late Mr D. F. Mackenzie, F.S.I.

(*With Portrait.*)

Mr Mackenzie was a native of Cawdor, in Nairnshire, where his father was a wood manager and engineer. Any little education he received in his early youth was obtained at the Ardersier parish school. In his boyhood he took part in the ordinary work of the farm occupied by his maternal grandfather, but having no liking for such occupation, he gave it up and joined his father's "squad." Thus he learned something of engineering and the manufacture, sale and valuation of timber, and acquired not a little knowledge of levelling, surveying and architecture. Thereafter, while hardly out of his teens, he accepted the under-managership of a large timber business. After some months in this capacity he was appointed manager to the proprietor, the late Mr John Maclennan, Beauly, where he remained nine years. He then took up a

Plate I.

THE LATE MR D. F. MACKENZIE, F.S.I.

By kind permission of the Proprietors of the *North British Agriculturist.*

[*To face page* 114.

similar appointment, with the additional posts of forester and land steward, on the estate of Auchlunkart, in Banffshire. However, he soon found that that position did not give his energies sufficient scope, so he resigned it in 1871, when he transferred his services, as wood manager and land steward, to the Byth estate in Aberdeenshire. After a year thus employed, Mr Urquhart, the proprietor, entrusted him with the management of his Meldrum estate in addition. Here a large extent of arable land was in the proprietor's own hands, and besides timber manufacture on a commercial scale, large improvements were being carried out, such as building, draining, lime burning, etc. After resurveying the estate and giving effect to alterations of boundaries and plantations, he resigned in 1877, on receiving the appointment of sub- or resident-factor for the Murthly and Grantully estates of the late Sir Douglas Stewart. Here works of various kinds and of considerable extent were carried out, all the plans and specifications being prepared by Mr Mackenzie. The Murthly estates extend to over 20,000 acres, and their natural beauty is much enhanced by the great wealth of exotic trees, some of which are believed to grow there with greater luxuriance than in their native habitat. It was in this arboreal paradise that Mr Mackenzie gained most of the wonderful practical knowledge he possessed of exotic trees and their timber.

He resigned the Perthshire appointment in 1883, on becoming factor for the Mortonhall estates in Midlothian. The following year the late Sir Douglas Stewart asked him to reconsider his position and return to Murthly. While he deliberated on the matter, it was decided for him by the late Sir Henry Trotter of Mortonhall appointing him factor for his Charterhall estates in Berwickshire in addition. These appointments he held to the day of his death.

Mr Mackenzie became a member of the Society in 1872. He was elected a councillor in 1879, and served a term of three years. After an interval, he was re-elected in 1883, and thenceforward he served continuously on the council to the day of his death. During that period he served four terms as a vice-president. He was elected a judge of essays in 1884, a position which he also held for many years. At the jubilee of the Society, in 1904, he was elected to the honorary membership, which is the highest honour in the gift of the Society.

Mr Mackenzie contributed articles on many forestry questions to the *Transactions* of the Society, and gained two of the Society's gold medals, besides many others of less value, and he took a leading part in the discussion of the forestry questions of the day. On many of these subjects he was in advance of the opinion of the time, and when questions were being discussed he frequently referred to what he had written in the *Transactions* years before. He held advanced views on the subject of afforestation of waste lands, to which he drew particular attention in an address delivered by him at Dingwall in 1890. On the subject of larch disease his views were not in accordance with those of other experts, and it was well known that he was anxious that the Society should make further investigations into this subject. On various occasions he spoke on behalf of the Society on deputations to members of the Government, and he also gave evidence before the Commission on Coast Erosion.

In 1893, Mr Mackenzie prepared and presented to the Society a collection of microscopic sections of the wood of British-grown trees and shrubs, made into lantern slides, and showing the tissue, medullary rays, etc., and two years later he prepared and presented a collection of micro-photographic slides illustrative of plant physiology, relating specially to trees. In recognition of the original work represented by these sections and slides, the Society awarded him the gold medals mentioned above.

The Mackenzie dendrometer was invented and patented by Mr Mackenzie in 1883. It is self-calculating, and not only measures the height of trees, and other objects, but can also be used for finding the distance of any object.

Mr Mackenzie was an Examiner in Forestry to the Highland and Agricultural Society, and a Fellow of both the Surveyor's Institution and the Botanical Society of Edinburgh. He enjoyed an extensive practice as a consulting forester and land valuator.

While Mr Mackenzie made the most of the slender educational facilities in connection with forestry which were available in his youth, he, unfortunately, never had the advantage of visiting continental forests and of studying continental systems on the spot, which he himself was ready to acknowledge would have been of immense advantage to

him, and would probably have modified, to a considerable extent, his views on our home system of forestry.

Mr Mackenzie had been in failing health for a considerable number of years, but still continued to discharge his duties, and expressed the hope that he would die in harness, which he did, as he was suddenly struck down, on 22nd July 1910, while superintending some estate improvements, and died within a few hours.

Mr James Robertson, late Wood Manager, Panmure.

Mr Robertson was a native of Murthly; as a young man he worked under Mr John Murray, the forester there, and later had charge of the woods on the Grandtully and Murthly estates, where he was much esteemed by the late proprietor, Sir William D. Stewart. About forty years ago he was entrusted with the planting, with large beech trees, of the beautiful avenue which leads from Birnam Hotel to Murthly grounds, and this is a fine monument of his work.

After working for fourteen years at Murthly, Mr Robertson went to the Perth Nurseries to acquire more experience in sowing and transplanting, and he then became forester to Sir M. S. Stewart, Duchall, Kilmacolm. Soon afterwards he received the appointment of wood manager at Drummond Castle, where he remained four years.

About thirty-four years ago the late Earl of Dalhousie, on the recommendation of the late Mr M'Corquodale, Scone, appointed Mr Robertson wood manager on his extensive Panmure estates, where he remained until within a short time of his death.

Mr Robertson was elected a member of the Society in 1872, and ten years later was elected a member of the council, a position which he held for a considerable number of years, finally retiring in 1903. He acted as a judge of essays for several years, and was a local secretary for many years. While he contributed little directly to forestry literature, he was a valued councillor, and took a keen interest in all the affairs of the Society up to the day of his death. During his stay at Panmure he established an extensive nursery and many thriving plantations, and reorganised the management of the old woods. He was generally recognised as a sound forester of the old school.

About a year ago Mr Robertson retired on account of the state of his health, which was unfortunately then more precarious than either he or his friends appeared to realise. He died very suddenly from heart failure on 28th August 1910, at Barnhill, Broughty Ferry, where he had settled on retiring from Panmure.

The late Mr W. R. Fisher.

We regret to record the death, at Oxford, on Sunday the 13th November 1910, of Mr William R. Fisher, M.A., Brasenose College, Assistant Professor of Forestry.

Born at Sydney in February 1846, he was the son of Mr Francis Fisher, Crown Solicitor, New South Wales. He was educated at St John's College, Cambridge, where he took his degree with mathematical honours, coming out twentieth senior optime, in 1867, the year in which W. K. Clifford was second wrangler and second Smith's prizeman. After that for two years he was assistant master at Repton School, and in 1869 he passed as probationer for the Indian Forest Department.

Commencing his studies at Hagenau, in Alsace, he was transferred together with the rest of his class, on the outbreak of the Franco-German War in 1870, to St Andrews University, under the superintendence as to their forest studies of the late Dr Cleghorn of Stravithie. On the termination of the war, Fisher and his companions (among whom were included the late H. C. Hill, Inspector-General of Forests to the Government of India, and D. E. Hutchins, now Conservator of Forests, British East Africa) resumed their studies at the French Forest School at Nancy, and finally went to India in November 1872.

His service for the next few years was in the province of Assam, under Gustav Mann, Conservator of Forests, where he had to do with the formation and tending of the rubber plantation in the Tezpur district; and in 1878, on the formation of the Imperial Forest School at Dehra Dun, N. W. Provinces, he was one of the two trained assistants selected by Dr Brandis for work in the forests attached to the school. Here he rose to be Deputy Director, and finally Officiating Director of the Dehra School; and in 1890 he was appointed Assistant Professor of Forestry at Coopers Hill Engineering College, a post he held to the day of his death, moving with the staff to Oxford in 1905.

During the last twenty years Fisher conducted a class of Indian Forest probationers through some of the best forests in France, and during the last few years the party accompanying him was increased by many private and Colonial students, as well as by Indian Forest officers on leave, several of whom were able to take advantage of the perfect arrangements made by Fisher to renew their acquaintance with those forests, and to profit by the clear and masterly explanations given by him of the latest phases of French forest science. An account of these forests is appearing in the *Quarterly Journal* of the Royal English Arboricultural Society, of which Fisher was editor-in-chief. He was president of that society in 1904 and 1905, and was a member of the Departmental Committee of the Board of Agriculture for re-afforesting Ireland in 1907-08.

Fisher was the author of vols. iv. and v. of Schlich's *Manual of Forestry*, and contributed numerous articles on forestry and allied subjects to the *Land Agents' Record* and other periodicals. He was frequently consulted by landowners in all parts of the country as to the proper management of their woodlands, and, among other works, he was called in to advise the Liverpool Corporation as to how they should plant up the catchment area of Lake Vyrnwy in North Wales, the source of their water supply.

Fisher's untimely death will be felt as a great loss by all interested in British forestry, as his wide experience and training made him one of the leading authorities on the subject.

He was a man of very simple character, and was universally beloved by his students and by a large circle of friends. He was liked and honoured by all ranks of the French Forest Service with whom he came in contact during his class excursions.

A. S.

Death of M. Broilliard, formerly Professor at Nancy.

On the 12th July last, the famous forester, Charles Broilliard, died suddenly at his home at Morey, in the Haute Saône, France, at the age of seventy-nine. M. Broilliard passed into the Forest School of Nancy in 1851, and was top of his year. After active service in various places in France, he was appointed to a professorship at the Forest School in 1865. There he remained for sixteen most useful years till 1881, when he became conservator,

first at Macon and then at Dijon, retiring in 1891. From 1892 to 1903 he was editor of the *Revue des Eaux et Forêts*. He was also closely connected with the Society of Franche Comté and Belfort, of which he was honorary president.

M. Broilliard was the author of several well-known works on forestry, and of innumerable pamphlets. The best known of his works are his *Traitement des bois en France*, written specially to assist private owners of woodlands, and his *Aménagement*, a manual of working-plans which, though written long ago, is a classic and still of the greatest value. M. Broilliard's style was strong and clear, and his letters always most amusing and picturesque. In his latter days there was sometimes a note of patient pathos which was touching, as when he closed a letter to an old pupil with the words, "Je ne puis plus circuler dans les bois, mais la forêt est toujours belle." What it must have cost him to give up his visits to the woods can only be fully understood by those who knew his absolutely passionate devotion to the forests. Great teacher though he was, out of the immense stores of his experience and observation (for he knew all the State forests in France, and had studied them with keenness and wisdom), his greatest value to his pupils was his enthusiasm. None could meet him without seeing a little of that inner light which seemed to burn with the ardour of a religion. He did not believe in a pedantic application of mathematics to forestry, holding that although of course they were necessary in a general sense, yet the conditions of soil, aspect, situation, and many other factors are so infinitely varied that too much should not be expected of mathematics, and that the forester should never cease to watch and observe.

Naturally M. Broilliard was best known in France, but he was also well known abroad, and many members of the Indian Forest Service have been his pupils. To some of them he continued to write to the end of his life his pleasant, characteristic and friendly letters. A. G. H-H.

TRANSACTIONS

OF THE

ROYAL
SCOTTISH ARBORICULTURAL SOCIETY.

VOL. XXIV.—PART II.

July 1911.

LIEUT.-COLONEL F. BAILEY, F.R.S.E.,
HONORARY EDITOR.

ROBERT GALLOWAY, S.S.C.,
SECRETARY AND TREASURER.

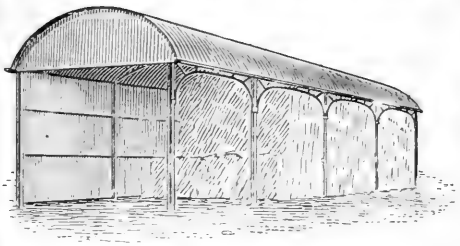
EDINBURGH:
PRINTED FOR THE SOCIETY.
SOLD BY DOUGLAS & FOULIS, CASTLE STREET.

Price to Non-Members, 3/-

A. & J. MAIN & Co., LTD.,

MANUFACTURERS OF

HAY & GRAIN SHEDS.

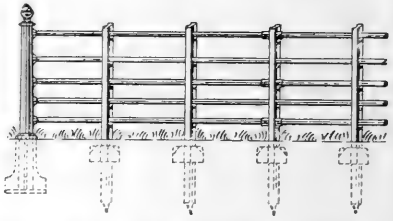


Design No. 661.

In this SHED the HAY or GRAIN can be stored to within a few inches of ROOF.

FOLD YARD COVERINGS,
STEEL AND IRON BUILDINGS,
of every description.

CONTINUOUS BAR FENCING,
IRON & WIRE FENCING,
WROUGHT IRON RAILINGS,
GATES, HURDLES,
PALE FENCING, TREE GUARDS,
Etc., Etc.



Roofing and Fencing Catalogues
on Application.

GALVANIZED WIRE NETTING & FENCING WIRE
at Lowest Prices.

SPECIAL QUOTATIONS ON APPLICATION.

CLYDESDALE IRON WORKS,
POSSILPARK, GLASGOW.

31 BUDGE ROW,
LONDON, E.C.

CORN EXCHANGE BUILDINGS,
EDINBURGH.

BY SPECIAL APPOINTMENT TO HIS MAJESTY THE KING.

Telegrams—

"Hothouse, Edinburgh."

"Iron, Edinburgh."

"Treibhaus, London."

Telephone Nos.—

London—2117 P.O., Hampstead.

Edinburgh—Central, 2674, 2675, and 4665.

Glasgow—Argyle, 2336, National.

MACKENZIE & MONCUR,

HOTHOUSE BUILDERS, LTD.

Heating, Ventilating, and Electrical Engineers, and Iron Founders.

HOTHOUSE BUILDING.—Hothouses of every description designed and erected in any part of the country, with improved Ventilation, Gearing, Staging, and Heating Apparatus complete.

HEATING.—Churches, Public Buildings of all kinds, Schools, Mansions, Villas, &c., heated efficiently by Low Pressure Hot Water, or by Steam. Also by "Barker's" CABLE SYSTEM of Hot Water Low Pressure Heating, with small bore pipes and no sunk stoke-holes.

LIGHTING.—Complete Installations for Lighting by Electricity fitted up in any part of the country. Petrol Gas Lighting Apparatus fitted up complete on approved lines.

FOUNDRY. Architectural Ironwork of all kinds, Stable and Cowhouse Fittings, Sanitary Castings, Manhole Covers, Ventilators, Gratings, &c.

PLANS AND ESTIMATES ON APPLICATION.

EDINBURGH — Registered Office — Balcarres Street.

WORKS—Balcarres Street. **FOUNDRY**—Slateford Road.

GLASGOW—121 St Vincent Street. **LONDON**—8 Camden Road, N.W.

*

Membership.

THE Roll contains the names of over 1350 Members, comprising Landowners, Factors, Foresters, Nurserymen, Gardeners, Land Stewards, Wood Merchants, and others interested in Forestry, many of whom reside in England, Ireland, the British Colonies, and India.

Members are elected by the Council. The Terms of Subscription will be found on the back of the Form of Proposal for Membership which accompanies this Memorandum.

The Principal Objects of the Society,

and the nature of its work, will be gathered from the following paragraphs:—

Meetings.

The Society holds periodical Meetings for the transaction of business, the reading and discussion of Papers, the exhibition of new Inventions, specimens of Forest Products and other articles of special interest to the Members, and for the advancement of Forestry in all its branches. Meetings of the Council are held every alternate month, and at other times when business requires attention; and Committees of the Council meet frequently to arrange and carry out the work of the Society.

Prizes and Medals.

With the view of encouraging young Foresters to study, and to train themselves in habits of careful and accurate observation, the Society offers Annual Prizes and Medals for essays on practical subjects, and for inventions connected with appliances used in Forestry. Such awards have been granted continuously since 1855 up to the present time, and have yielded satisfactory results. Medals and Prizes are also awarded in connection with the Exhibitions aftermentioned.

School of Forestry, Afforestation, Etc.

Being convinced of the necessity for bringing within the reach of young Foresters, and others interested in the Profession, a regular systematic course of Instruction, such as is provided in Germany, France, and other European countries, the Society, in 1882, strongly urged the creation of a British School of Forestry; and with a view of stimulating public interest in the matter, a Forestry Exhibition, chiefly organised by the Council, was held in Edinburgh in 1884.

As a further step towards the end in view, the Society, in 1890, instituted a Fund for the purpose of establishing a Chair of Forestry at the University of Edinburgh, and a sum of £584, 3s. 10d. has since been raised by the Society and handed over to the University. Aided by an annual subsidy from the Board of Agriculture, which the Society was mainly instrumental in obtaining, a Course of Lectures at the University has been delivered without interruption since 1889. It is recognised, however, that a School of Forestry is incomplete without a practical

training-ground attached to it, which would be available, not only for purposes of instruction but also as a Station for Research and Experiment, and as a Model Forest, by which Landowners and Foresters throughout the country might benefit. The Society accordingly drew up a Scheme for the Establishment of a State Model or Demonstration Forest for Scotland which might serve the above-named objects. Copies of this Scheme were laid before the Departmental Committee on British Forestry, and in their Report the Committee recommended the establishment of a Demonstration Area and the provision of other educational facilities in Scotland.

The Government has recently acquired the Estate of Inverliever in Argyllshire; and while this cannot be looked on as a Demonstration Forest, it is hoped that it may prove to be the first step in a scheme of afforestation by the State of unwooded lands in Scotland. Meantime Mr Munro Ferguson, M.P., for a part of whose woods at Raith a Working-Plan has been prepared, and is now in operation, has very kindly agreed to allow Students to visit them.

After the Development Act came into operation, the Council passed a Resolution urging that the Government should, as soon as possible, create a Board of Forestry, with an adequate representation of Scottish Forestry upon it, and an Office in Scotland, where the largest areas of land suitable for Afforestation are situated, which would provide Demonstration Forests and Forest Gardens, and otherwise assist the development of University and other Educational enterprise, and would carry out, as an essential preliminary to any great scheme of National Afforestation, a Survey of all areas throughout the country suitable for commercial planting. The Society's policy for the development of Forestry in Scotland has since been fully laid before the Development Commission. As a result of these representations, the Secretary for Scotland has appointed a Committee to report regarding the acquisition and uses of a Demonstration Forest Area, and any further steps it is desirable to take in order to promote Silviculture in Scotland. The Society has also published a valuable Report on Afforestation—including a Survey of Glen Mor—prepared for it by Lord Lovat and Captain Stirling, which, it is hoped, may form the basis of the Forest Survey, by the Government, advocated by the Society.

Excursions.

Since 1878 well-organised Excursions, numerously attended by Members of the Society, have been made annually to various parts of Scotland, England, Ireland, and the Continent. In 1895 a Tour extending over twelve days was made through the Forests of Northern Germany, in 1902 a Tour extending over seventeen days was made in Sweden, during the summer of 1904 the Forest School at Nancy and Forests in the north of France were visited, and in 1909 a visit was undertaken to the Bavarian Forests. These Excursions enable Members whose occupations necessarily confine them chiefly to a single locality to study the conditions and methods prevailing elsewhere; and the Council propose to extend

the Tours during the next few years to other parts of the Continent. They venture to express the hope that Landowners may be induced to afford facilities to their Foresters for participation in these Tours, the instructive nature of which renders them well worth the moderate expenditure of time and money that they involve.

Exhibitions.

A Forestry Exhibition is annually organised in connection with the Highland and Agricultural Society's Show, in which are exhibited specimens illustrating the rate of growth of trees, different kinds of wood, pit-wood and railway timber, insect pests and samples of the damage done by them, tools and implements, manufactured articles peculiar to the district where the Exhibition is held, and other objects of interest relating to Forestry. Prizes and Medals are also offered for Special Exhibits. In addition to the Annual Exhibition before referred to, a large and important Forestry Section organised by this Society was included in the Scottish National Exhibition which was held in Edinburgh in 1908, and a similar Section is included in the Scottish Exhibition of National History, Art, and Industry, which is being held in Glasgow this summer.

The Society's *Transactions*.

The *Transactions* of the Society, which extend to twenty-four volumes, are now published half-yearly in January and July, and are issued *gratis* to Members. A large number of the Prize Essays and other valuable Papers, and reports of the Annual Excursions, have appeared in them, and have thus become available to Students as well as to those actively engaged in the Profession of Forestry.

Honorary Consulting Officials.

Members have the privilege of obtaining information gratuitously upon subjects connected with Forestry from the following Honorary Officials appointed by the Society.

Consulting Botanist.—Isaac Bayley Balfour, LL.D., M.D., Sc.D., Professor of Botany, Royal Botanic Garden, Edinburgh.

Consulting Chemist.—Alexander Lauder, D.Sc., 13 George Square, Edinburgh.

Consulting Cryptogamist.—A. W. Borthwick, D.Sc., Royal Botanic Garden, Edinburgh.

Consulting Entomologist.—Robert Stewart MacDougall, M.A., D.Sc., Professor of Entomology, etc., 9 Dryden Place, Edinburgh.

Consulting Geologist.—R. Campbell, M.A., B.Sc., Geological Laboratory, University of Edinburgh.

Consulting Meteorologist.—Andrew Watt, M.A., F.R.S.E., Secretary Scottish Meteorological Society, 122 George Street, Edinburgh.

Local Branches.

Local Branches have been established in Aberdeen and Inverness for the convenience of Members who reside in the districts surrounding these centres.

Local Secretaries.

The Society is represented throughout Scotland, England, and Ireland by the Local Secretaries whose names are given below. They

are ready to afford any additional information that may be desired regarding the Conditions of Membership and the work of the Society.

Register of Estate Men.

A Register of men qualified in Forestry and in Forest and Estate Management is kept by the Society. Schedules of application and other particulars may be obtained from the Local Secretaries in the various districts, or direct from the Secretary. It is hoped that Proprietors and others requiring Estate men will avail themselves of the Society's Register.

Consulting Foresters.

The Secretary keeps a list of Consulting Foresters whose services are available to Members of the Society and others.

Correspondents.

The following have agreed to act as Correspondents residing abroad: —

Canada,	ROBERT BELL, I.S.O., M.D., LL.D., D.Sc.(Cantab.) F.R.S. of Ottawa. Chief Geologist to Government of Canada, Ottawa.
India,	F. L. C. COWLEY BROWN, Deputy Conservator of Forests, c/o Inspector-General of Forests, Simla.
British East Africa,	EDWARD BATTISCOMBE, Assistant Conservator of Forests, Nigeri, *via* Naivasha, East Africa Protectorate.
United States of America,	HUGH P. BAKER, Forester, State College, Pennsylvania.
Cape Colony,	W. NIMMO BROWN, M'Kenzie's Farm, Mowbray, P.O.
Western Australia,	FRED MOON.

LOCAL SECRETARIES.

Scotland.

Counties.	
Aberdeen,	JOHN CLARK, Forester, Haddo House, Aberdeen.
	JOHN MICHIE, M.V.O., Factor, Balmoral, Ballater.
Argyle,	JOHN D. SUTHERLAND, Estate Agent, Oban.
Ayr,	ANDREW D. PAGE, Overseer, Culzean Home Farm, Ayr.
	A. B. ROBERTSON, Forester, The Dean, Kilmarnock.
Berwick,	WM. MILNE, Foulden Newton, Berwick-on-Tweed.
Bute,	WM. INGLIS, Forester, Cladoch, Brodick.
	JAMES KAY, Barone, Rothesay.
Clackmannan,	ROBERT FORBES, Estate Office, Kennet, Alloa.
Dumfries,	D. CRABBE, Forester, Byreburnfoot, Canonbie.
East Lothian,	W. S. CURR, Factor, Ninewar, Prestonkirk.
Fife,	WM. GILCHRIST, Forester, Nursery Cottage, Mount Melville, St Andrews.
	EDMUND SANG, Nurseryman, Kirkcaldy.
Forfar,	JAMES CRABBE, retired Forester, Glamis.
Inverness,	JAMES A. GOSSIP, Nurseryman, Inverness.
Kincardine,	JOHN HART, Estates Office, Cowie, Stonehaven.
Kinross,	JAMES TERRIS, Factor, Dullomuir, Blairadam.

Scotland.

Counties.	
Lanark, .	JOHN DAVIDSON, Forester, Dalzell, Motherwell.
	JAMES WHITTON, Superintendent of Parks, City Chambers, Glasgow.
Moray, .	D. SCOTT, Forester, Darnaway Castle, Forres.
Perth, .	JOHN SCRIMGEOUR, Doune Lodge, Doune.
Renfrew, .	S. MACBEAN, Overseer, Erskine, Glasgow.
Ross, .	JOHN J. R. MEIKLEJOHN, Factor, Novar, Evanton.
	Miss AMY FRANCES YULE, Tarradale House, Muir of Ord.
Roxburgh, .	JOHN LEISHMAN, Manager, Cavers Estate, Hawick.
	R. V. MATHER, Nurseryman, Kelso.
Sutherland, .	DONALD ROBERTSON, Forester, Dunrobin, Golspie.
Wigtown, .	JAMES HOGARTH, Forester, Culhorn, Stranraer.
	H. H. WALKER, Monreith Estate Office, Whauphill.

England.

Beds, .	FRANCIS MITCHELL, Forester, Woburn.
Berks, .	W. STORIE, Whitway House, Newbury.
Cheshire, .	WM. A. FORSTER, Belgrave Lodge, Pulford, Wrexham.
Devon, .	JAMES BARRIE, Forester, Stevenstone Estate, Torrington.
Durham, .	JOHN F. ANNAND, Lecturer on Forestry, Armstrong College, Newcastle upon-Tyne.
Hants, .	W. R. BROWN, Forester, Park Cottage, Heckfield, Winchfield.
Herts, .	JAMES BARTON, Forester, Hatfield.
	THOMAS SMITH, Overseer, Tring Park, Wigginton, Tring.
Kent, .	R. W. COWPER, Gortanore, Sittingbourne.
Lancashire, .	D. C. HAMILTON, Forester, Knowsley, Prescot.
Leicester, .	JAMES MARTIN, The Reservoir, Knipton, Grantham.
Lincoln, .	W. B. HAVELOCK, The Nurseries, Brocklesby Park.
Middlesex, .	Professor BOULGER, 11 Onslow Road, Richmond Hill, London, S.W.
Notts, .	WM. ELDER, Thoresby, Ollerton, Newark.
	W. MICHIE, Forester, Welbeck, Worksop.
	WILSON TOMLINSON, Forester, Clumber Park, Worksop.
Suffolk, .	GEORGE HANNAH, The Folly, Ampton Park, Bury St Edmunds.
Surrey, .	JOHN ALEXANDER, 24 Lawn Crescent, Kew Gardens.
Warwick, .	A. D. CHRISTIE, Hillside, Frederick Road, Selly Oak, Birmingham.
Wilts, .	ANDREW BOA, Land Agent, Glenmore, The Avenue, Trowbridge.
York, .	D. TAIT, Estate Bailiff, Owston Park, Doncaster.

Ireland.

Dublin, .	A. C. FORBES, Department of Forestry, Board of Agriculture.
	JAMES WILSON, B.Sc., Royal College of Science, Dublin.
	ARCH. E. MOERAN, Lessadell, Thelorgan Park.
Galway, .	THOMAS ROBERTSON, Forester and Bailiff, Woodlawn.
King's County,	WM. HENDERSON, Forester, Clonad Cottage, Tullamore.
Tipperary, .	DAVID G. CROSS, Forester, Kylisk, Nenagh.
	ALEX. M'RAE, Forester, Dundrum.

Royal Scottish Arboricultural Society

FORM OF PROPOSAL FOR MEMBERSHIP.

To be signed by the Candidate, his Proposer and Seconder, and returned to ROBERT GALLOWAY, S.S.C., *SECRETARY*, Royal Scottish Arboricultural Society, 19 Castle Street, Edinburgh.

Candidate's

Full Name, ...

Designation, Degrees, etc., ...

Address, ...

Life, or Ordinary Member, ...

Signature, ...

Proposer's

Signature, ...

Address, ...

Seconder's

Signature, ...

Address, ...

[CONDITIONS OF MEMBERSHIP, see Over.

CONDITIONS OF MEMBERSHIP (excerpted from the Laws).

III. Any person interested in Forestry, and desirous of promoting the objects of the Society, is eligible for election as an *Ordinary* Member in one of the following Classes:—

1. Proprietors the valuation of whose land *exceeds* £500 per annum, and others, subscribing annually . . One Guinea.
2. Proprietors the valuation of whose land *does not exceed* £500 per annum, Factors, Nurserymen, Timber Merchants, and others, subscribing annually . . Half-a-Guinea.
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, subscribing annually . . . Six Shillings.
4. Assistant-Foresters, Assistant-Gardeners, and others, subscribing annually . . . . . Four Shillings.

IV. **Subscriptions are due on the 1st of January in each year, and shall be payable in advance. A new Member's Subscription is due on the day of election unless otherwise provided, and he shall not be enrolled until he has paid his first Subscription.**

V. Members in arrear shall not receive the *Transactions*, and shall not be entitled to vote at any of the meetings of the Society. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.

VI. Any eligible person may become a *Life* Member of the Society, on payment, according to class, of the following sums:—

1. Large Proprietors of land, and others, . . . £10 10 0
2. Small Proprietors, Factors, Nurserymen, Timber Merchants, and others, ... 5 5 0
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, ... 3 3 0

VII. Any *Ordinary* Member of Classes 1, 2, and 3, who has paid *Five* Annual Subscriptions, may become a *Life* Member on payment of *Two-thirds* of the sum payable by a *new* Life Member.

XII. Every Proposal for Membership shall be made in writing, and shall be signed by two Members of the Society as Proposer and Seconder, and delivered to the Secretary to be laid before the Council, which shall accept or otherwise deal with each Proposal as it may deem best in the interest of the Society. The Proposer and Seconder shall be responsible for payment of the new Member's first Subscription. The Council shall have power to decide the Class under which any Candidate for Membership shall be placed.

CONTENTS.

The Society does not hold itself responsible for the statements or views expressed by the authors of papers.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY

15. The State and Private Woodlands.[1]

By Wm. Dawson, M.A., B.Sc.

Now that the great body of public opinion has turned in favour of afforestation, things are ripe for development, and the question which remains to be answered is,—How can development take place most quickly and most economically? It is necessary that every point of view be considered, and that every scrap of experience which has been gained in this and in other countries be brought forward, so that we may devise a complete scheme to suit our own particular circumstances.

The many proposals which have been put forward are unanimous in laying the burden of afforestation on the State. It is recognised that unaided, individual enterprise can never bring very much of the ideal timber lands of our country again under trees. The State will be obliged, in the first instance, to find the money. The question as to how far the State itself is to directly apply the money, or how far the money can be used to foster the industry in private hands, is a matter for the most careful consideration. Further, as private woods of considerable extent are already in existence, and as the maintenance of these woods is now recognised as a matter of national importance, we have also to consider the question of how far the State can interfere with the private individual in the working of his woods, and how far it can restrict his rights. In a proper adjustment of these points lies the solution of the problem. I propose to bring forward some facts as to the position of things in other lands, not with the idea of suggesting that we should copy what other countries have done, but of showing what their experience has been, and of seeing if, in their often dearly bought experience, we can find anything of use.

[1] A paper read before the Society in Edinburgh on 3rd February, 1911.

In this country, the whole of the woodlands are privately owned, with the exception of the Crown woods in England, which form about 2 per cent. of the whole. Thus, forestry has been kept alive in this country by the foresight and the efforts of private individuals; but individual effort has not succeeded in maintaining the woodland area. Each year the cutting is considerably in excess of the replanting, and this in face of the facts proving the necessity for extending the area. This state of affairs has forced many people to the conclusion, that, as a private enterprise, forestry cannot be a success, and that the State alone can successfully cope with the problem. On the other hand, in most of the countries of the Continent, the area of woodlands in the hands of individuals is far in excess of that directly under the State. Only in Russia, Spain and Greece, do the State-owned forests exceed in extent those privately owned.

Proportion of Forest Area in possession of the State in—

Russia	66·4 per cent.
Germany	33·7 ,,
Sweden	33·2 ,,
Norway	28·5 ,,
Denmark	23·8 ,,
Hungary	15·2 ,,
France	12·0 ,,
Austria	7·3 ,,
Belgium	4·8 ,,
Switzerland	4·6 ,,
Britain (Crown)	2·2 ,,

In weighing the advantages and disadvantages of State ownership and of private ownership of woodlands, it is interesting to note that, usually, the profits are far higher in the State woods than in the private woods. No doubt, instances can be cited where this is not the case, but where forestry is really worked as a business, the fact is indisputable. In Germany, we find that the timber yield and the net profit is bigger in the State woods than in the Communal woods, and in these again higher than in the private woods. From returns of 1900 we find that the private woods return just about half the profit per acre that the State woods yield. Sixty years ago, State and private woods yielded about the same returns, but the State

woods have been steadily rising in value. The State has not been afraid to make its management more intensive.

Among continental countries, State ownership of a considerable area of wood is also invariably accompanied by a complete and thorough educational system. Perhaps in no other way does the private owner stand to benefit more from State action than in this. In Hungary, there are about half-a-dozen schools for forestry apprentices, apart from the higher educational institutions. In Germany, there is a much bigger number of the same type of school. These schools are worked in conjunction with State forests, and the training given qualifies the men to act as forest overseers and guards, that is for the lower branches of the State service. Then in each country there are institutions for higher education where a complete scientific training can be got. Each State has at least one such place, and some of them have several. Germany has eight, some of them as University Departments and others as separate colleges. In addition, or often in connection with these, there are research stations with special investigators detailed off for special work. Then, directly for the benefit of the landowner and land agent, instruction in forestry is given in the agricultural colleges. It is interesting to note that the comparative failure of private forestry in some parts of Germany, is attributed to the fact that formerly the agricultural colleges in these parts did not teach the subject. The landowners or land agents, when studying at the agricultural college, had thus no opportunity of studying the subject. Nowadays this has mostly been put right, and in some of the agricultural colleges, forestry occupies a surprisingly prominent place. Other educational facilities are also provided to suit the special circumstances of each country.

Closely associated with this, is the system of placing at the disposal of the landowner, expert advice as to the laying down and management of his woods. This work of advising is, in some cases, done by the ordinary State officers of the district; in others, by special officers, or by the staffs of the various teaching bodies. Some of the countries have developed this system to a considerable extent. In Bavaria, the local officers are lent where possible, but in addition there is a special staff of officers who, though they rank with the ordinary officials, have no State woods to manage, and whose whole time is occupied in sasisting and advising private owners and public

bodies which own woods. In Saxony, the Department of Forestry undertakes, at low charges, the making of working-plans for private estates. In most States such assistance is given, and in many it is given gratis.

Still another means adopted by many States for advancing private forestry, is the distribution of good plants at cost price to willing planters. In Germany, and in Austria and Hungary, many millions of plants are distributed annually to private planters at trifling prices. In some cases (often in Italy) they are given free; but experience goes to prove that where free distribution takes place the results are disappointing. Much is made of this system, and, as a rule, the result seems to justify the method, but the need for such a system is not apparent with us. In this country, a willing planter can always find the planting material; and, after all, the system is only applicable to countries with peasant proprietorship, where the woods are parcelled up into small lots. One thing, however, the State might well do in this connection, is to establish seed control stations, which would serve the professional seedsman as well as protect the private buyer. This matter is not in such a satisfactory state as it should be, and the question of the seed is too important to be left to chance. It is certainly the work of the State to see that the private woodowner is not handicapped more than is necessary.

Then there is the question of taxation, and here, perhaps, more than anywhere else do we meet with difficulties. The woodlands must, of course, bear their fair share of taxation, but in special circumstances there might be room for readjustment; especially is this true in the case of new plantations. Where new plantations have been made, the land is unproductive of any rent for a considerable period. Hence, as an encouragement to planting, it might be suggested that land, planted for the first time, be relieved of part or even the whole of its taxation for a period of years. There is nothing unreasonable in this proposition, as the land in question, in addition to being unproductive for the time being, has had a considerable amount of capital expended upon it. Then at the end of a period of twenty to twenty-five years, when the wood came near to being self-supporting, it would be in a position to pay its proper contribution to the national exchequer. The temporary loss to the State would be trifling, while the encouragement given

to the individual would be considerable. This applies, of course, only to the planting of new ground, not to the replanting of ground from which a crop has been taken. Woods worked on a proper system are able to bear their fair share of taxation at all periods. In many of the States on the Continent, the system of remitting taxes under these circumstances is already in operation. In Baden, since 1886, land which has just been brought under trees is free of the ordinary land tax for a period of twenty years. In Austria, since 1869, it is relieved for a period of twenty-five years, whereas in France certain classes of land have to pay only three-fourths of the ordinary tax for a period of thirty years. In Alsace-Lorraine, when heath land or sandy wastes are afforested, the land in question is relieved for thirty years. In Russia, protection woods are free for ever, while all newly-made plantations are relieved for thirty years. Further claims than this to escape taxation, the woodland has none. It is simply analogous to affording protection to a new industry till such time as it is established and able to hold its own. The woodlands must pay their contribution to the national income, like the rest of our resources, but the special circumstances of the moment call for special consideration. As regards expenditure entailed in replanting existing woodlands, it might be claimed that here again there is ground for rebate, in this case in income tax. In a properly organised system of forestry, the expenditure entailed in replanting forms a necessary part of the working expenses, without which the business could not be carried on. It is simply part of the overturn of the business. In Prussia a rebate is, at the present time, allowed on this head, and, in addition, a rebate is allowed for the annual amount expended in the protection and in the general management of the woods. In Würtemberg and one or two other of the German states, the cost of replanting and of protection only are deducted. In Bavaria and the other states no rebate in income tax is allowed on these heads at all. On this point, however, there are strong claims for consideration, and it is certain that the adoption of such a system would immediately have beneficial results, and would, without more ado, ensure the replanting of cleared ground. Here again the immediate loss to the State would be trifling in comparison to the ultimate gain.

The question of State loans opens up another great field

of possibilities. Any system by which the State acquires the land outright entails enormous expense, before anything can be done in the way of planting. Then for a very big expenditure, only a small area of new woodlands can be created. Extension would be much more rapid if the bulk of the available money could be spent in the actual work of planting. This clearly suggests co-operation between the individual who can supply the land, and the State which can find the money. There are several different forms which such co-operation can take, but I propose to deal only with that where the State advances the money in the form of loans. Although there are great possibilities in this, there are also certain elements of difficulty. In the first instance, there is the necessity for some measure of dual control, which frequently means double the expense for half the efficiency. The State, as the lender, must see that the moneys are properly spent, and that the management of the woods is such as to afford sufficient security. Thus, as a direct transaction, the State would certainly lose, as the money must necessarily be cheap. No doubt, in many cases, it may be worth the State's while to lose on the transaction directly, on account of the indirect advantage which might follow, but as a general scheme it would become expensive. Then again, if the onus of finding the cheap money is to be put on the State, the State has the right of dictating how the money is to be spent, and the borrower must forfeit his liberty in the management of his woods. Further, a loan brings with it other disadvantages, and at best it is only a loan. In Germany, money is often advanced by the State, less often to individuals, however, than to communes, corporations and local authorities. In Hanover, where there are vast tracts of moorland, a system was introduced by which the State supplied, in the form of a premium, forty per cent. of the cost of new plantations. The remainder, or any part of it, can be given in the form of a loan. The rate of interest charged on the loan is 2 per cent. to corporations or suitable local authorities, and 3 per cent. to private individuals, while in both cases an additional 2 per cent. is paid to a sinking fund. The work of afforestation and supervision is mostly done by the State authorities. This is really a very suggestive scheme, and is well worthy of our consideration. In Hanover, most of the work has been done through the various villages and councils, like our own County Councils. The idea is sound, as it throws

part of the responsibility on the local authority and part of the expense on the general taxpayers of the district in question. Some County Councils in Scotland have already been taking steps to secure grants for afforestation, but till there is a definite State department to secure proper supervision, and a definite scheme somewhat on the lines that I have described, it would be sheer waste of money. With a department, and with such a scheme, the possibilities are great. County Councils are responsible for developing their districts, and a scheme of afforestation is a sure way of doing it. Ultimately it would mean a great increase in work in the district, and with the new industries which would arise, it would mean a large increase in the rate-paying population.

As illustrations of what can be done in this way let me quote two cases. In the Landes, near Bordeaux, we have a case where a huge area, almost 2,000,000 acres, of the worst possible kind of land was turned into flourishing forest. Prior to 1857, some 50,000 acres had been planted, mostly by private individuals and communes. In 1857, a law was passed placing the responsibility for afforestation on the various local authorities, and if they could not see their way to undertake the work, the State did so, but took possession of the land till such time as the capital expended and the interest thereon was repaid. Loans were offered but only seldom taken advantage of, as most of the communes did the work without even borrowing. In this way no less than 1,700,000 acres were planted—120,000 by the State, 180,000 by communes, and 1,300,000 acres by private individuals.

The afforestation of the Karst district in Austria (Istria, Dalmatia, Herzegovina) was even more remarkable. This vast tract of wilderness of 12,000,000 acres, of which about 5,000,000 acres are afforestable, is gradually being covered. Special committees have been appointed, and, by a system of loaning money by the State, the work is going forward, to a considerable extent, in private hands.

In both these cases the subjects dealt with are not fine timber lands like our own, but ground which presents almost all the difficulties that can arise.

Let us now look for a little at the other side of the question. If forestry is of such national importance that the forest owner can legitimately call on the State for help, then the State

will be justified in adopting means to secure that the industry suffers in no way at the hands of those in charge of it. If the State loans or gives money for forestry purposes, then this certainly is true; but even apart from that some measure of State interference may be justified. As the forests really are of national importance, it is argued that their owners should have to conform to strict regulations, and that neglect to re-plant should be punishable. Such laws may not be desirable, and certainly ought not to be necessary; but, on the other hand, we are faced with the fact that the area of forest in this country is steadily decreasing. Cutting goes on with the same cheerful abandon, while re-planting is in many cases tardy, and often entirely neglected. There seems to be little hardship entailed in making this impossible, as the advantage of maintaining the woodlands is of such great importance to the property itself, and to the individual. We find that in Prussia and Saxony the private woodowner is not restricted in any way, except in special cases where afforestation has been carried out by public money. In most of the other German states things are different. In all of them re-planting is compulsory; and, in some, regulations are laid down for the general working of the woods. The effect of these laws is clearly to be seen in the condition of the woods. They are certainly justified. In the north, where there is no compulsion, the area of the private woodlands is decreasing. In Prussia, Saxony and Mechlenburg, in spite of State assistance and good example, in the period 1883-1900, the area decreased by about 600,000 acres, whereas in Bavaria and the other states, where re-planting is compulsory, the area has not merely remained constant, but has actually been largely increased. It is obvious, therefore, that no hardship is felt by the forest owner, for by his own efforts he keeps on increasing his holding. Any regulations, to be workable, must of course be so far elastic, in order to suit changing conditions. It must not be thought that the removal of woods is in every case a calamity, or in many cases the ground they occupy could be put to better use, and there can be no doubt but that, especially in England, woods sometimes occupy ground to which they have no claim. Even at the present time such woods are being formed.

In the countries where legislation on this head does exist, it is mainly directed to maintaining the area of existing woodlands,

rather than to the creating of new ones. The Bavarian laws may be summed up by saying, that the utilisation of existing woodlands for purposes other than that of growing timber is permitted, only when it can be shown that the proposed use, brings with it advantages in the form of higher ground rent or other economic gains. The Act of 1852-96 reads:

"Art. 34. Complete or partial deforestation of land is permitted:

(*a*) When the area in question can be used to greater advantage, as for agriculture, gardening, etc."

Then follow other conditions.

"Art. 36. The intention of deforesting must be announced to the Forest Authorities, who will make inquiries into the circumstances and report."

"Art. 75. Infringement of the law is punishable by a fine which may equal the value of the wood felled (prior to 1896, £4 to £60 per acre)."

Failure to restock the ground, or a second offence of the same kind, is punishable with a higher fine, and besides, if the reafforestation does not take place at once, the work is done by the Forest Authorities at the owner's expense. In Baden, a similar law prevails. An Act of 1879 fixes the penalty for unallowed deforestation at the value of the wood felled, and, if that value exceed £75, still heavier penalties can be imposed. In Würtemberg (Act 1879–1902) the conditions are somewhat similar, and here, when permission is given, a fee of one shilling to two shillings per acre must be paid. In Austria, since 1852, deforestation without permission has been illegal, while in Russia it is allowed for certain purposes, but only when the area taken away is compensated for by the addition of a like area elsewhere, or where a like area has been added within the previous twenty years.

Laws enforcing replanting follow naturally on those forbidding deforestation, only, the latter are intended to prevent clearances for a specific purpose, whereas the former are intended to prevent neglect. Legislation on this head is fairly common. In most states where it exists, no definite period is prescribed within which replanting must take place. In most cases, the local forest authority prescribes the period to suit the particular case. In Bavaria, Würtemberg, Baden, etc., if replanting has not taken place within the prescribed period, fines

varying from £8 to £20 per acre can be imposed, and the ground can be replanted by the State at the owner's expense. Interest as high as $3\frac{1}{2}$ per cent. is charged on the sum expended in some cases. This method, however efficient it may appear, is cumbersome, and often difficult of execution. The Austrian arrangement seems more business-like. There, the fine is repeated periodically, each time higher than before till the land is replanted. The South German laws also insist on the ground being fully stocked. These laws are never harshly applied. It is only after all warnings and offers of advice have failed, and all assistance been refused, that the final steps are taken. Every sympathy is extended to the owner, and full cognisance taken of all his circumstances at the moment, but for obstinate cases the law is there, and may be put in operation. That the laws do not press hardly is shown by the fact I mentioned, namely, that the area of privately owned wood in the south of Germany is steadily increasing.

In a few states, before felling is permitted, guarantees for the replanting of the ground are demanded. This is the case in Baden. Previous to 1896, the law could demand the deposit of money, but since 1896 bonds of sufficient amount are accepted. Even these need not be demanded in every case. Often the personal guarantee is enough. Similar regulations are in force in different parts of Austria.

Legislation on the actual methods of management is less common. In most countries, owners are permitted to adopt whatever system they please, provided the area of woodland is maintained. In some places, however, it is illegal to cut down immature wood, excepting in special cases. In Austria and Hungary, when the area of woodland in the hands of private individuals or public bodies exceeds a certain amount, a properly qualified and State-certificated forester must be employed. Practically everywhere, forest owners are bound to take steps for the necessary protection of their woods from insect and other pests. On the whole, the State attitude is one of sympathy to the private woodowner. Assistance is given in every way, and only as a last resource is actual restraint or compulsion resorted to.

In putting forward these facts, I have refrained from comments on how far they fit our own conditions, or how far the methods employed are desirable, but at the present moment, when we are

searching for ways and means of again bringing the timber lands of our country under forest, we must carefully examine everything bearing on the subject. It is clear that State action, whatever shape it may take, does not relieve the landowner of his responsibilities in regard to his woods. State care and assistance does not do away with the necessity for individual effort. In this country, private enterprise, quite unaided, has already done much in forestry, and with some measure of State assistance we can confidently look to it to accomplish more.

16. The Vegetation of Woodlands.

(*Concluded from page* 23.)

By Dr W. G. Smith.

It still remains to trace the connection between the practical side of forestry and the more strictly botanical aspects of woodlands dealt with in the earlier part of this paper. Probably a considerable part of what follows is familiar to many foresters who could add to it from their own experience. The object of the paper will have been attained if it leads others to add further and more useful observations on woodland vegetation.

It is of considerable value to have proof that the natural and semi-natural woods of Britain can be grouped into the fairly definite scheme already given. This adds nothing materially to what the forester who has travelled about already knows, but it is something gained to know how many types of wood there are, and where to expect them. The difficulty of classifying woods is also simplified, because the factors which count most are few in number, namely, wetness or dryness of soil, the presence or absence of lime and humus, and the items included under the terms exposure and shelter. It seems a natural follow-on to assume that if certain soils and situations are more favourable for native trees, then these same conditions must tell in the case of non-native trees with a timber value, such as sycamore, beech, Spanish chestnut and the exotic conifers. This is a branch which the forester might profitably follow up. On oak soils of the drier, shallower type, with a ground-vegetation of bracken, fern and wood hyacinth, it has been observed that sycamore grows freely

from seedlings, so that woods badly looked after become in time filled up with young sycamores. Larch always seems to us to grow well on the drier soils where ash is a natural tree, and, although often planted with Scots pine, the heathy soil which carries a good crop of Scots pine may be a poor soil for larch.

The natural classification of woods also raises another point. Under certain conditions the oak or other tree may form natural woodlands, but it does not follow that wherever a tree occurs naturally, it always produces good timber. The following experience illustrates this point. On a large Yorkshire estate, ash is abundant in the oak-woods on soils rather poor in lime; in another part of the same estate, ash is the only large tree on the highly calcareous mountain limestone where oak is absent, except on the river gravels; in both oak-woods and ash-woods the ash grows to a good size, but when it comes on the market the limestone ash always brings the better price. In this case, the tree natural to the soil yields there the best timber. An instance of the opposite kind was also seen in Yorkshire. On the Permian limestones, ash seedlings grow up abundantly wherever there is a break, but in spite of careful attention the long, lanky saplings are not easy to rear into good timber trees; in this district, the deeper soils seem much better suited for beech and larch.

In the former part of this paper, considerable attention was directed to the connection between the naturally dominant trees on the one hand, and the undergrowth and ground-vegetation on the other hand. This raises the question whether the ground-vegetation is of any value to the forester,—does it tell anything of the present condition of the wood, or would it help towards deciding what trees are best to plant on any soil? If this were something entirely new in forestry, we should be chary in discussing it. It is, however, not a new discovery, because next to the condition of the trees themselves, the condition of the undergrowth is the forester's usual method of estimating whether a wood is flourishing or not. That the forester pays any attention to the ground-vegetation is not very clear from writers on forestry, and in recently scanning a number of papers it has been surprising how few references there are to plants of the undergrowth, except as weeds to be removed or kept in check. Out-of-doors with the forester himself, it is easy to see that he

closely observes the condition of the undergrowth. Further, that in forming an opinion as to the value of any site for planting, it is the state of the natural vegetation which gives the first impressions. Observations on the low-growing vegetation of a piece of ground appear thus to be of some practical value, and an attempt is made here to state briefly the lessons of the ground-vegetation, and to point out some limitations

Ground-Vegetation and Soil Moisture.—The water in a soil is either spring water from underground sources, or it is aerial water which has fallen on the surface as rain or snow. The aerial water is originally pure soft water and contains no dissolved mineral matter. Spring water contains more or less mineral, according to the kind of soil or rock it has passed through ; in the case of limestones, which are easily dissolved, the springs emerging bring hard water with calcareous matter in solution. So far as plants are concerned, soft water does not aid so much in nutrition as water which carries mineral salts. Places where springs emerge are therefore frequently well-marked, and may be distinguished easily in a wood or on a hillside by brighter green patches. The green colour is due to a more abundant supply of water in movement, so that it brings to the plant-roots both food-material and air. Constant springs are generally indicated by a deep carpet of mosses and water-loving plants, with willows and alder as natural trees. Springs which only flush the ground now and then, as in spring or after rains, are frequently dry under foot, and they give rise to a drier vegetation, particularly grasses and sometimes bracken. When the green patches are sharply defined against a darker vegetation, it is either a sign that the spring water has sunk into the soil again or that it has ceased to flow and has become stagnant. The presence of surface springs in a wood shows that the tree-roots are supplied with water. If no springs are visible, the surface soil obtains its supplies of water mainly from the air, and in such soils there is always a risk of the upper layers becoming leached, that is, the soluble mineral matter is carried down into the deeper layers of the soil. This washing out rarely extends deep enough to affect the roots of old trees, but when it occurs the ground-vegetation soon becomes scanty, and if young trees are planted they make little progress till their roots reach the richer layers below, a frequent experience on heathy soils. The risk of surface impoverishment is modified by the action of springs, which not

only bring up water, but also carry up the lower soil and gradually spread it over the surface. On light sandy or heathy soils, where surface leaching is liable to occur, benefit would thus result if any springs or streams which may be present were made to run over the surface as far as possible. Generally, however, in our climate, and on the "till" soils, spring water accumulates and becomes harmful to trees if not kept moving by artificial drainage. The ground-vegetation soon indicates undrained places, while it also tells something of the kind of water. Tall herbage such as rushes, sedges, tussock grass (*Aira caespitosa*), queen of the meadow (*Spiræa*) and marsh marigold (*Caltha*) show excess of spring water injurious to trees, but the fact that the place carries a tall, quick-growing herbage indicates that the substratum contains more soil than peat and will be fertile if drained. Bog moss (*Sphagnum*) is a sign of too much water, and if tall plants are absent it generally means that the water is soft and acid; such a spot will only be suitable for such trees as birch or spruce. It is the beginning of a bog-vegetation, including plants like cotton-sedge, heather, pink bell-heath, sweet gale, and not suited for trees except after careful drainage.

Ground-Vegetation and Degeneration of Woods.—A wood does not remain always the same; it is either progressive, advancing more and more to the condition of closed wood, or it is degenerating and going back to scrub and moorland. Progression means more timber; degeneration means less timber. So long as a wood is progressive the trees are masters of the situation, the canopy is kept close so that the ground-vegetation is kept in check; in addition, humus is formed and preserved. Degeneration is the reverse of this, and for the signs of it one must look to the ground-vegetation. The injurious effects of a thin canopy have been frequently pointed out in these pages, by none more strongly than by Professor Schwappach.[1] The ground-vegetation is very dependent on the amount of light. Plants are like photographic plates in this respect that they will indicate differences in light and shade where to the eye there is no appreciable difference. In using the ground-vegetation as a guide, it is necessary to distinguish the growing season of woodland plants. Thus, bracken, which is late in throwing up its leaves, is a good guide; where it is thick there is a considerable amount of light passing through

[1] Schwappach, A. "The Importance of Density in Silviculture," *Trans. Roy. Scot. Arbori. Soc.*, vol. xv. p. 3, 1897.

the tree-canopy, but it is thin and poor below a thick canopy; of course, bracken does not occur on all soils, but mainly on fairly deep, moist, open sands or loams. On the other hand, spring-flowering plants, such as celandine, wood hyacinth, primrose and anemone, leaf and flower several weeks in advance of the tree-canopy, and can thus continue to grow in woods: if the ground-vegetation of a wood consists entirely of such plants, it becomes quite bare during the summer, and this indicates that the canopy is thick enough to exclude most of the light. Dog's mercury (*Mercurialis*) and wood garlic (*Allium*) grow under trees throughout early summer, and their main leafing period is later than the spring-flowering species, hence they can only flourish under a thin canopy and are exterminated in close woods. The growth of blaeberry (*Vaccinium myrtillus*) also takes place mainly during the summer, hence it is only abundant in woods with a poor canopy. Evergreens, like heather (*Calluna*) and hair grass (*Aira flexuosa*), although soon suppressed under evergreen coniferous trees, may remain under larch or deciduous trees, where the canopy in summer is moderately thick, because during autumn and spring they are able, by means of their evergreen leaves, to form sufficient food supplies. When the canopy is allowed to become very thin, birch, rowan, thorn, hazel and other shrubs soon make themselves evident. It is hardly necessary to point out that when a strong undergrowth is established, neither seedlings nor transplants of the more valuable timber trees have much chance.

Loss of canopy also acts indirectly on the soil, and may lead to even worse results than rank undergrowth. The condition of closed woodland leads to accumulation of leaf mould or "mild humus," a soil-covering of the greatest importance in tree-growth; an open canopy results in destruction of this mild humus. This subject of humus has been carefully investigated by several workers on forestry questions, and was dealt with in these *Transactions* recently[1]. The main facts are here summarised. Organic remains of plants and animals lie in the soil and are gradually destroyed by a number of agents. If these do their work well, the organic matter is quickly removed, as in the case of good farm and garden soils; if the various agents work slowly, then the organic matter accumulates. In woods, it may become a valuable element of the soil if converted into mild humus, but if it is left as raw humus it may become a serious enemy of good

[1] Hardy, M., "Humus as a Geographical Agency," vol. xvii. p. 256, 1904.

forestry. Mild humus results from partial decay of the organic matter, mainly by oxidation. It is rich in nitrogenous and other compounds available for the growth of plants, it is not acid, it generally contains earthworms and other organisms, and fungi flourish on it. The usual form of mild humus in woods is forest mould consisting of fine fibrous particles with a large proportion of mineral matter or ash when burnt, hence it crumbles easily in the hand, and does not swell up much or become slimy when wet. Raw or acid humus contains little ash, and is made up mainly of fragments of plant remains which can be identified under the microscope (bog moss, heather, and tree leaves or needles); when dry it is closely matted and stringy so that it does not crumble, when wet it swells considerably and frequently becomes slimy. The commonest forms of raw humus are forest raw humus in woods, and moor turf and peat on moorlands. This humus rarely contains earthworms, fungi, or other living organisms which would assist in its decomposition; the absence of these is probably due to lack of air and excess of acid in raw humus, so that while it contains much nitrogen, that substance is not converted so as to become available as a plant food. The effect of a surface layer of raw humus is to cut off the underlying soil from aeration and other atmospheric action, and as the felted mass absorbs water like a sponge, the lighter rains fail to reach the soil below. Raw humus itself soon loses its water by evaporation, but it prevents natural evaporation from the soil below which thus tends to become acid. So that the effect of the raw humus is not limited to the surface, but gradually leads to deterioration of the whole soil which thus becomes unfavourable to plants requiring a fresh and constantly moist soil.[1] Raw humus being at first a surface layer does not affect the older trees, but it is fatal to natural regeneration because the seedlings arising in it sooner or later succumb to drought before they become rooted in the deeper soil. Much of the labour involved in preparing heathy ground for planting young trees is due to the presence of a thick layer of raw humus.

Forest or mild humus is favourable to a mixed ground-herbage of deep-rooting plants, if there is sufficient light available. In the damper woods its presence is indicated by red campion (*Lychnis dioica*), wood hyacinth (*Scilla*), wood garlic (*Allium*),

[1] See also W. G. Smith, "Origin and Development of Heather Moorland," *Trans.*, vol. xvii. p. 117, 1903.

primrose and the tufted male, lady and broad buckler ferns. On lighter and drier loams, dog's mercury (*Mercurialis*) and wood sage (*Teucrium*) indicate moderately deep soils with less humus. The formation of raw humus is indicated by surface-rooting plants, frequently by a mossy carpet which is easily stripped off. In heathy woods, heather (*Calluna*), the white wood bedstraw (*Galium saxatile*) and the yellow tormentil (*Potentilla erecta*) are abundant, while in grassy woods the tufts of wavy hair grass (*Aira flexuosa*) and the loose creeping mats of soft grass (*Holcus mollis*) are indicative. Blaeberry (*Vaccinium myrtillus*), although deep-rooted, generally follows a surface layer of humus. In the case of recent plantations on ground previously non-wooded, a layer of raw humus frequently forms as a result of open canopy, especially on poor, dry soils or those constantly wet in winter; here again it results in a surface mat of moss and shallow-rooted plants easily stripped off.

Loss of mild humus may also result from the action of rain and wind so that the humus, alternately wet and dry, is either blown away or becomes decomposed. This change follows frequent and heavy coppicing, and is often seen in the copses of the drier parts of England. With the humus layer the woodland plants are more or less exterminated, and the soil is left bare and rain-washed or becomes covered with grasses and weeds such as sheep's sorrel (*Rumex acetosella*), white bedstraw (*Galium*), etc. The soil is so crusted that germinating acorns or other seeds fail to establish themselves, except, perhaps, thorn, sloe, whin, bramble and rose. In moister localities, the ground-vegetation is generally heather, wavy hair grass, blaeberry and other plants indicating the formation of surface raw humus.

Assessment of Waste Land for Afforestation.

The methods for assessing the value of waste land have already been carefully set forth by Mr A. C. Forbes.[1] This paper rightly lays most weight on the evidence obtained from trees already growing on or adjacent to the area under consideration, but it is recognised that this gives but a meagre amount of information. Where trees are not present, the value of the area has to be reckoned from other factors, those of locality, especially the "lie" of the land and the kind of soil. To these, we think, ought to be

[1] A. C. Forbes, (*a*) *Trans. Roy. Scot. Arbori. Soc.*, vol. xx. p. 142; (*b*) *Report on Forestry Work*, 1904-6, Armstrong College, Newcastle, 1906.

added another factor, the evidence of the natural vegetation, which in practice is used by the forester to a considerable extent. This suggestion is given, it is for the man in the field to decide whether it is of any value. Too little has been done in that direction to warrant a dogmatic attitude, but in a general way there is evidence in favour of the supposition. One strong argument against the value of the ground-vegetation as an index of value of any site for tree-growth, is that the low-growing plants are more or less surface-rooting, and therefore do not give full information as to the lower soil-layers where the roots of older trees would be. On the other hand, the following points are put forward for consideration.

If the originators of a certain report that "millions of acres" were available for tree-planting saw the natural vegetation, a very moderate experience of tree-growth would show how unsuitable many square miles of Britain were. Where the natural vegetation is pink bell-heath (*Erica tetralix*), cotton sedge (*Eriophorum*) or deer-grass (*Scirpus*), an examination of the soil will show wet, deep peat generally unfit for trees unless large sums are spent in reclamation. Again, the presence of sedges, rushes, water plants and bog moss is an indication of need of drainage before trees can be grown successfully. The natural vegetation is thus a fairly certain index of ground to be avoided in earlier experiments.

Where there are both semi-natural woods and waste lands, it has been observed that conditions which bring change in the woods also affect the waste land. Thus, in north-east Yorkshire, if one sets out from Helmsley and proceeds northwards up one of the larger valleys (*e.g.* Beckdale), the first woods are strongly ash, and the undergrowth includes a number of plants characteristic of calcareous soils in that district; oak is also present, while larch is extensively planted and grows well. The adjoining farmland on the calcareous Oolite soils is fertile, and uncultivated tracts of the valley slopes, not wooded, are grass or scrub with lime-frequenting plants. Higher up the valley a change is met. Ash diminishes while oak and birch increase; the undergrowth consists of blaeberry, ling, and wavy hair-grass, plants of siliceous soils. The adjoining farmland is poorish, and on considerable tracts of treeless heath, ling is the most conspicuous plant, but on the heathery moors Scots pine has been successfully planted. Apart from the evidence of the trees, the natural vegetation in this area gives good information as to the character of the soils.

Since much of the waste land below 1500 feet altitude is degenerate forest, it indicates places where shelter and other climatic conditions are favourable to tree-growth. It has already been pointed out that degeneration of woods leads to considerable changes in the soil, all unfavourable to tree-growth, and these must be reckoned with. But where forest was, it should be possible to establish forest again. Such places are indicated by the natural vegetation. Thus, well-drained heathery land (not heather bog) generally indicates suitable places for such trees as Scots pine. Bracken is an indication of a soil at least six or nine inches deep, moist, yet well drained, and not peat, because only in these conditions can the underground stems of this fern survive; the conditions are therefore suitable for afforestation.

17. The Home Timber Trade Outlook.[1]

By Donald Munro (of Messrs A. & G. Paterson, Ltd., Wood Merchants, Banchory).

After having referred briefly to the foreign and colonial timber trade, Mr Munro said:—Now, gentlemen, I come to a subject which, if not nearer to your hearts, is certainly nearer to your homes. The outlook regarding our own home timber trade is much worse than anything I have pictured to you From my own experience I can say that in Scotland we are pretty near the end of our resources. We seem to have been cutting down timber with what I might term "a cheerful abandon," never pausing for a moment to consider the question of re-planting. Many people are under the impression that we possess very large resources in the North,—resources that, according to them, have not been tapped. This, however, is not the case; for although there is still a good deal of wood in Ross and Cromarty, Inverness, Elgin and Moray, and Banff shires, there is not more than sufficient to keep going the mills already working in these counties during many years. The same story is also applicable to the once great timber areas in Perthshire, Argyllshire, Forfarshire, Dumfriesshire and Ayrshire.

[1] An address delivered before the Aberdeen branch of the Royal Scottish Arboricultural Society, on Jan. 14, 1911.

It is perhaps not a matter of common knowledge that the old Highland forests, in certain Scottish districts, were entirely depleted in the latter half of the eighteenth and beginning of the nineteenth centuries, in the manufacture of pig iron. The Carron Iron Works, to begin with, depended solely on native timber for smelting the ore. Coal and coke were not then supposed to be suitable for this. There were large furnaces also in Ayrshire, the iron being brought there from Furness, in England, simply because of the great quantity of timber available; and these furnaces were worked for over a hundred years, till the whole timber in the district was exhausted. In our own immediate neighbourhood, namely, in Aberdeenshire and Kincardineshire, the supply is very far from equal to the demand. It is an easy matter to point out the estates, within fifty miles of Aberdeen, where any great acreage of woodland still exists. Commencing with Deeside, we have Durris, Crathes, Glen Dye, Ballogie, Finzean, Craigievar, and the fine old woods of Glen Tana, Abergeldie, Invercauld, Mar Lodge and Balmoral; but it is doubtful whether some of these can be taken into account, as on several of the estates there is every probability of the timber never being sold. On Donside and vicinity there are the Fetternear and Cluny Woods, and the woods of Strathdon; while on the north-western portion of our county we have the famous Binnhill, at Huntly; and we have still some fine old wood belonging to the Dukes of Fife and Richmond and Gordon, in Morayshire; while on the Seafield estates there are some 30,000 acres of wood, of which about 20,000 acres, however, have been planted during the last forty-five years, on ground whose former value was eightpence per acre.

What is left of our home timber is getting further and further away from our only means of transit. At the present moment, I know of several lots of wood being cut from twenty to twenty-five miles from the nearest railway station. As regards re-planting, too little is being done by the proprietors. In a few isolated cases natural seedlings are springing up, but one may travel for miles over ground that was bearing marketable timber thirty years ago, and not find a single tree on it now. At Tominourd, near Cromdale, there is an exceptionally thriving crop of natural larch, and on the Curr Hill, Abernethy, both on the Seafield estates, a splendid example of 250 acres, composed of firs and larches of thirty years' growth. The results obtained

here are certainly equal to any continental product, and in fact have excited the admiration of experts from other countries.

I need not remind you, gentlemen, that there are millions of acres lying waste, or bringing in not more than sixpence per acre to the proprietors—acres that could be utilised at very little expense, and turned into the finest timber-bearing land in Europe. In Kincardineshire, I know of an area where I am quite sure there is room for a 20,000-acre afforestation scheme, on heath ground, not worth more than sixpence per acre for sheep-grazing. I am not posing as an alarmist, but we are not only reaching, but have reached, a crisis which gives cause for serious anxiety. Something must be done, and that quickly, as the evil cannot be remedied in a year or two. If our large landed proprietors could only be made to realise the actual position that must inevitably arise if we take no steps to avert the calamity which is bound to come, they would lay the foundations of wealth, if not for themselves at anyrate for their successors. Many mills are shut down owing to want of material, and in several places woods are being cut that, had it not been for the destruction done to them by vermin, would not have been in the market for many years yet; and it is within my recollection that on Strathspey alone not one half of the mills that were working there fifteen years ago are there now. Several of you will, doubtless, remember the time when thirty or more floats of timber could be seen at any time being piloted down the Spey for ship-building and other purposes at Garmouth. The floating of timber on the Dee is within my own recollection: but floating, unfortunately, is now a lost art, as far as this country is concerned, simply because no employment could be found for the floaters owing to the timber having been all cut at or near the river's banks.

And now, gentlemen, I think it would be interesting and useful for us to consider how matters would stand in Scotland at this moment if, 150 years ago, or even 100 years ago, the State had passed a law ordaining the preservation and re-planting in a fixed rotation of the then existing woods, and the gradual afforestation of all the available land not suitable for agriculture, and yet capable of producing wood. This would still have left the higher ground available for grouse moors and deer forests, which bring in so great a revenue now. Let us suppose that there had been a great survey,

and a working-plan for every estate and parish and county in Scotland, with a rotation of, say, 150 years. Such a survey and working-plan would have cost a good round sum of money, but a mere flea-bite compared with the harvest to be reaped. That is to say, then, that all thriving forests would have been allowed to grow on till they were a size sufficient to produce all descriptions of building timbers, and all intermediate sizes, of course, also. Had that been done, even as late as the first year of the nineteenth century, we should now possess millions of acres of mature wood, and we would be independent, if we pleased, of all other countries, so far at least as pines and spruces are concerned. At this stage of my illustration I want to criticise mildly the attitude of architects and joiners, and dealers in foreign wood generally, as regards our native pine woods. The experts in forestry lend no countenance to their views, I may say, however. One would think, to listen to those gentlemen, that our ancient castles, and churches, and schools and cottages had from time immemorial been built of foreign red pine and Baltic or American spruce; but, of course, that was not so. It was first the exhaustion of our older native forests, and then the exceeding cheapness of foreign importations, which brought about the change in our building material. The virgin forests along the Baltic, Norwegian and American coasts could then be bought for an old song, and the freights cost less, generally, than the haulage from even comparatively short distances of the old Scottish woods. But the result has been that our grand old Scottish red wood, or Scots fir, has lost caste with the users of building material, and is now marketed, to a great extent, comparatively young, perhaps at seventy years of age, with undeveloped heart-wood. It is used for such special purposes, apart from building wood, as railway sleepers and all sorts of box woods and barrel woods, etc., etc., and so it has come about that the foreign timber men will tell you that Scots fir cannot now be grown either in size or quality to compare with his importations of red wood, or even with the Scots fir our ancestors used. But our critics almost invariably make an exception in favour of some particular wood of great age, in their own district. The Ross-shire man excepts some grand old Lovat or Balnagowan woods, perhaps; the Nairnshire man must, of course, except the magnificent old woods near there, where there are still thousands of firs, which for size and

quality are equal to the best foreign importations. During the boom in the seventies, indeed, when foreign wood rose high enough to make it worth while, large quantities of these great trees were shipped at Nairn to the English ports, and used for construction purposes, as the best red wood. I have been credibly informed that the late Provost Mann of Nairn offered £13,000 in cash for some 6000 of these trees to the late Mr Ranald M'Donald, factor for the Cluny estates, near Nairn. Then, if you turn to Inverness-shire, the critic excepts the natural grown forests of Rothiemurchus and Abernethy, only skeletons now, however; and he may well do so, for in the latter part of the eighteenth century these were the sources of regular shipments to the Thames for building purposes. In Perthshire, and some southern counties, the exceptions are too many for our foreign wood friends. In Dumfriesshire, for instance, on one estate alone, 10,000 firs, averaging about fifty cubic feet, were blown down during the great gales in the eighties, besides vastly more smaller trees; and, curiously, it would not have paid then, or scarcely ever during the latter half of the nineteenth century, to convert those fine trees into construction sizes, owing to the cheapness of foreign deals and battens, even although the architects had been unprejudiced enough to pass them. How does the critic of Scots fir, as grown now, account for all these exceptions—his Ballochbuies, etc., etc.? The fact is, that if we could imagine Scotland as it might have been now if afforestation had been ordained 150 years ago, there would be no critics to argue with, for all around the hillsides of every county we would have fine timber of every description, varying in size and quality, according to soil and climate, and in age, from the veteran plantation of 150 years to the seedlings newly transplanted from the great national or local nurseries.

The sawmills to manufacture the wood a hundred years hence, after a great afforestation scheme, will not be at the ports of shipment, as they are in merely exporting countries. They will, naturally, be right in the growing woods, with light railways connecting with the ordinary lines. It will not be necessary then merely to half manufacture the product into square or hewn logs, and deals or battens, as the foreign shipper must do at present, leaving it to the mills at our ports to finish all the processes. The fully manufactured article will issue from the mills near the woods on the hillsides as joists, battens and

flooring, as linings, sleepers, boxwood, and a hundred other forms. The result will be a rich harvest to the grower, and much saving of weight in carriage, and much saving of waste. This is really what happens with Scotch mills in our comparatively small and young woods now. The home miller is able to produce his thinly-cut boxwood, for instance, at a well-equipped mill right in or beside the woods, and compete successfully, in Scots fir, with the best boxwood shipments of Norway and Sweden. It is a fact that boxwood for many hundreds of thousands of boxes is sent every year from mills in the North of Scotland to southern markets, and it not only holds its own against foreign shippers, but is vastly preferable, both as regards quality and workmanship.

The strain which Scots fir will bear, is so much greater than that of Norway spruce, that a thickness of $\frac{5}{16}$ in. in Scots fir is accepted in many cases where $\frac{3}{8}$ in. is demanded for white pine, and it is a well-known fact, that Scots fir does not split in the nailing, a common fault with white pine. The foreigner gets his raw material for boxwood production at an extremely low price, usually as a by-product, but he is unable to cut so accurately as our up-to-date mills do, for he is hampered by the irregular cutting of his raw material, of ends of deals or battens, and the numerous cracks, twists and blemishes which have led to their production. One finds also that cutting boxwood, etc., with the thinnest swedge saws, at a high rate of speed, and from the green tree, we, in Scotland, produce a more regular and smooth finish than the foreigner can do, or than we ourselves can do from foreign material.

Pulpwood has for many years been imported in very large quantities into this country, and in this city, as you may know, roughly speaking, 20,000 tons are used annually for boxmaking purposes alone, which is altogether a new departure, but it is of a soft fibrous nature, and is better adapted for paper-making purposes. To show the vast forests consumed, and the immense labour employed in this industry for the manufacture of paper, for one newspaper company alone, I purpose to show you a cinematograph film of the great Harmsworth undertaking in Newfoundland. This is only another instance, however, in which I think our home spruce, if properly grown, would compare favourably with the imported article.

Although I prefer to leave it to forestry experts to determine

the class of trees best suited by experiment to particular soils and exposure, I may be pardoned if I refer briefly to what I myself would consider it best to plant.

Too little attention, in my opinion, has been given to a very vital question relative to afforestation, namely, the rearing and supply of forest plants. Apart from the fact, that in many cases only a superficial knowledge is possessed as to the care and selection of plants, still more unfortunate is the way plants are sometimes dumped into unsuitable soil; and, I think, it would be a feasible plan for the State to supply proprietors with trustworthy plants from State nurseries at cost prices, and, in some cases, if desired, a practical man could be sent from them to advise as to soils, and to give practical instructions in planting where it was required. I have, in my mind's eye, a case in point where 1200 acres were planted indiscriminately, the result being that half had to be cut down and burned, about fifteen years ago, and the remainder, now thirty years old, is practically useless. On small estates with nurseries, I have occasionally been struck by the haphazard manner in which planting was conducted, little or no regard being given to soil or exposure. In valuing woods, also, I have often felt that if due regard had been paid to the planting of the trees adapted to the particular soil, a far better result would have been attained financially.

The trees I would select for planting are the larch, Scots fir, spruce and Douglas fir. The larch is one of the best trees possible, and produces a wood of the finest quality for a generality of purposes. It is extensively used in our mines, in boatbuilding, fencing, and outside work generally. Scots fir is admirably suited for building and for construction purposes, sleepers, boxwood, staves, heading, etc. Spruce, which has been considerably neglected by most of our foresters and proprietors, can be grown equal to the best Baltic product. I am, however, glad to say, that this fine timber is now being recognised at its true value. In my opinion, spruce planted in suitable soil and surroundings would give far better returns than any other wood I know; and, as an instance, I may state that there is an area of this fine tree, not many miles from here, growing about 550 to the acre, and sixty years of age. The value is £110 per acre as it stands. Later on I propose to show you a few photographs of this fine wood. With regard to Douglas fir, I must frankly

admit that I have not much experience in its manufacture, but I believe it will be found to be very useful, and, in many instances, I think, will take the place of Scots fir for the manufacture of boxwood, fencing, sleepers, etc. Many people seem to be under the impression that it will ultimately take the place of larch, but such is not my opinion, as the principal use to which larch is put, namely, pole and pitwood, renders Douglas fir unsuitable owing to its shape. That trees can be grown with success in many districts up to an altitude of 1400 feet above sea-level has been amply demonstrated. I may here mention that I examined lately some Scots firs, larch and spruce at Auchernach, Strathdon, measuring from 6 feet to 9 feet in circumference at 5 feet from the root. I know that great trouble is being experienced with disease in the larch plants. The reason why some larch plantations have not been a success, I think, arises from the fact that not enough care is exercised in the selection of the seed, which, in many cases, is taken indiscriminately by the cone gatherers. If further proof is necessary that we can grow the trees, I would just briefly refer you to the fine specimens of grand old trees still existent at Monymusk, Breadalbane, Ballochbuie, Gordon Castle, Finzean, etc., etc., etc. Those of us who visited Monymusk in the summer, through the courtesy of Sir Arthur Grant, had ample opportunity of seeing the far-famed larches in Paradise, giants ranging from 175 to 416 cub. feet, averaging for twelve trees 268 cub. feet.

In the Episcopal church there the seating showed us the capabilities of Scots fir for architectural and decorative purposes. Other very fine examples of larch can be seen at Breadalbane. One cut the other day had a diameter of 14 inches at a height of 75 feet. The first 25 feet cut measured 30 inches on the side at centre. Others cut on the estate recently, I am informed, measured from 60 to 70 feet long, and 12 to 13 inches diameter at top ; and, at 90 feet long, 7 inches diameter at top. When at Ballogie recently, my attention was directed to a fine old fir 103 feet high. At 5 feet high, the circumference measured 11 ft. 6 ins. ; 40 feet, to the first branch, gave a circumference of 7 ft. 6 ins., and the cubic contents were over 200 feet.

Our German friends, who can give us points in forestry, have made a concession in favour of our soil, and frankly admit that for timber cultivation it is second to none. That our soil has

been able to retain its reputation is an undoubted fact. Seeing, then, that we have the soil, the men, and the plant, the State ought at once to commence some great national scheme of afforestation. That a timber famine is staring us in the face, so far as this country is concerned, goes without saying, and, gentlemen, what is a country without timber? It is one of its most valuable assets, and I cannot see why a vast amount of the wood imported into this country should not be grown at home. It is a pity that the motto of our Society, "When ye hae naething else to do, ye may be aye sticking in a tree: it will be growing when ye're sleeping," had not been adopted in this country when the laird o' Dumbiedykes uttered those memorable words to his son. We may, I suppose, congratulate ourselves on the fact that the Government have at last shown some signs of stirring in forestry matters. The Development scheme is, I understand, fairly under way; and it is of interest to note that within the past few days the Development Commission have adopted the report from their Forestry Committee, which favours the appointment of a Committee in Scotland to carry out further investigations regarding Scottish forestry. It has been suggested that the Committee might comprise a representative of each of the following bodies and classes: Scotch Education Department, Royal Scottish Arboricultural Society, landowners, working foresters and factors.

In connection with the recent election, Mr Munro Ferguson, speaking at a meeting at Bowhill, said that the Highlands could be made an industrial centre as well as a sporting centre. When he was member for Ross-shire, he had a feeling that the best way to make the Highlands a productive industrial centre was by means of afforestation. Mr Lloyd George had taken up the matter along with him, and helped him. Afforestation would not only double the population of the Highlands, but would make a new industry in the country. The trees would take a hundred years to grow, and they would require a management that never died.

If the State is, however, so particularly anxious to encourage afforestation, it certainly employs peculiar methods. A case which came under my immediate notice, may very well be quoted.

On an estate on Donside, about thirty miles from a railway station, nineteen acres of land were planted up, which the Assessor promptly assessed at £12. The proprietor had every

intention of planting up from two to three hundred acres—as a matter of fact the plants had been purchased—but this encouragement on the part of the State has effectually precluded any possibility of this being done.

Another hardship under which proprietors suffer is in connection with the roads. They may plant up trees, and be taxed from anything up to a hundred years. The local authorities are perfectly well aware of their existence, and know that the crop will have to be harvested some day, but they seem to go on the improved old adage, "Always put off till to-morrow what you should do to-day." This is distinctly unfair, and they ought to have the roads in such a condition that they would be impervious to any ordinary strain. Timber is a crop just as much as grain or turnips, and if a farmer expects to find the roads in his district strong enough to bear the removal of his produce, so, I think, a proprietor ought to find the roads strong enough to bear the removal of his timber to the market. The result of this negligence is that the expense of haulage is considerably increased, while the proprietor naturally has to accept a reduced price.

If afforestation is to be a success, a clean sweep all over Scotland must be made of vermin in the woods. It is a curious thing to consider the fascination of the squirrel; but the charm, it seems to me, is all in the big curly tail. Had squirrels been without their big, pretty tails, they would have been as ugly as weasels, and would have been exterminated long ago. Even the laird sometimes forgives their depredations when admiring their gambols; for we are all apt to forgive the sins of beauty. I know one proprietor, in fact, who rigidly preserved them. Nobody can compute how many hundreds of thousands of pounds the squirrel has cost Scotland. We are supposed to be a practical people, and yet our lairds have never, until recently, in the far north, thought of putting their heads together and making an effort to utterly root out the vermin; but without combination the thing is impossible. Recently I was engaged in valuing two woods, each of several hundred acres in extent, and there was not a Scots fir in these woods which had not been more or less destroyed by squirrels. It is pure guess-work, of course, but considering the age and present small dimensions of the trees, and other circumstances of these particular woods, I believe the damage by squirrels must have amounted to more

than the present value of the woods, to perhaps as much as £15 per acre, or, say, £9000 on 600 acres.

Now, gentlemen, I must apologise for taking up so much of your time, but I should like you to bear with me while we consider, as briefly as possible, "what afforestation would mean in the way of employment." If, let us suppose, the possibility occurred during the next few years, to plant even ten millions out of the twenty practically waste acres of Britain, this would mean employment for about 100,000 men as foresters and labourers alone, while at least as many more would be employed in subsidiary work. Allowing four dependents to each man, this would mean that a living on the land would be given to about a million of human beings who, otherwise would go to swell the already overcrowded towns.

In addition to those actually engaged in forestry, there would also be employed the necessary labour for haulage, loading and sawing, to say nothing of other industries such as building, shopkeeping, schooling, etc., etc., which would follow; and it may be taken that more men would be employed by the conversion of the timber than by its growth. Think of the vast number of saddlers, blacksmiths and engineers that would find employment, to say nothing of those engaged in the oil and saw-making industries, and the manufacture of belting, etc. Railway companies and shipowners would also be greatly benefited by the additional traffic, and our farmers and small-holders would find a ready market for their crops. Surely such a prospect should appeal to the nation at large as a highly desirable thing to attain to. It is a national question, and should not be mixed up with any political party. A further advantage lies in the fact that forestry gives employment at a time of the year—late autumn and winter—when country work generally is scarce, and thus, by keeping men fully employed all the year round, there would be a great inducement to them to remain on the land. There are many difficulties in the way, of course, such as prejudice, ignorance, indifference, and disbelief in the possibility of the scheme, but these are all surmountable, and should be an additional incentive to us to bring the facts home to the people of this country.

The moral is, gentlemen, that we must start afforestation on a national scale in real earnest now, or so soon as the necessary surveys can be prepared, and certainly with State aid in some

manner, for it must be under State control and regulation to be effectual; and so our presently existing Scottish woods, and the new national forests, will ultimately realise the imaginary picture which I have drawn, and will become the reality of a century hence. The national and private owners of the twenty-first century will then reap a regular and mighty annual harvest from Scottish forests, and foreign importations will no longer be indispensable when that good time comes.

18. The State in Relation to Afforestation.

By A. S. Hedderwick.

The days being past and gone when afforestation was regarded by the ruling powers as a mere dream of dreamers, discussion now turns upon details and the relative merits of various schemes for carrying it into practice.

In this connection two very different plans have been put forward, and each has been supported by much able argument. The fundamental difference between the two schools (if I may use the term) is, that on the one hand it is believed that the work can be undertaken and managed by private individuals, and that it is possible to save the industry from the somewhat narcotic effect of Government control; on the other hand, it appears to many people that the difficulties attendant on private management are insuperable, and that nothing short of State afforestation, pure and simple, is within the range of practical politics.

So far as the former view is concerned, it must be admitted that the difficulties are immense. Indeed, while certain other industries may more or less advantageously be managed by the State, afforestation seems at first sight imperatively to require State action. To begin with, it cannot be carried out by private capital; no capitalist can afford to forego all interest on his money for the half century that must elapse before the forests yield any appreciable return. Again, landed proprietors as a class, do not possess and could not raise the necessary funds; nor could they afford to plant farm lands, and thereby to incur the loss of the rents now paid by agricultural tenants.

It has, however, been suggested that the State should advance money to the owners of land on the security of a mortgage over

the land, and subject to payment of a moderate rate of interest and a share in the ultimate profits.

But here one is faced with the fact that complete private control of public moneys would hardly be tolerated. The aphorism about "benevolent despots" seems to apply; there is no guarantee that the estates would be wisely and zealously administered by series of proprietors. It is possible, also, that in the hardships which accompany most economic changes, the tenants and crofters might find cause for discontent and irritation, and in this way political influences might be invoked in a manner most harmful to the proper management of the business. Of course, so far as the administration of the forests is concerned, it would be possible to frame some scheme of public supervision. But the limits of such control would be difficult to determine; the landlord might be either too strong or too weak, and in each case friction would be likely to arise to the detriment of the industry. It is, after all, not so much dual ownership as dual control that is unsatisfactory.

The other alternative which has been proposed is afforestation by the State. But this possesses, besides the usual weaknesses of State-controlled industry, the additional disadvantage of subjecting varying local considerations to the decision of a remote Government department. Indeed, such centralised control of local matters is out of harmony with our traditional methods and institutions. In striking contrast to continental procedure, we have constantly entrusted local affairs to local bodies, and our practice has been justified by experience. The object of this paper is to suggest that methods which have been successful in other departments might well be applied to forestry. It would be in accordance with our traditional usage to allow all sections of the local community to combine in the administration of a matter of public local interest. "What touches all should be approved by all" is a sound maxim, and makes for peace. It seems, moreover, that a system of local government afforestation would be free from many of the disadvantages on the one hand of private, and on the other hand of national afforestation. And such a scheme would combine many of the advantages of both of these plans.

First of all, "Corporations do not die"—it would provide permanent mechanism of a fairly uniform character for the administration of the forests. Secondly, adequate control of

State loans would be a comparatively simple matter. Thirdly, all interests in the county could be reconciled and united in furthering the work: and the invigorating influence of competition itself would not be absent, for county would compete with county. Lastly, it would be possible to combine a large measure of freedom in local enterprise and initiative, with a certain degree of uniformity in the general policy of County Forestry Boards throughout the country.

Perhaps then, suitable machinery for undertaking afforestation would be found in the creation of *ad hoc* bodies, which would have authority to borrow money from the State, and would possess compulsory powers for carrying out afforestation. These bodies might borrow on terms of the payment of moderate interest (for which they would have power to levy a rate), and on subsequent payment of a certain percentage of the ultimate profits of the industry. All surplus earnings would go to relieve local rates, and thereafter to other local purposes; and it may be observed incidentally, that this would benefit not only those parishes comprising forest lands, but the whole county; and thus the interests of the whole county would be identified with those of the industry.

It is suggested that the Boards should be small. Large bodies are merely loquacious, but these should be executive. Hence, perhaps, they might consist of, say, five members; two elected by the County Council or by popular vote, two nominated by the Lord Lieutenant, and one nominated by the Government. The last should be an expert, and, if possible, a local man of independent position. In the event of disagreement, the vote of the majority of the Board would decide on any line of action; and it is thought that the presence of a Government expert on the Board would be sufficient to safeguard State interests, and while permitting great elasticity, to give a certain cohesion and uniformity to the whole system of management by the Boards all over the kingdom.

This is no place to elaborate a detailed scheme; moreover, that must be left to experts. But there is one other suggestion that might be made. Instead of the County Boards purchasing or leasing land from the proprietors, might it not be cheaper to acquire merely the right to afforest the land? This would leave the landlord full use of the ground in so far as that did not interfere with afforestation, and in determining any compensation

payable for loss of rent and so forth, the value of the land for purposes that were no impediment to forestry would fall to be deducted. Thus, in the case of sporting estates which might eventually be improved rather than spoiled by planting, a nominal sum would be payable, and the State would not be saddled with the cares and obligations of a possessor of land.

19. Primitive Woodland and Plantation Types in Scotland.

By G. P. Gordon.

In various parts of Scotland there occur, either in the form of small groups or of fairly extensive woodlands, remains of forests which in the past have occupied large tracts of land, and which have evidently reached a great age. Up to the present, tradition has classed these as remnants of an ancient forest somewhat vaguely styled the "Old Caledonian Forest." Now that schemes to increase our forest area in Scotland are so much discussed, a few recent observations on some of these older forests may not be without interest. The attempt is made here to describe the present condition of some of these forests with reference to their composition and silvicultural value, also to bring them together as far as possible under certain standard types. In addition, a comparison is made with plantations in the same localities. The following quotation indicates some of the problems relating to existing woodlands[1]:—"In a country like England, much of which has been cultivated and comparatively thickly populated for centuries, it may be asked, Do there remain any natural woodlands at all? Have not existing woods been so altered by planting, and in other ways, that they no longer represent the native plant-communities, but are rather to be considered as mere congeries of indigenous and introduced species?

"It is undoubtedly true that there is little 'Urwald,' true virgin or primitive forest, remaining in the country, though some of the woods, especially near the upper limit of woodland in the more mountainous regions, might make good their claim to this title.

[1] C E. Moss, W. M. Rankin and A. G. Tansley, "The Woodlands of England," *New Phytologist*, vol. ix., Nos. 3 and 4, pp. 114 and 115.

On the other hand, there are, of course, many plantations pure and simple which have been made on moorland, heath, grassland, or arable land, and which may, of course, consist of native trees or of exotic trees, or of a mixture of the two. But between these two extremes, according to the conclusions of all the members of the British Vegetation Committee who have given any special attention to this subject, come the great majority of the British woods, which are neither virgin forest, nor plantations *de novo*, but which are the lineal descendants, so to speak, of primitive woods!"

Thus, while there would appear to be in England an undoubted scarcity of "Urwald," as such, it might be advanced that in Scotland, which has never been densely populated, where cultivation has never extended beyond a certain limit, and where the mountainous nature of the country affords many examples of woodlands approaching the upper limit of tree-growth, one might expect to find woods which more or less conform to the primitive woodland type. Also the average climatic conditions which prevail, especially in the Highlands, are rather rigorous. For these reasons, it may be of interest to ascertain what indigenous trees, undergrowth, etc., constitute these forests. Generally speaking, I have found the number of prevailing trees to be comparatively small, and that they tend to form pure woods of this "Urwald" type. Such a pure wood may be said to give the simplest type, because in it the various formative factors of the locality find expression on the same area, and in one species. Thus it would seem that modifications of and divergences from virgin forest might be more easily observed and possibly explained, than in the more complex cases of "Urwald" consisting of a mixture of species.

The observations dealt with here were made in woods selected as suitable after a preliminary examination of practically all the woods in the districts referred to. Observation areas were established in the selected woods, and were visited periodically from early spring on to late autumn. No attempt was made to distribute these stations uniformly over the area, as, especially in the part of the area lying south of the Forth and Clyde, and extending to the Borders, it was somewhat difficult to find woods representative of any primitive forest type at all. In this district I fixed upon the following woodlands:—Presmanon, Haddingtonshire; Hartside and Gateheuch in Berwickshire; Dalkeith Park

and Heriot Water in Midlothian; Lochwood and Auchenskew in Dumfriesshire. The other part of the area is confined to the Highlands, and extends roughly from Loch Long north to Fort William, and east to include Strathspey and Deeside. Here the stations selected were Loch Long and Loch Goil in Argyllshire; Glen Lui and Ballochbuie in Aberdeenshire; Rothiemurchus, Abernethy, Glenmore, Loch Ossian, Loch Arkaig and Loch Laggan in Inverness-shire. In addition, observations were made on several plantations, as distinct from "Urwald," at Penicuik in Midlothian; Carolside and Mellerstain in Berwickshire; Haystoun in Peebleshire; Achnacarry in Inverness-shire. As far as possible, these latter were taken in the same locality as the respective "Urwald" types with which they are compared. Where authentic records of the woodlands were available, both in the case of primitive forest and of plantations, these were referred to.

My observations on the primitive woodlands of this area indicate that three main types are represented, namely: (1) pure birch woodlands; (2) pure Scots pine woodlands; (3) pure oak woodlands. Although alder (*Alnus glutinosa*) occurs in several places over the area, in no part was it observed to be in sufficient abundance to form a definite woodland association.

At this point, it may not be out of place to define, in more or less general terms, what exactly is understood here by "primitive woodland" or "Urwald." The meaning intended to be conveyed by this term is not necessarily an association of trees that has reached a great age, but one whose formation and after-treatment has been left entirely to nature. Apart from tradition and historical record, the distinguishing features of "Urwald" may, from observation, be taken as follows: inaccessible position and irregular shape of the wood; sparseness and irregularity of stocking; abnormally large crown and diameter development; small height development; marked unevenness of age of the stock; and a typical woodland flora, which varies with the species composing the primitive forest.

Birch "Urwald."

Of the three species mentioned as forming primitive woodlands, birch covers the largest area, and has also the widest altitudinal range on this area. It was observed to extend practically from sea-level to elevations of about 2000 feet, and is reported to ascend in some parts of Scotland to 2300 feet. It

typically assumes a more or less irregular strip formation, which is usually rather sparsely stocked. It occurs fringing both Scots pine and oak "Urwald," and is in turn occasionally skirted by juniper (*Juniperus communis*). In virgin forests of birch and Scots pine on this area, juniper may be said to form the sole undergrowth, where any is present, and, in many such situations, it often shows an abnormally large development in height-growth. From the variety of its distribution, birch has been well termed the "weed" tree of Scotland, and if allowed scope it would, without doubt, cover much of the land at present included in "hill pasture" and "deer forest."

Airhouse wood, near Lauder in Berwickshire, is here described as a natural birch forest. This occupies a steep slope on the right bank of the river Leader, and extends along the valley for about half a mile. The wood probably owes its present state of preservation to the steepness of the ground, the shallowness of the soil, and the fact that it has been fenced from the surrounding agricultural land. The comparatively inaccessible position of the wood also accounts, to some extent, for its present state. The geological formation of the district is essentially Silurian, an outcrop of which is obtained at the north end of the wood, but it is almost completely masked by an extensive sheet of boulder clay which overlies it. The wooded area extends from the river, at an elevation of about 800 feet, to a plateau whose elevation is about 1000 feet. Juniper (*Juniperus communis*) fringes the wood on its upper margin, and appears to be suffering severely from an attack of *Gymnosporangium clavariaeforme*, which probably, to some extent, accounts for its poor development in this and in other similar woodlands. A conspicuous feature is the predominance of hazel (*Corylus avellana*) in the underwood; it occurs to such an extent as to form, in some places, along with juniper, a complete second canopy. In general appearance the wood is dwarfed and sparsely stocked, while the individual trees are gnarled, twisted and crooked, rarely having their boles clean above a height of 10 feet to 12 feet. The stems and branches of the trees are clothed with lichen, while the large spreading crowns cast a deeper shade than the density of stock would lead one to expect. Occasionally one meets with a dead bleached stem, falling to decay, devoid of branches and leaves, and bearing the bracket-like fructifications of *Polyporus betulinus*. The variety of birch composing the

wood appears to be *Betula tomentosa*. In the underwood, juniper and hazel (*Corylus avellana*) are abundant, while sloe (*Prunus spinosa*), aspen (*Populus tremula*), goat willow (*Salix caprea*) and honeysuckle (*Lonicera periclymenum*) occur occasionally.

The ground-vegetation of this wood is of interest since it is typical of birch woodland. The wood-rush (*Luzula sylvatica*) is dominant, especially in the upper part of the wood, where the soil is very shallow. On the middle slope, with deeper soil, wood anemone (*Anemone nemorosa*), earth-nut (*Conopodium denudatum*) and primrose (*Primula vulgaris*) occur, forming the chief constituents of the ground flora. The carpet of the lower slope consists mainly of these latter species along with *Holcus mollis*, while dog's mercury (*Mercurialis perennis*), wood hyacinth (*Scilla nutans*) and *Holcus lanatus* occur occasionally. As subdominant elements of this ground flora, wood-sorrel (*Oxalis acetosella*), wood violet (*Viola riviniana*) and moschatel (*Adoxa moschatellina*) may be taken as the chief. As occasionals, lesser celandine (*Ranunculus ficaria*), speedwell (*Veronica chamædrys*), stitch-wort (*Stellaria holostea*), barren strawberry (*Potentilla fragariastrum*), hard fern (*Blechnum boreale*), *Lastrea montana*, and polypody (*Polypodium vulgare*) are obtained in all parts of the wood.

From the presence of hazel in the underwood, and especially from the nature of the ground flora, it may be safely argued that this marks the site of a primitive oak-wood. The oak has entirely disappeared; whether this is due to human agency, to some catastrophe, or to the natural rotation of species, is not evident, but birch has now completely established itself over the area. On the river Tweed, at Gateheuch, which lies within the same district as the above wood, there occurs a primitive oak-wood in an exactly similar position, and with practically the same ground flora. It would appear, indeed, that many natural birch woodlands, which occur at low elevations, are of the type of, and have a similar origin to, Airhouse wood. This opinion has also been expressed by another writer,[1] thus: "The birch-woods in the shelter of the river valleys may, however, have as rich a vegetation as the oak-coppice, and, indeed, may be regarded as having replaced that association. Thus, for example, a list taken in the birch-wood between Loch Tummel and the Falls of Tummel shows a flora almost identical with that already given as characteristic of the oak-coppice." The rotation of species does not then appear to alter much the

[1] Robert Smith, *Botanical Survey of Northern Perthshire*, p. 17. 1900.

character of the ground flora, nor to impair the other features which stamp the wood as primitive.

What might be termed the true type of birch "Urwald" appears to be characteristic, more especially of the Highland part, of this area, and may be obtained in places forming the upper limit of tree-growth. This has a much wider distribution than the type just referred to, and in parts may have replaced some former Scots pine forest. As examples of this type, the woodlands on the shores of Loch Ossian and Loch Laggan may be taken. These occupy considerable areas on either side of the lochs, those on the northern slopes covering a larger area, and extending to a higher altitude than the woods on the southern slopes. From the shores of the lochs (1260 feet and 830 feet respectively above sea-level) the woods ascend to elevations ranging to 2000 feet, at which height the trees are so isolated that perhaps the term "savannah" or "scrub" might be more applicable than woodland to this association. For the following reasons, one may fairly apply the term "Urwald" to the above class of woodland—(1) it occurs so far removed from cultivation, which, in this as in other districts of the area, has never extended beyond the alluvial flats of the river valleys; (2) the timber is of practically no value (not even for local use as firewood); and (3) the positions in which this type of woodland occurs are so inaccessible, that the question of human agency in its formation and subsequent treatment may be ruled out.

An examination of the geological formation of the district under consideration, shows the underlying strata to consist mainly of schistose rocks, while glacial *drift* and peat form an overlying soil cap. In parts, where the underlying rock projects through this mask to form rugged hill tops, the greater part of the vegetation is seen to be sharply arrested at the borders of the "drift." These woods extend up the hillsides in a more or less phalanx-like form. They show an almost complete absence of undergrowth, and the density of stock is even less than in the lowland birch-woods. The birch in both types is very similar as regards height and diameter development, but there appears to be a difference in crown development and in foliage. The commoner Highland birch has a distinctly pendulous and very graceful habit, and its leaves are somewhat triangular, as contrasted with the other birch which is not pendulous, and has rounded leaves.

It is in the ground flora of these Highland woods that a marked

difference from the other type is observed. They are characterised, in the first place, by the comparative poverty of their undergrowth, juniper being the only shrub; and secondly, their ground flora is very similar to the vegetation of the surrounding pasture. Even in the more densely stocked of these woods there is not a typical woodland flora, and the dominant plants of the woodland are the grasses which form the chief constituents of the pasture. W. G. Smith, in "The Vegetation of Woodlands,"[1] refers to this type of wood as follows:—"The undergrowth is generally grassy, and shows little difference from the adjoining hill-grazings; in the woods we have examined, the canopy was open and sheep grazed freely through them destroying any seedling trees or shrubs, hence probably arose the pasture-like character of the ground-vegetation."

My observations seem to confirm the above view that these birch-woods have been considerably modified by the grazing of sheep, cattle and deer. In this connection it was observed that such woods attained a better development, and ascended to higher altitudes, on northern aspects; in part explanation of which it is suggested that, so far as observation goes, stock of all classes tend to graze and lie on other than northern aspects. Some idea of the length of time over which this modifying influence has acted may be obtained from the fact that the first enclosures of land for grazing were made in the period from 1470 to 1530. A second period of enclosures is recorded to have extended from 1770 to about the middle of the nineteenth century.

An extreme case of destruction of woods by grazing is seen in the remains of a birch-wood, found on the slope of one of the side valleys of the Heriot Water in Midlothian. This wood takes the form of a long, narrow strip, tailing off into the pasture at either extremity. As the trees are in a state of almost complete isolation, there is really no approach towards the formation of a canopy at all. The individual trees assume a more or less bush-like form, few of them exceeding a height of above 12 feet. The crowns are developed out of all proportion to the stems, and appear drawn out in the direction of the prevailing wind. Of a typical woodland ground flora there is no evidence, and the hill pasture association, unbroken and undifferentiated, extends right through the wood. Indeed, this may be taken to represent the final stage of this type of birch "Urwald" before it is entirely

[1] See *Transactions of Royal Scottish Arboricultural Society*, vol. xxiv., 1911, part i., p. 20.

effaced. This, then, would seem to have very little claim to the title "woodland," but may be rather classed as something between that and pasture. In fact, because of the xerophilous nature of the grassland, the rich growth of grass between the trees, the sparse stocking of the wood, and the absence of undergrowth, "scrub" may be more applicable to it than any other term. Finally, although much of this birch scrub would seem to be the result of grazing, it is possible that on the upper limits of tree-growth, where the influence of grazing is reduced to a minimum, and where only natural factors exist, the birch may be very little altered from its most primitive state.

Scots Pine "Urwald."

This type occurs as pure forest, typically on the middle valley slopes, and has a much more restricted range than birch, which occupies positions at higher as well as at lower elevations than Scots pine. Like birch, it often assumes a strip formation, tapering off at one or both ends, or, in the form of a wedge, it may extend up "dry" and river valleys, with the apex reaching the highest elevation, as is seen in the Cairngorm district. Again, it may occur as small groups of only a few trees studded along a valley slope, and completely surrounded by birch. One may take this type as being more or less restricted to the Highlands, although, in Galloway, an example is said still to exist, and all accounts seem to indicate that it represents the remains of the great central forest of Scotland. Sir Thomas Dick Lauder, in his *Moray Floods*, refers to "these immense tracts of pine still covering the country at the roots of the Cairngorm mountains," as "the relics of the great central forest of Scotland." In the same work, he thus describes a cut through the Moss of Cluihaig, where, in 10 to 15 feet of peat, six or eight strata of roots of trees were obtained: "The lowest stratum is of birch roots, about 2 feet above the gravel the moss rests on. Then come three successive strata of fir (*i.e.* Scots pine) roots, 18 inches apart—another stratum of birch roots—and above that one or two more of fir that do not seem to have attained any great size. Lastly, there are firs now rooted and growing on the surface, but these are small and stunted and are called, in the language of the country, darrachs." This affords an excellent example of the natural rotation of virgin forest, and also bears out the above statements regarding the relative ranges of Scots pine and birch "Urwald."

The wider distribution of the birch implies that it is the less exacting of the two species, and therefore is found forming the lowest stratum on the gravel; with soil improvement Scots pine would probably encroach and finally oust the birch; on the advent of some catastrophe, perhaps, or possibly in the natural rotation of species, Scots pine was effaced, and birch established itself to again repeat the cycle. So that, as regards their occurrence on the same area in the past, Scots pine is seen to have been intercalated between birch.

On the area under consideration, Scots pine "Urwald" was observed at elevations varying from about 200 feet at Achnacarry to 1500 feet at Ardverikie, although at this latter altitude the trees were quite isolated. In Rothiemurchus and Ballochbuie, however, Scots pine ascends to an elevation of over 2000 feet, and in Strathspey and Deeside this tree reaches a higher altitude than birch. Thus, while sufficient statistics are not at present available to determine definitely the relative altitudinal zones of Scots pine and birch, it may be taken that in the past these species have been in competition for the middle and upper zones of tree-growth. It was observed that in the eastern part of the area, in Strathspey and Deeside, Scots pine occupied the upper limits of tree-growth; while in the western part, from Loch Long to Fort William, birch took up this position. In this connection, the fact that the rainfall in the eastern part is roughly only one-third of that in the western, may not be without significance.

The Black Wood of Rannoch in Perthshire, Rothiemurchus, Glenaffric, Glenmoriston, Glenmore and Abernethy in Inverness-shire, Ballochbuie and Glen Lui in Aberdeenshire, and Glentulla in Argyllshire, form extensive and typical examples of Scots pine "Urwald," but probably one of the best examples of its kind is Locheil Old Forest in Inverness-shire, which will now be described as the type. It lies considerably to the west of the Cairngorm district, but probably belongs to the same primeval forest which extended right across that part of Scotland. The forest forms a strip of some six miles in length along the southern shore of Loch Arkaig, and occupies therefore a northern aspect. It takes up a position on the middle hill slope, and is fringed above and below by birch. At Gusach, farther up Loch Arkaig side, there still exists an "outlier" of this forest, which was practically clear felled about a hundred years ago, and it is of interest to note that the few trees left are regenerating the area naturally. Locheil forest covers an area of about 1500 acres, and lies approximately

between the contour lines of 200 and 700 feet, the elevation of the loch being about 140 feet. Although the elevation of the forest is comparatively low, it is nevertheless far removed from the region of cultivation, a fact which no doubt largely accounts for its present natural condition. The soil of the forest and district is essentially of a peaty nature, while the formation immediately below it is glacial *drift*. This *drift* in turn overlies schistose rocks, which constitute the greater part of the solid rock in this district.

In general view the forest has a strikingly imposing appearance, and there is an undoubted air of antiquity about it. What strikes one first, perhaps, is the variety of colour which it presents. The green canopy supported on the typically copper-coloured branches of the crowns gives place to the deep bronze of the boles, and finally culminates in the brilliant purple of the heather-clad floor. The individual tree has a flattened umbrella-shaped crown developed right at the top of an almost perfectly cylindrical bole. It is interesting to contrast this habit of growth with that of Scots pine in Rannoch, Speyside and Deeside forests, where the trees are pyramidal in habit; the stems, even of the older trees, are far from "clean"; and the foliage is distinctly grey. The bole of the trees in Locheil Old Forest is encased in deeply fissured bark, in some cases over 6 inches in thickness, with the fissures often extending to within about half an inch of the cambial ring. The density of the stock is now fairly low, although in the past it was probably much greater, as the stems are clean to a height of about 40 feet on the average. The following dimensions and increments of some of the trees of this forest were obtained by means of the Brandis hypsometer, and Pressler's increment borer.

No.	Length of Bore.	No. of Rings.	Species.	Girth at Chest Height.	Height.	Radial Increment during last 3 Years.
5	5·5 cms.	40	Scots Pine.	9·2 feet.	60·0 feet.	·3 cms.
6	3·3 ,,	38	,,	9·1 ,,	62·5 ,,	·2 ,,
7	3·4 ,,	45	,,	5·75 ,,	56·5 ,,	·17 ,,
8	3·7 ,,	40	,,	4·0 ,,	51·0 ,,	·15 ,,
9	3·5 ,,	40	,,	6·3 ,,	78·3 ,,	·15 ,,
10	4·7 ,,	29	,,	11·4 ,,	88·2 ,,	·34 ,,

The above brings out rather an interesting point in connection with the general opinion that when trees of this species reach an age of 200 to 300 years—as is the case here—and incidentally these large dimensions, they cease putting on increment, or, in other words, cease growing. The last column of the above table will now compare with an increment table obtained in a similar manner from a pure larch wood at Tor à Mhiult in the same locality though perhaps on better soil. This wood has an average age of 50 years, with a density of stock of about ·85 of the normal.

No.	Length of Bore.	No. of Rings.	Radial Increment during last 3 Years.
A	5·1 cms.	34	·3 cms.
B	4·4 cms.	32	·3 cms.
C	4·7 cms.	25	·3 cms.
D	4·2 cms.	24	·5 cms.

While such a comparison seems to show that the increment of Locheil Forest is falling off, it cannot be said to have ceased altogether. The economic value of such a wood is seen in the first-class quality of its timber, which, I may state here on good authority, surpasses any imported Scots-pine timber. Besides being clean and sound, it has the special qualities of being very close grained, of having a high ratio of "red" or "heart" wood to "sap" wood, and of having a "sap" wood which does not readily discolour in seasoning.

It is, indeed, unfortunate that this type of forest has, in almost every case, undergone severe modification. Doubtless, in early times, it would to some extent be influenced by game, but later times saw the introduction of more drastic influences. For example, it is recorded that in the Cairngorm district, about the year 1730, a branch of the York Buildings Company made extensive exploitations in the forest of Abernethy. So in Locheil Forest and Gusach, records show extensive fellings to have been made about a hundred years ago. During the same period, in districts where pig-iron was manufactured, many of these primitive forests are said to have been entirely depleted. The final stages

of these modifying influences may be seen in the small "outliers" and isolated clumps of Scots pine which stand out in relief on the birch-clad mountain sides. After the clearing of these areas birch has often taken possession of them, although in some cases, as at Gusach, and especially in Rothiemurchus, Abernethy and Ballochbuie, Scots pine is again establishing itself. Juniper is apparently the only undergrowth obtained in these forests, and in parts of Abernethy and Rothiemurchus it shows a very vigorous development.

The ground-vegetation of this Scots pine "Urwald" is unique, in that it consists mainly of plants which one does not usually associate with woodland, but rather with moorland. In Locheil Forest the dominants may be taken as ling (*Calluna*), bell-heather (*Erica tetralix*) and blaeberry (*Vaccinium myrtillus*), while bracken (*Pteris aquilina*) fringes the forest and also appears in the "opens." W. G. Smith describes a similar ground flora for this type of primitive woodland in the Rannoch and Speyside districts, and, in addition, other small plants which are peculiar to this class of forest. These are wintergreens (*Pyrola*), chickweed wintergreen (*Trientalis*), and several small orchids (*Goodyera repens*, *Listera cordata*, etc.).[1] Possibly the fact of Scots pine yielding a comparatively acid humus, might tend to the development of the more or less xerophilous heath plants in association with it.

Oak "Urwald."

This type again finds a more extensive and better development in the Highland part of the area under consideration. Within this area natural oak-woods occur at elevations varying from 50 feet to 650 feet above sea-level, while in other parts of Scotland oak is reported to ascend to over 1000 feet. These woods mainly occupy the lower hill slopes, and occur typically skirting the shores of lochs, or following the course of some river in a narrow strip along either bank. Thus, as regards altitudinal distribution, natural oak-woods seem to be much more restricted than either birch or Scots pine; while the actual area covered by oak-woods is distinctly less than that covered by birch woodlands. The position and shape of many of these natural oak forests would seem to indicate that soil conditions play an important part

[1] See "The Vegetation of Woodlands," *Transactions of the Royal Scottish Arboricultural Society*, vol. xxiv., part 1, pp. 20 and 21.

in the distribution of oak. For example, the oak-woods of Loch Goil take up positions practically on the shores of the loch, and the irregularities in shape do not seem to be due to any artificial or natural influence other than a difference in depth of soil. In this district, due possibly to a long continued washing action; pockets of comparatively deep soil have been formed along the loch sides, and on these natural oak-woods are developed. *Quercus robur* (= *Q. pedunculata*) appears to constitute the main element of oak "Urwald" on this area, and only in one oak station, viz., Presmanon in Haddingtonshire, was there observed a slight admixture of *Quercus sessiliflora*.

As it was impossible to find an oak-wood in the Highland area which had not been coppiced at some time or other, a station for observations was selected at Lochwood in Dumfriesshire. This wood occupies a rising piece of ground in the centre of Lochwood Moss, and lies approximately between the contour lines 550 and 650 feet. The oak is fringed all round by birch, which, however, only extends for a short distance on to the deep peat. The Moss consists mainly of cotton-grass (*Eriophorum vaginatum*) and flying bent (*Molinia cærulea*), while bell-heather (*Erica tetralix*), deer-hair (*Scirpus cæspitosus*), blaeberry (*Vaccinium myrtillus*), and bog myrtle (*Myrica gale*) occur occasionally. Only on the south side does the region of cultivation border on the wood, and, from the evidence of the ruins of an old border "keep" in the wood, it was probably even more inaccessible in the past than it is at present. While the underlying rocks of this district belong to the Silurian system, they are covered by a thick sheet of boulder-clay. The knoll on which the wood is situated is entirely composed of boulder-clay, which projects through the surrounding covering of peat.

In general appearance the wood exhibits a very poor development in height-growth, as do all woods of this type. Here and there is a tree which has been topped by the wind, and has "pollarded" naturally. The shape and development of the individual trees composing the wood are very characteristic, and as there are only about 50 trees per acre they have had ample scope to express their individuality. The abnormally large spreading crown, supported on a short stunted bole, gives the tree a top-heavy appearance. The crown consists of the typical "kneed" branches, while the bole, which in rare cases is "clean" above a height of about 15 feet, is often heavily "burred." On

these "burred" parts galls, caused by *Andricus terminalis*, were observed in profusion, as bright red excrescences on the bark. This, it is suggested, may be a possible cause of the "burring." Another feature of the wood is the occurrence of the polypody fern (*Polypodium vulgare*) and the lichen (*Usnea*) on the stems and branches of the trees. Some of the more decayed specimens were observed to have blaeberry (*Vaccinium myrtillus*) and rowan (*Pyrus aucuparia*) growing in their forks some 15 feet above the soil. A similar phenomenon is recorded in the Atholl woods, Perthshire, where the polypody fern was found growing luxuriantly on the stems and branches of oak trees. Of Lochwood oaks McNab states: "The trees average from 9 to 14 feet in circumference, and 30 to 50 feet in height; where the branches begin to diverge, the girth is generally greater than at the base. Nearly all the trees are in a decayed or decaying condition. The chief or upright portion of their stems varies from 6 to 8 feet in height, after which they divide, and the spread of branches sometimes measures 60 feet in diameter, almost all of them being coated with a variety of mosses and lichens. At the time of my visit, these trees were clothed with the common polypody (*Polypodium vulgare*), but notwithstanding the enormous quantity of this fern, no varieties of it were seen. The trees cannot be less than 300 years old, and judging from their appearance the tops have been removed at an early period of their growth, either for the bark or to induce a spread of branches to make them useful in naval architecture. The soil in which they stand is exceedingly good, having been enriched with decaying leaves; judging from the mossy state of the stems and branches, it is naturally damp, which has probably hastened the decay of the stems. Dr Walker, in his essays on 'Natural History' and 'Rural Economy,' in 1812, says that in 1773 one of these oaks measured 14 feet in circumference. He also states that, judging from some that were cut down, they were (in 1773) about 230 years old."[1]

In this wood the undergrowth has a better development than in any other oak-wood examined. It consists mainly of hazel (*Corylus avellana*), alder (*Alnus glutinosa*) and honeysuckle (*Lonicera periclymenum*), and in parts the undergrowth forms a complete second canopy.

The reference made to "pollarding" this wood in the above

[1] McNab, *Transactions of Botanical Society of Edinburgh*, vol. ii. p. 96. 1873.

quotation is one of some importance, because had this been a common practice in the past, it would have led to the formation of a modified type of oak "Urwald" in Scotland. Now primeval oaks observed at Loch Goil, Achnacarry, Dalkeith Park, Cadzow Park, and records of oaks in the Atholl woods, in the Lowther valley and elsewhere, show few of the stems to be "clean" beyond a height of 15 feet to 20 feet. It is also argued above, that this practice produces timber suitable for naval architecture; but would not "pollard" shoots tend rather to grow straight? Perhaps, as additional evidence in support of the view that the trees were not "pollarded," one might take the fact that the trees are decaying from the ground upwards, and not from the forking point downwards, as would probably be the case in "pollarded" trees. Also there is no "burring" observed at the point where the tree forks, whereas in "pollarded" trees "burring" usually occurs at this point. It is hoped that the above reasons are sufficient to justify the exclusion of pollarding as a modifying influence on our natural oak forests in Scotland.

The ground-vegetation of virgin forest of this type is perhaps one of the most distinctive features about it, and is observed to be very similar to that already described for lowland birch "Urwald." In spring, the special feature of such a woodland, as seen at Lochwood, is the abundance of wood hyacinth (*Scilla nutans*), which occurs in extensive sheets on the forest floor; primrose (*Primula vulgaris*) flowers at this time, and is also present in great abundance. Bracken (*Pteris aquilina*), *Holcus mollis* and *Anthoxanthum odoratum* complete the list of main constituents of the carpet, while wood-sorrel (*Oxalis acetosella*), wood violet (*Viola riviniana*), and species of mosses may be classed as sub-dominant. *Potentilla tormentilla*, *Stellaria media* and *S. holostea*, *Luzula vernalis* and *L. campestris* (var. *conjesta*), *Arctium lappa*, *Rumex acetosa*, *Rubus idæus*, *Galium saxatile*, *Conopodium denudatum*, *Polypodium vulgare*, *Vaccinium myrtillus* and *Lastrea dilitata* were observed to occur occasionally. Of the grasses in this flora *Festuca ovina*, *Poa pratensis*, *Triticum repens* and *Holcus lanatus* are the chief. Where the oak woodland vegetation merges into that of moor, marsh marigold (*Caltha palustris*), horse-tail (*Equisetum sylvaticum*), speed-well (*Veronica chamædrys*), *Centaurea nigra*, bog-bean (*Menyanthes trifoliata*), bog-myrtle (*Myrica gale*) and lesser celandine (*Ranunculus ficaria*) were obtained.

Over the area in question there occur many examples of oak "Urwald," all more or less crumbling to decay. In these, as the canopy becomes thinner, the ground-vegetation gradually loses its woodland type, and approaches that of the surrounding pasture, to form a "parkland" association. Thus, although the individual trees still remain typical, they are isolated to such an extent, in many cases, that they fail even to form an association, much less a wood. Some examples are—the "Hagg," in the old Jed Forest, Roxburghshire; Atholl woods, Perthshire; Dalkeith Park, Midlothian; Cadzow Park, Lanarkshire; and possibly the final stage in this process of extermination is to be seen at Bowhill, Selkirkshire. Here, although a few specimens still stand (1883), the site only of the primitive oak forest of Ettrick can be said to remain.

As in the case of birch and Scots pine, the more extensive natural oak-woods of this area are obtained in the Highlands, and while the origin of these may be taken to be oak "Urwald," owing to the influence of coppicing, they might best be described as "lineal descendants" of such. They consist essentially of *Quercus robur* (= *Q. pedunculata*), while Highland birch, alder (*Alnus glutinosa*), holly (*Ilex aquifolium*), rowan (*Pyrus aucuparia*), ash (*Fraxinus excelsior*), hawthorn (*Cratægus oxyacantha*) and hazel (*Corylus avellana*) occur occasionally. Their lower limits are usually sharply defined by natural barriers, *e.g.* lochs, rivers, etc., while their upper and side limits are quite irregular, and seem to be determined by depth of soil rather than by any other influence. On the whole these oak-coppice woods present a fairly uniform type, any variation being due to a difference in the age of the coppice; in which case the relative height development of the woods differs. The individual trees, or rather stool shoots, are very similar in character, forming much cleaner stems than the trees of the Lochwood type, but while showing practically the same height development as that type, they evidence a very much smaller development in diameter-growth. The density of stock in the coppice is naturally very much greater than in the other type. Of all the woodlands examined, this oak-coppice has probably the most fertile soil, this being due no doubt to the increased shade and leaf-fall afforded by the coppice allowing a very deep humus-forming layer to accumulate.

The ground flora of oak-coppice is naturally, up to a certain point, influenced by the age of the coppice. In the woods of

north-east Kent, it is stated[1] that under coppice the shade condition of the vegetation is reached by about the tenth year. In the Highlands of Scotland, with a difference in soil and climate, this condition will probably be reached later. During this shade-period a minimum development of the ground flora is obtained, but with increasing age, accompanied by an opening of the canopy, quite a typical woodland flora establishes itself. This, as listed by Robert Smith in his *Botanical Survey of Northern Perthshire*, for oak-coppice in that district is very similar to the ground flora already described for Lochwood.

What might be classed as a variety of the last type is seen in oak-woods which, as coppice, have been heavily thinned and then allowed to grow into high-forest. While the principals of forestry deprecate this practice of growing high-forest from stool shoots, yet some such conversion of oak-coppice woods has been done in the past, and probably more will be done in the future, as within recent times the demand for oak-bark has been much reduced. In this high-forest type the density of stock lies between that of oak-coppice and the Lochwood type, as does also the development in diameter-growth, while the development in height-growth exceeds that of both the other types. The development of crown is medium, while the boles of the trees are "clean" to a greater height than in either of the other types.

In its ground flora this high-forest oak-coppice would appear to be somewhat unique, in that it is very simple in character and seems to consist mainly of only a few dominant species. These in Presmanon wood, Haddingtonshire, are bracken (*Pteris aquilina*), wood-rush (*Luzula sylvatica*), *Lastrea dilitata*, dog's mercury (*Mercurialis perennis*) and *Holcus mollis*, while wood-sorrel (*Oxalis acetosella*), wood-hyacinth (*Scilla nutans*) and primrose (*Primula vulgaris*) occur occasionally. A possible explanation of this may be that a woodland flora once occupied the forest floor; and that the wood was then coppiced, with the result that the sub-dominant and perhaps some of the dominant plants were crushed out, especially if they were late-leafing. The coppice was then thinned, and the more aggressive dominants took possession of the soil to the exclusion of most of the other species. As an example of a wood of this type, which is

[1] M. Wilson, *Plant Distribution in North-east Kent*, British Association, Sheffield, 1910.

approaching the latter condition, the natural oak-wood on Loch Arkaig side may be mentioned.

Plantations.

It will be observed that the typical woodland flora in publications on woodlands, is generally recorded in connection with woods which have been established for some considerable time. Some attention has therefore been given towards determining at what particular stage in the development of the wood this flora establishes itself. Unfortunately, my observations up to date can be said only to lead to negative conclusions. For observational purposes, several pure and mixed plantations, on the area considered, were examined. The woods in which the ground flora was sufficiently developed for purposes of comparison, exhibited all phases of development, ranging from the "pole" stage to that of mature forest. The plantations were taken in different localities, and they consisted of various species. The density of stock and uniformity of the canopy differed from plantation to plantation. They were also of different ages, and their past treatment varied. Some, having regard to species and locality, would seem to be "normal" plantations, *i.e.*, fully stocked and developed; others were not. In all these cases it was observed that, while the majority of the plantations had developed in them quite a vigorous ground flora, no plantation examined could be said to have a typical woodland flora. The oldest examined was planted 200 years ago, whilst the majority ranged in age from 50 to 200 years. This, then, would seem to indicate that, on the area in question, the conditions which are favourable to the development of a typical woodland flora are not established within the period of the first 200 years in the life of the plantation. The exact conditions, and whether they refer specially to the soil or to the amount of shade, are, as yet, undetermined.

On the other hand, the question of how long a woodland flora will persist under changed conditions may be illustrated. The plantation Tor à Mhiult, Achnacarry, Inverness-shire, occupies the site of a primitive oak forest, and the ground flora to-day is as typically woodland as that described for Lochwood natural oak forest. At present the plantation consists of pure larch (*Larix europea*), with occasional specimens of spruce (*Picea excelsa*) and beech (*Fagus sylvatica*), while a few birch and oak trees of the

original forest still remain. The oldest part of the plantation is about 60 years, the remainder being about 40 years of age, and the density of stocking is almost normal. Here, then, in spite of the disturbing influence of exposure after the felling of the original oak forest, and during the first youth of the larch plantation, this ground flora has persisted as such. Nor during a period of changed conditions, lasting for about 60 years, has it altered to any appreciable extent.

"Urwald" types compared with Pure and Mixed Plantations.

A very general comparison only between the above types may be attempted. In every case the primitive woodland types are compared with a pure plantation of the same species and in the same locality. In the case of mixed plantations it was thought sufficient to compare the "Urwald" as a whole—irrespective of the species composing it—with the average of mixed plantations, not necessarily in the same locality.

Birch plantation in contrast to birch "Urwald" shows a greater development in height-growth, as well as being more densely and regularly stocked. The diameter development is usually greater in the primitive birch type. On comparing individual trees, the plantation tree appears to be more "drawn," and has the bole "clean" to a greater height than the other type. The crown of the plantation type, especially in youth, assumes a more or less conical shape, and, in having a small lateral and large vertical extension, it shows an opposite development to the "Urwald" type of crown. The bark of old birch trees in "Urwald" often assumes a rough, corrugated appearance, while in plantations it is invariably smooth.

In young birch plantations the ground flora is very scanty, as is the case in all young fully-stocked plantations, and appears to have no distinctive feature about it. Later on in the life of the plantation, however, a ground flora establishes itself. It has been observed that this consists mainly of invading plants from the surrounding land, whether this be pasture or woodland. Thus, plants collected from such a ground flora showed adaptations either in root or stem for rapid encroachment.

A comparison between plantation and primitive forest, in the case of Scots pine, shows that there is not such a marked difference

between the two as in the case of the other species compared. For example, 66 feet may be taken as the average height of Locheil Forest, which height was observed to compare favourably with Scots pine plantations in the same locality. On the same quality of locality, namely "average," a comparison with Scots pine 130 years old, at which age the maximum height-growth has been reached, does not show a great difference in the relative heights.[1] Also the proportion of clean bole to the total height of the tree is, in the primitive forest type, often quite as large as in the plantation type. With regard to diameter and crown, "Urwald" shows a much greater development than the plantation type. On the other hand, the plantation has a greater density of stock, and is also more regularly stocked than natural forest. In volume the bole of the individual "Urwald" type of tree approaches very closely to that of a perfect cylinder, and has, therefore, a "form factor" which is more nearly equal to unity than that of a plantation tree.

The ground flora of such plantations, even at the age of 100 years, is very scanty indeed, and may be taken to consist mainly of bracken (*Pteris aquilina*), pasture grasses, wood-sorrel (*Oxalis acetosella*) and species of mosses. Indeed, it may be said that, spruce and beech plantations excepted, Scots pine has the most feebly developed ground flora of any plantation on this area. Scots pine plantations and "Urwald" afford us, perhaps, the best examples of natural regeneration in Scotland. In this connection the plantations of Curr, Skye and Ballnagowan in Speyside are probably without equal, while in parts of the primitive forests of Abernethy, Glenmore, Rothiemurchus and Ballochbuie a full crop has been established by natural regeneration.

Natural oak forest always shows a very poor development in height-growth when compared with oak plantation. In addition, as already mentioned, the clean bole of the tree in oak "Urwald" rarely exceeds a height of about 20 feet, while 40 feet is a fair average in plantation oak. The crown and diameter development is greater in the primitive type, while the density of stock is seen to be much less than the plantation type. A comparatively small crown, developed at a considerable height from the ground, is a feature which characterises the plantation oak. . The variety of species composing the ground flora of oak plantation appears to

[1] See *Manual of Forestry*, by Sir William Schlich, K.C.I.E., vol iii., appendix iii., pp. 364, 365.

be distinctly greater than in the other types of plantation. The chief constituents of the ground flora are again pasture plants, but among the others there seems to be a predominance of comparatively deep-rooted plants. Perhaps, as a result of the heavy leaf-fall, the deeper accumulation of humus-forming material may have the effect of introducing more of these deep-rooted species than are obtained in other types of plantation.

As compared on the one hand with "Urwald," and on the other with pure plantations, mixed plantations would, in many respects, appear to occupy an intermediate position. At the outset, the height-growth, diameter-growth, crown development and density of stock, generally speaking, may be said to be intermediate. The canopy naturally differs from either "Urwald" or pure plantation, in that the individual crowns forming it may be deeper, more spreading, or flatter, according to the species of tree. This, of course, takes away from the uniformity of canopy which is characteristic of both primitive forest and pure plantation. As might be expected, the form of the individual trees composing such a wood varies according to the species, and thus, from an æsthetic and sporting point of view, a mixed plantation is preferred. Again, in this type, where shade-bearing and light-demanding species are mixed promiscuously, the suppression of part, or, in some cases, the entire crown of one species by another is of common occurrence. It was observed that in plantations of this type evidences of natural regeneration were fairly numerous, and in parts the seedlings showed quite a vigorous development. A feature of all the plantations examined was the almost entire absence of undergrowth of any description.

The ground flora of such a plantation is by no means the least interesting part of it, and although the variety of species may not be so great as in primitive forest, they are distributed in the plantation in a much more striking manner. The canopy being far from uniform, the intensity of light in different parts varies. So that very often, even within the sphere of influence of a single crown, there may occur a marked change in the nature of the ground flora. For example, in Hurley Wood, Penicuik, Midlothian, it was observed that spruce (*Picea excelsa*) allowed only moss and wood-sorrel (*Oxalis acetosella*) to grow under its shade at any season of the year. Lime (*Tilia Platyphyllos*) in the spring allowed a ground flora consisting mainly of lesser celandine (*Ranunculus ficaria*), *Ranunculus repens*, golden

saxifrage (*Chrysosplenium oppositifolium*), *Lastrea dilitata* and nettle (*Urtica dioica*) to develop beneath it, but later in summer, when the shade condition was established, only *Lastrea dilitata* and nettle (*Urtica dioica*) persisted. The shade of the Wych elm (*Ulmus montana*) was observed to have a similar effect on the ground-vegetation, though perhaps not quite to such a marked extent. The ground flora forming a carpet over the major portion of this wood consists essentially of lesser celandine, golden saxifrage, wood-sorrel and species of mosses. So that in the development of its ground flora, as of its tree species, the mixed plantation would seem to present the most varied type of all the woodlands and plantations discussed.

Summarising what may be termed the "Urwald" associations of the area under consideration, they appear to assort themselves as follows:—

1. Birch (which has a range extending from the lower to the upper limits of tree-growth, and has the widest distribution of the three types) consists of two more or less distinct associations—

(*a*) Birch-oak association; this has replaced oak "Urwald."

(*b*) "Birch-scrub" association; this occurs typically on the upper limits of tree-growth, and extends over large areas in the Highlands.

2. Scots pine (which, either by itself or accompanied by birch, ascends to the upper limits of tree-growth, but only in rare cases descends to such low elevations as oak and birch. Next to birch it has the widest distribution of the three species), and comprises really only a single association—

(*a*) Scots pine association; this occurs on the middle hill slopes, and is essentially Highland.

3. Oak (which occupies positions along the lower limits of tree-growth, and of the three associations has probably the most limited range) contains at least three distinct associations—

(*a*) Oak-association; which occurs most typically in the lowlands, in parks and enclosures.

(*b*) Oak-coppice association; this has a wide distribution along the lower limits of tree-growth in the Highlands, but is not confined to the Highlands.

(*c*) High-forest oak-coppice association: this has a very limited distribution.

Conclusions.

It may be taken, then, that the various types of "Urwald" described represent some of the more concrete and typical examples of natural plant associations included in the area under consideration. This being so, it is endeavoured here to interpret the observations made in these woodlands, in so far as they appear to have some bearing on the problem of the afforestation of the "hill pasture" and "deer forest" which surround them.

At the outset, from observation and from a study of the various influences which have modified these natural woodlands in the past, and also from comparisons made with existing plantations of the same species in the same localities, these woodlands at no period seem to have represented normally stocked and developed forests. The factors of the locality also in which they are situated, have probably changed considerably during the life of the forest. For the above reasons alone, it would scarcely seem possible to ascertain the quality of any locality from its natural woodlands, by considering them as crops of trees produced by the locality, and therefore as guides to the assessment of its yield capacity. But it may be asked whether these natural plant associations form any index at all to the quality of the locality in which they occur? For the following reasons, the answer to this would seem to be in the affirmative. In the first place, these natural woodlands, having the distribution already referred to, show that the least exacting of our indigenous tree species, namely birch, occupies in the main that part of the locality which appears to be least favourable to tree-growth. The more exacting Scots pine is observed to take up a somewhat intermediate position in this respect; while oak finds a development in valley bottoms, on river banks and loch sides, or, generally speaking, in that part of the locality which seems best suited to tree-growth. In addition, the fact that while birch "scrub" association consists of practically pure forest, oak "Urwald" usually contains a variety of species, may not be without significance; in the latter, an increase in the number of species may be safely assumed to indicate more favourable conditions for tree-growth.

In a similar manner, consider the ground floras of these primitive woodland types. With this in view, the specific case of the pure larch plantation Tor à Mhiult, in Inverness-shire, may not be without interest. This is undoubtedly one of the finest

larch plantations in Scotland, and forming the carpet of its forest floor is a typical woodland flora. From this, then, it is argued that the soil conditions here, of which this flora is more or less the expression, are, and have been in the past, specially suited to tree-growth. While actual observations for the other types of ground flora were not made, it may be taken that they, having fewer varieties of less exacting plants, indicate parts of the locality where the soil is less favourable for tree-growth.

Passing from this to the case of land entirely devoid of tree-growth, Do the natural plant associations of this land form any index to the quality of the locality, especially in regard to the soil conditions? In this connection it may with advantage be asked how the agriculturalist assesses such land? While such questions as the head of stock the land carries, the death-rate, the percentage of lambs, etc., etc, are to him all-important, does he not pay considerable attention to the variety of natural plant associations, their relative extent, and the positions and aspects which they occupy? Now, as the agriculturalist and forester have the object in common of producing from the soil, it may not seem strange for them to have, to some extent at least, a common method of ascertaining its productive capacity. Our conclusions would show that in primitive woodlands a certain type of ground flora indicates a part of the locality specially adapted for tree-growth or the reverse. So, on hill pasture, certain natural plant associations (which in this class of land also would seem to express more or less the soil conditions) may indicate portions of the locality which are better or less suited to tree-growth than others. While, admittedly, there is not yet sufficient known about these associations to warrant any very definite conclusions being drawn from them regarding the existing soil conditions, still they would seem to deserve some consideration in, say, a general afforestation survey of extensive tracts of land. Of course, it must be borne in mind that whatever application this method may have, it can only be used as auxiliary to the other method of assessing completely the quality of the locality in which this land lies, namely, according to the several factors of the locality.[1]

"Urwald," however, as such, would seem to deserve some further attention, and to have a certain potential value—other than that already mentioned—in the afforestation of parts of this or of any other area. In the first place, as mentioned by W. G. Smith in

[1] See *Manual of Forestry*, by Sir William Schlich, K.C.I.E., vol. ii. p. 48.

"The Vegetation of Woodlands,"[1] wind is a climatic factor of great importance in forestry, and tree-growth ceases whenever the wind attains such a force that the formation of young shoots is prevented. It would, therefore, seem advantageous to determine this wind zone, and it is suggested that the birch and Scots pine "Urwald," along the upper limits of tree-growth, may assist in its determination.

Then again the question of shelter, especially in the Highland portion of this area, is of considerable importance from an afforestation point of view. The shelter afforded by primitive woodlands has been recognised and made use of to a limited extent in the past. In the present, the feasibility of converting certain of these natural woodlands into shelter-belts might not be altogether unworthy of consideration. Finally, it may be said that the following quotation has a special application to the greater part of "hill pasture" and "deer forest," not only within this area but all over Scotland:—"There is, however, one great drawback in the case of afforesting land which has been lying waste for long periods of time, inasmuch as it has suffered in yield capacity owing to continued exposure and the dissipation of all organic matter."[2] In addition, land of this type has borne the strain of producing wool and mutton for many years past, without any appreciable return being made to it in the form of manure. From a study of natural woodlands it is concluded that while these vitiating factors have influenced all classes of "Urwald" in the past, in no case did they exercise so powerful an effect as on hill pasture, and in certain woodlands their influence was reduced to a minimum. While these facts would indicate that the sites of such woodlands might be used as nuclei from which to afforest the surrounding land of this nature, it must not be forgotten that they usually occupy the more inaccessible portions of this class of land.

In conclusion, I desire to thank the many friends who have given me assistance in my work. I am specially indebted to Dr Smith, under whose supervision this research has been carried out, and also to Dr Borthwick for many valuable suggestions. In addition, my thanks are due to various members of this Society for the facilities they have given me in carrying out field observations.

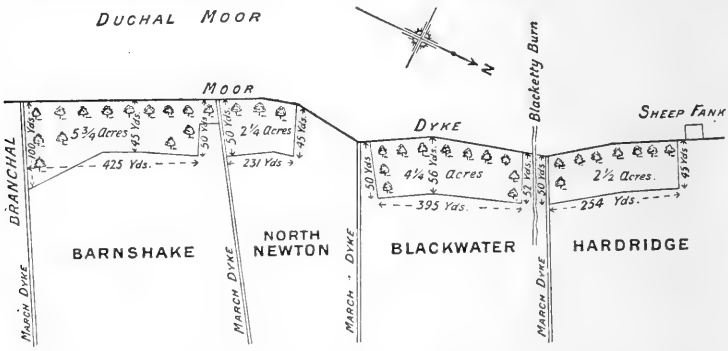
[1] See *Transactions of Royal Scottish Arboricultural Society*, vol. xxiv. p. 13. 1911.

[2] See *Manual of Forestry*, by Sir William Schlich, K.C.I.E., vol. i. p. 184.

20. Planting for Shelter.

By Sir Hugh Shaw-Stewart, Bart.

During the last three years I have planted a strip of ground along the edge of Duchal moor near Kilmacolm, Renfrewshire, for the purpose of affording shelter to the young dairy stock of several tenant farmers whose lands adjoin the moor. Appended is a rough sketch (not drawn to scale).



The moor lies to the west of the farm-lands, and has a rainfall of 60-70 inches per annum. Rising to a height, in several places, of over 1000 feet, it is swept during many months of the year by strong W. and S.W. winds. The plantations lie between the 600 feet and 700 feet contour lines, with an easterly exposure.

So keen are the farmers to obtain some shelter for their stock on these upper lands, that they have readily yielded the necessary ground without asking for any reduction of rent. Fifty yards was the width of the sections aimed at, but, in order to obtain good dry ground along the outside of the plantations, for the stock to stand on while sheltering from the storms of wind and rain, the actual width is broader or narrower according to the lie of the ground.

Conifers—native Scots pine, larch, and spruce-fir—have been planted from 3 feet to 4 feet apart, mixed with hardwoods at from 10 feet to 15 feet apart. The hardwoods are principally alder and birch, with sycamore and a few beech where the ground is suitable.

The young plants are doing very well where the ground is dry, and where there is a little soil on the surface; on the mossy,

wet parts the progress is not so marked, though the plants appear healthy. Wherever the straight line of fencing had to be deviated from owing to water-courses and inequalities of ground, the sections were laid off with the view of affording the stock as many cosy corners as possible.

To the outlay for fencing and planting there must be added the cost of cutting surface drains where necessary, also the cost of rabbit wire-netting laid along the fences and along the top of the moor dyke. This already existing stone dyke gives useful protection to the young plants.

Apart from the ultimate value of the timber, these little plantations will, undoubtedly, add to the value of the farm-lands by the shelter they will afford, and they should ultimately more than repay the cost of fencing and planting.

21. Larch Seed.

By G. F. Scott-Elliot, F.R.G.S.

Although there may be possible rivals to the supremacy of larch as our best forestry "essence," it seems almost indisputable that larch should be the main crop in Scottish forestry.

Unfortunately, during the last twenty years, the larch disease, sometimes called "blister," has prevailed in many districts to such an extent that many proprietors have given up further efforts to grow larch, and have contented themselves with planting Scots fir or spruce. This is a very serious matter for the future of Scottish forestry, for the value of larch timber is nearly double that of spruce, and planters in this country cannot afford to lose the slightest economic advantage.

I have to thank many practical foresters for kindly information as to their experience, and I have also consulted such of the best foreign sources as were obtainable, and can only hope that the following notes on this important subject may prove useful.

The larch disease is not, according to good botanical authority, the chief enemy of larch, but is rather a sign that the trees are unhealthy and wanting in natural vigour.

Larch disease may be brought about by all sorts of conditions or accidents. Trees peeled by deer or rabbits, or whose branches have been broken by snow, may eventually be killed by "blister."

Sometimes climatic reasons bring about an epidemic, as for instance when trees are grown in a humid, still hollow where the wind does not reach them. Unsuitable soil, as for instance a wet heavy alluvium or even a poor dry soil, may render the trees feeble and unhealthy so that they cannot throw off the effects of the disease, and eventually they succumb.

Cieslar (1), one of the very best continental authorities, considers that any one of these conditions may produce a dangerous epidemic of Peziza.

But so far as Scotland is concerned, there is no question but that first-rate larch can be grown in our climate in suitable localities. Magnificent larches have, in fact, been grown, and in many different districts.

So far as one can gather from observation, those plantations which are over fifty years old hardly seem to have been seriously attacked by the disease. The damage is most visible in plantations of from ten to fifty years of age. There has been a great improvement during the last ten years, but this may be due to the undoubted development in forestry that is now obvious everywhere in Scotland.

As a matter of personal observation, much of the injury seems to be due to careless silviculture. I have myself seen larches planted in a perfectly flat peat moss with a subsoil of stiff estuarine clay and in a sheltered place. They happened, in this case, to be attacked by insects rather than by Peziza, but it was obvious enough that whoever it was that planted larch in such a situation was guilty of arboricide.

Mr S. J. Gammell of Drumtochty also informs me that in humid, windless places, Aphis and not Peziza is usually the executioner selected.

I know also of cases where, on the same property and within half a mile of one another, one plantation on a steep hillside was healthy and vigorous, hardly showing a trace of disease, whilst others on the flat alluvium of the river valley were rapidly dying and obviously doomed to destruction.

But although the question is confused by these considerations, it is certain that very fine larch have been and are still, in a few places, being grown in Scotland. Therefore our climate is not solely to blame for the bad state of so many plantations to-day.

Are we using the same variety of the larch that was planted seventy and more years ago?

Most of these magnificent larches were undoubtedly grown from continental seed. It seems, therefore, at first sight, not improbable that the use of Scottish seed may be responsible for the inferior results too often obtained nowadays. Mr Robertson, Dunrobin, informs me that Mr John Gregor, nurseryman, of Forres, in his book on Forestry, guaranteed his seed as obtained from acclimatised—that is, Scottish trees. In considering this an advantage, he was entirely correct according to the scientific teaching of his time, and, indeed, of to-day. But it really seems probable that the extended use of Scottish seed coincided with the more dangerous tendency to disease which has been so very common during the last forty or fifty years.

Comparative experiments have been made of Tyrolese, Scottish and Japanese larch seed in many of our best Scottish nurseries, and I am allowed to mention some of their results.

As regards power of germination and efficiency, the following opinions are of some importance :—

"The germinating power of Tyrolese seed is much higher than native . . . by weight one pound of Tyrolese produces as many plants as from four to six pounds of native; Japanese is in my experience even better—three pounds being equal to four of Tyrolese" (Mr John Boyd, Inverliever). "The seed of the former (Tyrolese) germinates much more regularly than that of the latter (Scottish seed), the seedlings being very strong and regular in size with very little or no signs of weak plants damping off (of course this is probably to a certain extent due to the stronger germinative capacity of the seed)" (Mr Gilbert Brown, Grantown-on-Spey).

But there are two distinct questions which must be kept apart in any investigation of this kind. On the continent the greatest care is taken in collecting the seed. Only the seed of sound healthy cones is used, and all light or defective grains are carefully eliminated. Is the same care always exercised in Scotland?

"The (Scottish) seed is not so well cleaned" (Mr Boyd). "The native seed is collected from diseased and unhealthy trees under contract. These may have cones four to six years old still hanging. . . . The Tyrolese seed is clean and healthy" (Mr William Mackenzie, Novar).

But if there is a real difference in the seed, due to heredity and not caused by careless collecting and grading, this should show itself in the seed-bed; and that there is such a difference seems

probable from the fact that the Tyrolese appear in some places, at least in the nursery, more liable to be frosted than the home-grown plants. Mr Boyd, Mr D. Robertson, and Mr W. Mackenzie agree on this point, but Mr G. Brown finds little difference between the Tyrolese and home plants in this respect. He notes that the Tyrolese retain their needles longer; "still they may harden off in time to withstand any frost" which the home-grown seedlings can resist.

It is clear that all these observers do find a difference in behaviour as regards the effects of our climate between Tyrolese and Scottish seedlings.

The long and laborious researches carried out by Engler (2) and Cieslar, in Switzerland and Austria, seem to show that the seed does inherit the habits of its parents. Seed from plants grown at very high altitudes produces seedlings which at first begin to bud much later in the season, and also shed their leaves much earlier than other seedlings from lowland plants grown beside them.

These experiments really seem to be decisive on this point, if any experiments may ever be so described. It is a very unfortunate thing for Scottish forestry that the paper in which they are recorded has never been translated into English.

In the point (liability to frost) mentioned by these observers, the Tyrolese seedlings appear to follow the habits of their continental ancestors. They are more liable to frost, and differ in this respect from the Scottish seed. Schott (3) mentions, in reference to the Scots pine, that the seed from northerly localities (by which he means Northern Scandinavian situations) is inferior. The cones are lighter and smaller, and the seed is apparently not so well ripened and not so heavy as that which is grown in more southerly situations. It is probable enough that in the natural home of the larch, the seed has far more chance of ripening and maturing than in most Scottish summers.

The natural home of *Larix europæa* is (according to Kirchner, Loew and Schröter) (4) a belt of country running from a point in the Maritime Alps of Dauphiné (44° 30′ N. lat.) in a north-easterly direction through Switzerland as far north as Gabris in Canton Appenzell, and eastward as far as Kronstadt in the Siebengebirgen. Throughout this region it seeds freely, and is able to reproduce itself by natural seedlings. Although it has been planted and thrives vigorously, it has never become

indigenous elsewhere, and but seldom produces natural seedlings, except in its natural home.[1]

Now the whole district alluded to above (from the Maritime Alps to the Carpathians) appears, according to meteorological data, to possess a continental and not an insular climate.

It is probable that throughout this, its natural area, the larch enjoys at least 1700 hours of sunshine annually. In the south-west part of this range it may receive 2200 and probably has 2000 hours of sunshine (5). As no part of Scotland receives so much as 1400 hours of sunshine in the year, there is obviously a great difference in climate, at any rate in this respect; and it seems probable that the seed is not able to ripen and mature so efficiently in Scotland.

Meteorological data are often unsatisfying, and it would be interesting to know whether the Scottish seed differs in weight and size from continental and especially Tyrolese seed. The seeds are variable both as to size and weight. They are from 3 to 4 millimetres long, and weigh from 4·3 to 8·3 milligrammes (on an average 5·9 mgr.). These figures, cited by the same authors (4), depend, no doubt, on a large number of careful measurements. I have not found any similar data regarding size and weight of Scottish seed.

I have compared samples of Scottish seed from one of our best nurseries with European larch seed. I do not lay much stress upon the result, for, of course, one cannot judge all Scottish larch seed from a single sample. As a matter of fact, in this particular case, the continental seed was superior in every respect. The foreign seeds were larger and heavier, a higher percentage sank in water, and, which was especially noticeable, there was very much less rubbish in the foreign sample.

This line of research is, however, invidious and possibly unfair. One could only be sure that Scottish seed, as a whole, is lighter and smaller than continental European seed after personally gathering seed both in Scotland and on the continent, and in several localities, and carefully measuring all the seed gathered. To do this properly a regular biometrical research would be required, and this has not, so far as I know, ever been attempted.

On the whole, it seems to me certain that whether, owing to

[1] Natural seedlings are common enough at Kirkennan, and also at Drumtochty, where they spring up so abundantly on wood roads that they have to be cut over with the scythe.

carelessness and lack of skill in harvesting the seed, or to some inherent defect in the Scottish climate, the commercial Scottish seed at present sold is, on the whole, inferior to European larch seed. As has been already mentioned, all those whose opinion I have asked seem to agree that foreign seed is superior in germinative power and in resistance to nursery diseases, to that collected in Scotland, except as regards frost injury, which can be guarded against.

Is the after behaviour of Tyrolese larch, when planted out, in any way better than that of Scottish seed?

The following are the opinions received:—

"I think when older the plant from Tyrolese seed is less liable to disease." "The plants from home seed . . . are more liable to be affected by Aphis and blister than either of the others (Tyrolese and Japanese) when from 4 to 12 feet high. . . . The Tyrolese does better than the home on all these places" (west, north, and east of Sutherland). "The worst plants I have ever seen with blister were natural seedlings which had grown in a railway cutting near Dunkeld." "At Novar, in Ross-shire, where I had charge of the woods for sixteen years, we planted very considerable areas of pure larch, and the parts which were planted with Tyrolese larch were, and are now, less affected with blister than the home larches are."

"There are not many larch plantations reared from Tyrolese seed throughout the country, but those that are about the ages from twelve to fifteen years decidedly show that they are much more clear of disease, and are altogether of a much healthier appearance." "We have a plantation of Tyrolese larch at Novar twenty-five years old, and it is very free from disease, whereas the native larch plantations of the same size are very much diseased."

The Japanese larch is, I think, admittedly superior in its resistance to Peziza, to any race of *Larix europæa*. The most instructive example known to me is a plantation at Murraythwaite, in Dumfriesshire, which is well known in forestry. The opposite sides of a small glen were planted with common and with Japanese larch. Although a case of disease was recorded on one Japanese larch, it was unable to affect the tree seriously. The whole Japanese side of the glen is in a splendid state of vigorous growth, whereas the larches on the Scottish side are for the most part dead or dying, and very few of them will ever come to maturity.

Unfortunately there is a belief in this country that the Japanese

larch, though exceedingly vigorous at first, begins to slacken in growth about the twenty-fifth year, and is then beaten by the home larch. I am not at all sure whether this belief is based on careful observation in Japan or on continental experience.[1]

There are not very many Japanese larches older than twenty-five years in this country. Mr Maxwell of Kirkennan, brought home seed from Japan twenty-five years ago. They were planted at Munches, in the spring of 1885, and have so far showed no sign of ceasing to grow. All made good growths in 1910. I also wrote to the Earl of Ducie on this question, and, in his opinion, the Japanese larch at Tortworth, of about the same age, is still growing vigorously. On the other hand, Mr Michie, of Balmoral, thinks that the Japanese larch does slacken off in vigour at about this age.

It is, perhaps, too soon to be certain on this point. But some hold that the Japanese larch grows so vigorously that it yields a profitable crop at the age of twenty-five years, and if this is the case, it is obviously well worth growing in Scotland.

On the whole, all the evidence which has come to my notice seems to point to the use either of Tyrolese or of Japanese seed. I do not think any forester would prefer continental Scots pine seed to that obtained from Scottish trees. The advantage of European larch seed over the home seed is, to my mind, even more marked.

Authorities.

1. Cieslar, Centr. f. d. ges. Forstwesen 1904, Heft 1, Wien.
2. Engler, Arnold, Mitteil. d. Schweiz. Centr. f. d. Forst. Versuch, 8 Band, 1905.
3. Schott. Centralblatt, Band 99, 1905, p. 527.
4. Kirchner, Loew u. Schröter, Lebensgeschichte d. Blütenspflanzen v. Mittel-Europa, 1908.
5. Bartholomew, Physical Atlas, 1893.

[1] Mr S. J. Gammell of Drumtochty thinks that Bavarian experiments are responsible for this belief.

22. Mr Henry's Investigation of Elm Seedlings.[1]

By A. D. Richardson.

In this paper the author gives an account of some experimental sowings of elm seed which he made in June 1909, and the results obtained would seem to throw an entirely new light on the inter-relationships of several of these trees, and may have the effect of revolutionising the nomenclature of the whole genus. They cannot but have far-reaching consequences in connection with the question of plant-breeding as applied to trees.

The author assumes (no doubt quite correctly) that there are two species of elm which occur naturally in the British Isles—*Ulmus montana*, With., the Wych, Scotch, or mountain elm of our parks and woodlands, and *U. glabra*, Miller, which is rarely found in woods, but is a common tree in hedgerows in the east of England (where both species are known as Wych elm), and is also somewhat prevalent in Cornwall and the south of Ireland. The latter species the author regards as the elm which flourished in pre-historic times in the forests of the alluvial lands now given up to agriculture, and he mentions that in France, Germany, Belgium and Denmark it is rare in woods, but becomes a component of the forests farther south, as in the alluvial lands of the Danube. The two species resemble each other in being wide-branching trees, but they are quite distinct in their other characters. In the former the young shoots are stout and hairy, and the leaves are large, thick, very hairy, and have short stalks; in the latter the young shoots are slender and nearly smooth, and the leaves are small, thin, smooth on the upper surface, and have long stalks. Other distinctions are that in the former the seed is in the centre of the fruit (*samara*), while in the latter it is near the top, and the former rarely produces suckers while the latter suckers freely.

The author sowed ninety different lots of seed, and the first fact established from this experiment was that only two of the kinds, namely *U. montana* and *U. glabra*, gave seedlings which were uniform in size and other characters. All the other kinds produced seedlings of different sizes, different leaf arrangements, etc. The seedlings of *U. montana* had unbranched stems,

[1] *On Elm Seedlings showing Mendelian Results*, by Augustine Henry, M.A., F.L.S. Paper read before the Linnean Society, 7th April 1910.

drooping to one side, and large leaves, the first two pairs of which were opposite and the others alternate. The seedlings of *U. glabra* had stiff, unbranched, erect stems, with small leaves, all of which were in opposite pairs.

The greatest interest centres in the sowings of the Huntingdon elm [1] seed, of which several were made. This tree (also known as the Chichester elm), on account of its extremely vigorous growth, in which it outstrips every other elm, is of great importance in forestry. It is said by Loudon to have been raised at Huntingdon about 160 years ago, from seed collected in the neighbourhood. The seed sown by the author was collected from a tree in the Brooklands Avenue at Cambridge. This avenue is planted with Huntingdon elms, quite unmixed with other kinds, so it is fair to conclude that the flowers were "selfed," *i.e.*, each flower (being protogynous and anemophilous) was fertilised by pollen from another flower of the same tree. The results obtained from the sowings were certainly very striking. One batch of 971 seedlings showed

732	with opposite leaves (*glabra* type)
239	„ alternate leaves (*montana* type)
971	

giving approximately the Mendelian ratio 3 : 1 (theoretically the numbers should be 732 : 244) as regards this single character. The author states that further examination of the seedlings showed that, taking all the points of difference in the two species into account, there were possibly sixty-four different kinds, but that, as it was desired to preserve the whole crop, and it was impossible to count the seedlings for more than one character without injuring them, this is not certain. The following four kinds were, however, distinctly visible in the bed, approximately in the following ratios:—

Small opposite-leaved	9
Large „ „	3
Small alternate-leaved	3
Large „ „	1

Although he is not quite certain, the author considers the Huntingdon elm to be a first cross between *U. glabra* and

[1] *U. glabra* var. *vegeta* of Loudon and Dippel (Loudon regarded *U. glabra* as a variety of *U. montana*); *U. montana* var. *vegeta*, Kew *Hand List of Trees and Shrubs*.—A. D. R.

U. montana. The branchlets are stouter than in *U. glabra*, and often do not become striated as in that species. The leaves resemble those of *U. glabra* in being smooth on the upper surface, and in having long stalks, but they are as thick as those of *U. montana.* The samaræ are intermediate, and abundance of fertile seed is produced. The tree suckers freely, and it has a peculiar habit, the branches being very ascending, and like most first crosses it is extraordinarily vigorous. The author states that in the Victoria Park at Bath, where nearly forty kinds of elms were planted about 1820, the Huntingdon elm is twice as large as any of the other kinds, and he quotes from Loudon the case of the tree in the Chiswick Garden which was 35 feet high ten years after it was planted. In the Huntingdon elm most of the characters of *U. glabra* are dominant, but the author points out that the comparatively large size of the leaf is due to vigour merely.

Sowings of a number of other elms—including the Jersey elm (*U. campestris* var. *sarniensis*), the Cornish elm (*U. glabra* var. *cornubiensis*) and others—were made, but all gave mixed seedlings. In the case of the common, or, as it is more frequently called in the north, the English elm (*U. campestris*, Linn.), from nineteen boxes of seed sown not a single seedling was produced, and, excluding doubtfuls, only two plants resulted from the total sowings. From an examination of some of the "varieties" of elm, the author found that in several of these the flowers tend to become malformed, and he thinks that possibly this may be what has occurred in the English elm; at any rate, had it not been a free suckerer it would have disappeared long ago. This elm, the author inclines to think, is "one of the descendants of the first cross between the two species, possibly due to a second hybridisation of some of these descendants with *U. montana.*"

These investigations served to guide the author "to a correct appreciation of the poplars, which have so long been a puzzle to systematists." According to the author we have in cultivation in this country three "black" poplars—*Populus nigra* (the European black poplar), *P. serotina* (the black Italian poplar, a hybrid, and always a male tree), and a number of female trees which, like the black Italian poplar, are generally supposed to be forms of the American species *P. deltoidea.*[1] The last-named

[1] In the Kew *Hand List of Trees and Shrubs* the black Italian poplar is considered to be identical with this species.—A. D. R.

species was introduced into France about 1700, and into England some years later. Soon after its introduction into France, a first cross with *P. nigra* accidentally arose, and this became known in France as *P. nigra helvetica*, or "Peuplier Suisse," and in England as the black Italian poplar. As the male form only is known, this tree has been entirely reproduced by cuttings.

Of the same nature probably also is the cricket-bat willow, though the author has not finished his investigations into its origin. This is only known as a female tree. It originated in Norfolk about 1700, and the author's view is that it is a first cross between *Salix alba* and *S. fragilis*, but resembling much more closely the *alba* parent than the other; in fact, so closely does it resemble *S. alba* that it has been considered by most authorities to be a variety of that species, viz., *S. alba* var. *caerulea*.

As the author remarks, "these experiments seem to show that what are called *varieties* are often simply Mendelian combinations of two existing species," and he points out that where there is only one species of a genus in a territory or country, as, for example, in the case of the beech or the ash (in which the variations which occur are of a quite different nature), such varieties are unknown, whereas in the case of such genera as *Quercus*, *Betula*, *Tilia*, etc., the variations are like those of the elm, and where the number of species increases, as in the case of the oaks of southern Europe, the number of "varieties" also increases, sometimes to an alarming extent.

In concluding this notice, it may be well to quote in full the last two paragraphs of this epoch-making paper:

"The practical corollary to all these observations seems to me evident. We have instances in the black Italian poplar, in the Huntingdon elm, in the Lucombe oak, probably in the cricket-bat willow, of vigorous first crosses that were produced accidentally, and which are timber trees of considerable value. Why not, then, proceed to make artificially first crosses in other trees, with still more valuable timber? In the ash and walnut[1] the quality of the wood, owing to its structure, will be improved the faster the tree grows; and both these trees produce extremely valuable timber. First crosses, of course, can only be re-

[1] De Vries, in *Plant-Breeding*, 174, fig. 37 (1907), describes a remarkable first-cross walnut which he saw in California. The particulars which he gives about its fastness of growth are so astounding as to seem incredible. I have no doubt, however, of the correctness of his observation.—A. D. R.

produced by cuttings or by grafting; and considerable difficulty may be anticipated in adapting on a large scale these modes of reproduction to forest trees. But our resources are not exhausted, as there is no telling but that amongst the crowd of different combinations that appear in the F_2 generation there may exist one which will display great vigour and yet breed true. This is the next step to explore.

"In countries like our own, the only hope of salvation for forestry is in growing timber rapidly: and we have been helped in that by the introduction of fast-growing trees like the larch, the Corsican pine, and the Douglas fir. But it is essential to grow the more valuable classes of non-coniferous timber; and I see no reason why an attempt should not now be made to essay experiments on the lines laid down in this paper. We are ourselves making some experiments in cross-fertilisation this year; but more workers are required in this field. Hitherto nothing whatever has been done to improve the breeds of forest trees; and foresters have never even thought of the possibilities in this direction, though gardeners and farmers have shown the way for centuries."

[Should not investigations of this kind, which must extend over a series of years, be conducted in Botanic Gardens by men trained in such work? The value of the results depends on the work being carried out with great accuracy under the closest control. The best foresters, and even botanists, have rarely the training or the facilities necessary to carry out such experiments. When a large number of crosses are raised, the interpretation of results requires much experience, otherwise confusion will result and the work be valueless. But foresters will readily avail themselves of any practical conclusions at which the experimental hybridist may arrive.—Hon. Ed.]

23. Afforestation of Water Catchment Areas.[1]

By George Baxter, M.Inst.C.E.

Afforestation is without doubt of great value in relation to the collection, conservation and purity of water.

It is now universally recognised that certain diseases are water-borne, particularly typhoid fever. It is therefore the plain duty of the Local Authority to place every barrier they can between sources of pollution and the public. Local Authorities are not only expected to discourage, but, where at all possible, to abolish absolutely human habitations and farming operations on their Catchment Areas. This may almost be treated as an axiom of public health.

Apart from the question of ensuring purity of water-supply, there is no doubt that an afforested watershed is beneficial for other reasons. It prevents sudden and heavy flooding, and consequently less débris is carried down by the streams to silt up the reservoir. All masses of woodland increase the humidity of the air, and this tends to increase rainfall. The influence of forests on evaporation is also very marked. It has been proved by experiment that the evaporation in woodlands is less than half of that which obtains in free and open areas in the same district, and there is thus saved to the water-supply a considerable portion of the precipitated rain which would otherwise be lost by the action of sun and wind.

It has been objected that wooded drainage areas may pollute the water-supply on account of the enormous quantity of dead leaves decaying on the watershed, or blown about and carried down by the feeders to rot in the reservoirs. Eminent physicists have proved, however, that the sour humus of a forest is antagonistic to pathogenic bacteria, and the last objection is guarded against in all skilfully designed works by planting the first hundred yards next the water-course with irregular clumps and bands of gorse and shrubby small-leaved plants to form leaf-traps.

I am strongly in favour of laying the watershed derelict, and

[1] This report was furnished by Mr George Baxter, engineer and manager to the Dundee Water Commissioners, at the close of last year, in response to a request of the Water Committee of that town that he should report on the advisability of afforesting the catchment area from which the Dundee water supply is obtained, and the employment which could be given in connection therewith.

where, by such procedure, farm lands become of little value, I am of opinion that they could be profitably afforested, particularly when they revert to moorland, and the rent for grazing purposes falls under 7s. 6d. per acre. Almost all the land at present under cultivation on the Lintrathen and Crombie watersheds is of poor quality, and if left in grass for a few years it will not bring a rent exceeding 7s. 6d. per acre, but most of the land on the Monikie Catchment Area is too valuable to convert into woodland. If at any future time it is acquired by the Corporation, it would yield a far higher return as a sheep pasture than as a plantation.

Many Corporations now own the whole or the greater part of their watersheds, and afforestation schemes have been commenced by at least eight Local Authorities. These schemes are in their infancy. Some of them gave work to unemployed men for a time, but the work was found unsatisfactory and expensive, and it is not now done by unemployed workmen.

The Departmental Committee appointed by the Board of Trade in 1902 reported very favourably on the possibilities of afforestation on a large scale as a means of furnishing remunerative labour to an increased rural population.

To finance an afforestation scheme over the catchment areas of the Dundee Water-Supply would be a very serious matter. While I would rejoice to undertake the work and so follow the example of several large Corporations in England, we cannot shut our eyes to the fact that public representatives are guardians of the ratepayers' money. Afforestation is a highly speculative undertaking—practically a gamble in distant futures. The monetary benefits to be derived by the present generation are practically nil, and it would be unfair to burden it with the cost even of the maintenance of such a scheme. The great benefits which would result therefrom—an increased rural population and a large stock of cheap timber—are national benefits, not local, and the burden of an expensive afforestation scheme can only be equitably adjusted if the scheme is State-aided. The Local Government Board might make grants for such a purpose, and defer payment of interest until the scheme was profit-bearing.

Government aid, however, need not necessarily be wholly in the shape of direct financial assistance. Let us have a compulsory system of land purchase for waterworks' purposes,

or afforestation by Local Authorities, under which such land may be obtained at something like its market value, instead of the present system through the operation of which communities are called upon to pay high prices.

We in Dundee can only deal with the matter in a very limited measure meantime. The Water Commissioners have a 99 years' lease of 500 acres of the Crombie Drainage Area. If this land is ultimately purchased outright by the Commissioners, a scheme of tree-planting should be considered seriously, because although the land is laid down in grass it will revert to moorland after a few years. Even under the 99 years' lease, probably one-fourth of the land could be profitably planted with fir and larch.

Mr Robertson, factor for Lord Dalhousie, kindly gave me the assistance of Mr Davidson, head forester at Panmure. Mr Davidson, after very careful examination, has given me details of how he would deal with the area, and I have drawn up an estimate of the cost of planting both at Crombie and Lintrathen. The 500 acres at Crombie would cost as near as may be £3250. If this sum were placed to capital account, the annual charge out of revenue would be—for interest and sinking fund, £146, and for loss of rent, £349, making a total annual charge of £495. Would it be prudent to charge work of this character, when executed in a piecemeal fashion over small areas, to capital account? I think not. It will be unremunerative for at least a generation, and even although posterity reap the whole profit, I believe that such highly speculative operations should be met right away out of revenue.

Conclusions and Recommendations.

(1) The afforestation of a large watershed, such as the 19,000 acres at Lintrathen, should only be dealt with by an expert in forestry.

(2) The lease of Wedderwells farm, which extends to 55 acres, should be terminated, and the whole farm gradually planted out.

(3) The lease of Fallaws has already been dealt with in minute of date 25th October last. The moorland on this farm should be planted out at the expiry of the lease, and the other fields as they revert to moorland, which will not be for some years.

(4) The lease of Skichen should be allowed to run its course. It expires twelve years hence.

(5) The land already possessed by the Commissioners and unplanted at Lintrathen, and the land to be acquired under the new bill, should be gradually afforested by the Commissioners' own men.

(6) All the expenses should be provided for in the yearly estimates, and charged directly out of revenue.

(7) There would be no immediate outlet for unemployed men on the Dundee Water Area, even although the Commissioners determined to afforest wholly or in part; and if such work is to be financially successful, it will require to be laid out under economical management and conducted throughout on strictly scientific and commercial principles.

24. Continental Notes—Germany.

(*With four Plates.*)

By B. Ribbentrop, C.I.E.

The International Convention of Forest Research Establishments held their sixth meeting in Belgium in September last.

The small beginning made by Germany, Austria, Hungary and Switzerland in fostering the interchange of practical experiences gained in all branches of forest research, has grown beyond expectation. The convention has become, in the true sense of the word, international, and now includes, in addition to the original members, Belgium, Bulgaria, Canada, Denmark, the United States of North America, France, Holland, Japan, Portugal, Roumania, Russia, Servia, Spain and Sweden—Britain does not as yet belong to the Convention, but, if the necessary time is allowed for our country to make up its mind, it will inevitably join, especially as two representatives attended the last meeting. What grieves me is that India has not yet joined this conclave of eminent workers, especially as that country has a highly developed forest research branch, and has turned out much original research work, of which any forest service might be proud.

The special delegates of the various States numbered thirty, and as a large number of Belgian, French and other forest officers,

scientists and gentlemen interested in forest work and progress visited the sessions, the attendance reached between sixty and eighty members.

During the excursions, which, in a true forester's spirit, were fully attended in spite of most miserable weather, practical results were shown of experiments with various manures. The experiments cover a considerable area, they have been carried on for a long period and exhibit unquestionable successes. Careful records have been kept of all experiments. The visitors had also an opportunity of seeing and judging for themselves the influence which the origin of seed exercises on the characteristics of a species. Numerous experimental areas in spruce forests were exhibited, and finally, as a *bonne bouche*, a splendid mixed forest of beech, maple and ash, treated on the selection principle.

The famous beech *Forêt de Soignes*, near Brussels, was also inspected, and the areas devoted to increment experiments were duly admired. The age of the trees on this area is 148 years, the mean height 125 feet, and the annual increment is nearly 215 cubic feet per acre. A curious fact about the forest is that, in spite of the favourable conditions which can produce a forest of such an eminent character, all efforts to secure natural reproduction have been singularly ineffective.

The advisability of establishing an International Review, by the forest research establishments of the numerous States who are members of the convention, was fully recognised, but though the money required for such a highly desirable publication has been practically guaranteed, the personal question presents difficulties which are as yet far from settlement.

The chief items of discussion were:—The advantages of mixed forests; the transformation of pure spruce forests into mixed forests; the influences of forests on the water level in the soil; the absorption of nitrogen from the air by forest trees; the minimum of nutriment in the soil required by forest trees; the utility of artificial manuring in the establishment and maintenance of forest growth; and the influence of the origin of seed on the character and development of forest trees.

The German Forest Administration especially takes a very serious interest in the last question, which is more or less shared by those of other countries, and it is therefore but right to notice prominently the excellent work done in respect of this interesting and important problem in connection with *Pinus sylvestris*.

Amongst the forest trees of the Eastern continent the Scots pine has the widest zone of distribution, and is at the same time one of the most important for forest culture. It ranges from the very east of Siberia to the utmost west of Europe, from the White Sea in the north to the south coast of the Black Sea in the south.

It is natural that, in the course of thousands upon thousands of years, the trees, though of the same original species, should have developed special characteristics in accordance with the great variety of climatic conditions under which they have existed.

It is a matter of general knowledge that *Pinus sylvestris* possesses in a marked degree the faculty of developing widely varying types of crowns, from the strong-branched, broad crown familiar in Scotland, to the slender pyramidal shape of a well-grown spruce, characteristic of the Baltic pine.

Attempts have been made to classify the species into different varieties. Various morphological differences in the shape of flowers, cones and leaves, etc., have been searched for, analysed and undoubtedly found to exist to some extent; but a sufficient constancy in typical differences has, so far, eluded the most diligent inquiries, and the practical establishment of botanically justifiable varieties has as yet failed.

The various types are, however, of the greatest interest to the forester, and the subject has, from this point of view, been most thoroughly and lucidly dealt with by Dr Kienitz in his treatise on "Shapes and types of *Pinus sylvestris*."

The author has for upwards of thirty years made a special study of the influence of the origin of the seed on the future character of forest trees, and is still continuing his inquiries and experiments in connection with the International convention, and its numerous branches of research, represented in Britain by Professor Fraser Story.

So far back as 1879, Dr Kienitz warned against the indiscriminate purchase of pine seed from afar, even in spite of favourable germination tests, on the supposition that the parent plant might have the characteristics of a different climate and of conditions different from those of the locality of the proposed cultivation, and that these characteristics might probably lie dormant in the seed, rendering the young plant raised entirely unsuitable to its new home. To the subsequent regret of numerous cultivators he was not listened to. Since then he has, by indefatigable research and many experiments, proved the

heredity of special forms and types, even if transferred to different conditions of climate, soil, etc.

As regards the pine, Dr Kienitz devoted his attention chiefly to the formation of the crown, but he suspects that the root-system will eventually yield similar interesting characteristics. He started his work in the forest of Brandenburg. Here he found no very distinct racial type, but observed local types, and proved that the characteristics of each showed themselves from the earliest youth and were maintained to maturity.

The forests of the province of Brandenburg contain large numbers of pines with crooked stems and branching crowns, especially in intermixture with beech, though in the vicinity pure pine forests exist with fairly straight stems. Dr Kienitz ascribes this occurrence to the survival of the "fittest," though not in this instance the "best." The pine with a tendency to a branchy, wide crown, can from the outset fight for its fair share in the canopy and maintain it, whereas the more slender type loses ground from the beginning, and is finally suppressed and killed out. When sufficient liberty has been allowed to the trees of the straight type, they grow well with the beech (see Fig. 11). The formation of the crooked stems of so many pine trees in the Brandenburg forests has been ascribed to the freshness of the soil, but the author points out that if this were so, no straight pine trees would grow on the fresh mountain soil, and this is contrary to fact.

Dr Kienitz has proved that, though much can be done by suitable training of the branchy type, and with care, quite decent and valuable forests of them can be grown, these trees never quite lose their inborn tendency to spread out; whereas those of the straight, slender type maintain their general character when grown in the open, though they may develop somewhat stronger branches.

Research has shown that even local types are transmissible, though far less so than racial types, which owe their origin to numerous generations propagated by selection. The young trees shown in Figs. 17 and 18 are proved by evidence to be the produce of that given in Fig. 11, and they already show signs of their parentage. In the southern portions of the North German Plain, in the valleys of the Rhine and Main, near the Boden See, in the plains of France, and to the south of the Alps, the broad-crowned kind is prevalent, but not to the exclusion of other forms,

and a distinct general type is not very pronounced. As a matter of fact, in low-lying stretches of country with a comparatively mild climate, where the pine has no vicissitudes to contend against, the general character is a broad and branchy crown, but other types are formed by more or less local conditions. The type in such localities is not constant.

When we go farther north, or higher up in the mountains, where the climate is rougher and where the pines have to resist the inclemency of the weather, the crowns assume more and more the spruce-like shape, with comparatively thin branches and short leaves; and the stems are straight. They form a distinct racial type.

The reason for the establishment of different types is, as already pointed out, a question of propagation by selection. Where pines grow up in an intermixture with young beech, the branchy, broad-crowned kind has, as already stated, the best chance; and even, barring the forester's assistance in favour of its more valuable comrades, or an accidental break in the young beech canopy, this kind only has a chance of reaching maturity and propagating itself. Hence the ill-shaped, branchy, but undoubtedly sturdy tree takes unaided possession of this field from generation to generation, often at the cost of the beech. Even in pure pine forests the branchy kind has a tendency to suppress its weaker neighbours, unless restricted by the forester's interference. On the other hand, when the stout branches, the broad spread of the crown and the long leaves represent a danger to the prosperity or existence of the pine forests, these types have disappeared in the course of generations.

Dr Kienitz considers annually recurring heavy snowfall to be the main cause of the formation of the racial type in the rougher climate, in more northern latitudes and at higher elevations. He had the opportunity of observing in Brandenburg the effect which two, for the locality, exceptionally heavy snowfalls had on the broad-branched type of pines. Both young and old trees of the branchy kind were heavily damaged, broken and bent to such an extent that large numbers had to be removed, whereas those of the slender type remained unharmed. The pictures taken in Chorin show the varying effects of the snow. Figure 5, which was taken in the Bavarian Highlands when the remains of the winter snow still adhered to the branches, gives some idea of the weight which trees of the spruce type can bear without breaking. It is

PLATE I

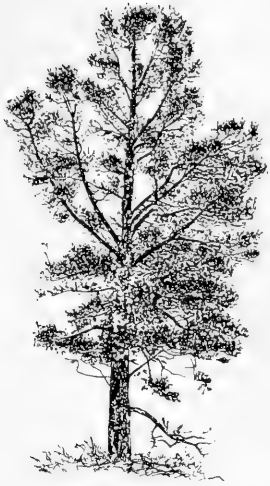


Fig. 1

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

CONTINENTAL NOTES—GERMANY.

(For explanation see text.)

[*To face page* 198.

evident that in localities where such snowfalls are an annual or frequent incident, only the trees that are most capable of resisting can survive, and a fixed racial type becomes established by selection. In the Hessian Reinhardswald, the pine of the plains type was cultivated on a somewhat elevated plateau over considerable areas. Snow destroyed these forests, and they have disappeared.

Dr Kienitz does not deny that there may be many other causes which aid in the formation of the racial types, but is satisfied that the annual fall of dry snow ranks in the first place.

The thesis brought forward that the tall, slender growth is due to greater moisture in the air is untenable. It cannot be doubted that any tree will grow higher in a moist climate than in an arid one, but why a tree should grow slender under the influence of moisture is not easily comprehensible, for the branches share with the top the facilities of the water-supply, and in a broad-crowned type should develop proportionately. Surely Scotland has a sufficiently moist climate, and should therefore produce the most slender spruce-like pines, but the numerous photographs taken in fifteen parts of Scotland show invariably the strong-branched spreading crown. Some are so crooked that even the southern part of the forest of Brandenburg can hardly show anything more artistic. Professor Fraser Story declares them to be typical of each district.

The pines of Northumberland, photographs of which were sent by Mr Holzapfel of Newcastle, show a similar development of strong branches. There may be occasional heavy snowfalls in Scotland and heavy damage among the pines, but the annually recurring, frequent and persistent fall of snow, without interruption by thaw, such as occur in the Bavarian Alps, or Scandinavia and the Baltic provinces, does not take place there.

Dr Kienitz soon found that, in order to enlarge the scope of his inquiries beyond the reach of his home and his restricted journeys, he required widespread assistance. He asked for pictures of pine trees upwards of one hundred years old, grown, as far as possible, in the open, and not interfered with by other trees. The selection of photographs made from hundreds sent to him from all parts of the world, testifies to the generous readiness with which his appeal for help was met, and since the International Convention of Research has specially taken up the subject, he is certain of future help.

The cultivation at Chorin, forming part of these experiments, has yielded results which may prove interesting, though the experiences in Wales in this respect have already been reported by Professor Fraser Story.

Pine seed from eight different localities, obtained in the cone, and abstracted under official supervision in Eberswalde, so that there might be no question as to its origin, was sown on the 25th April before 8.15 A.M., in cool, moist weather, which continued until 10th May.

The sources of origin are tabulated as follows :—

Country.	District.	Long.	Lat.	Height, in Feet, above the Sea.
1. Scotland	Inverness	3°42′ W.	57°14′	367
2. France	Haut Loire	3°07′ E.	44°58′	3740
3. Belgium	....	5°40′ E.	59°54′	341
4. Bavaria	Rhine	7°45′ E.	49°25′	984
5. Prussia	Brandenburg	14°10′ E.	52°50′	131
6. ,,	East	21°30′ E.	53°40′	394
7. Russia	Kurland	25°45′ E.	56°45′	33
8. ,,	Perm	64°00′ E.	57°00′	984

The seeds germinated almost simultaneously. In the course of the summer, however, the type differences appeared in the height of the plants, the length of leaves and summer colouring, and in the autumn, in the cessation of growth.

The seedlings from the Ural ceased to grow on the 23rd August. The first frost took place on the 23rd September. Only the Ural pines and the majority of those from the Kurland had closed buds. The frosty nights in the beginning of November found all plants prepared for the winter, with the exception of individual specimens from the south of France, Scotland, Rhine, Hesse and Belgium. However, no harm resulted.

The difference in the winter colour of the plants was remarkable. As early as the beginning of November the leaves of the Ural plants became almost the colour of the humus soil; those from Kurland, East Prussia and Brandenburg assumed their winter garb, which was of a less striking character, in the sequence enumerated; the plants from Hesse and Belgium showed only signs of winter colour, and those from the south of France and Scotland remained green throughout the winter.

On the 10th April 1908, the seedlings were transplanted into a nursery under identical conditions, but strictly separated. It was

Plate II.

Fig. 7

Fig 8.

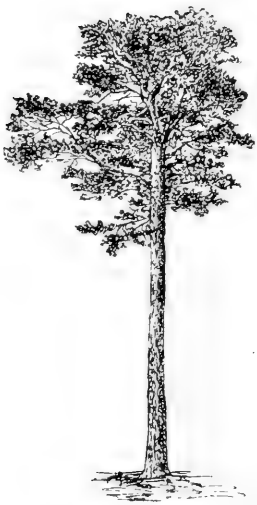


Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

CONTINENTAL NOTES—GERMANY.

(For explanation see text.)

[*To face page* 201.

noticed that the Ural pines, and those from the high elevation in the south of France, had already begun their summer growth, but that none of the others showed even a sign of the swelling of the buds. Twenty-five plants of each type were measured and weighed. The Scottish specimens, and those from the Ural, were both the shortest and lightest. In September 1908, measurements were again made of one hundred plants of each type, those of Scottish, south of France and Ural origin being still the smallest. The colouring of the leaves maintained the same difference, and those of Eastern origin took a decided winter colouring, which was less pronounced in those from the west, and absent in those from Scotland and France. In the third year of their existence, 1909, the plants of Scottish extraction were still the smallest, and this agrees with the observations made by Professor Fraser Story, already published in the *Transactions* of the Royal Scottish Arboricultural Society.

In the fourth year, 1910, the Scottish pines gained one place, but their average length was still but 57 % of those of Hessian origin. The Hessian, Belgian and Brandenburg plants are stouter than those from other countries and stronger in leaf. The winter colouring took place somewhat later, and was again not discernible in those of French and Scottish type.

Experience has shown that the few attempts at growing the plains pine at higher elevations resulted in their destruction, but it is, on the other hand, quite feasible to introduce the spruce-crowned types into areas where no distinct morphological type exists, and this has been done with success. The question naturally arises. whether it would be advisable to introduce generally the northern forms into such localities. Dr Kienitz is adverse to such proposals because, in a mixed forest, they would be useless unless they were constantly attended to, and in the formation of pure pine forests they are not required, for with close planting and frequent thinnings the sturdy pine can be grown into forests of greater cubic content per hectare, though the number of trees would be less. For it is by no means a fact that the straight type is also the taller, on the contrary, evidence tends to prove that, especially in the same locality, the sturdy type grows bigger in all directions (compare the trees given in Figs. 11 and 12, and even the splendidly shaped tree in Fig. 2, with the malformed specimen in Fig. 15). In parts of the Lueneburg plain the trees grown in pure pine forests reach the height of 42 metres (138 ft.).

The above refers to the real habitat of the pines, areas where they form compact natural forest and do not allow themselves to be ousted by trees of other species. Outside this sphere, the importation of seed of the best spruce-like parent trees cannot be too highly recommended, for the plains type has played the most miserable rôle in the mid-German hills. Though the cones for cultivation may be ever so carefully selected from a mother tree of the slender kind growing in a locality where no fixed racial type exists, there is no security that the pollen did not come from one of the most sturdy broad-branched specimens, which, as a rule, are much more prolific.

Researches, chiefly historical, regarding the limits of natural pine forests in Germany, are still in active progress, but they go so much into detail that it would be useless for us to attempt to follow them up. One of the indefatigable workers on this problem, Dr Dengler of Eberswalde, sums up the results of his inquiries thus: "The limitation of the natural zone of *Pinus sylvestris* in the north and middle of Germany is, in the first instance, governed by the soil; the climate has influence only in so far as, under more favourable conditions of warmth and moisture, an additional aggressive power is conferred on deciduous species (especially the beech), which enables them to oust the pine even from its own habitat, of which it would remain sole possessor under less favourable climatic conditions."

Dr Dengler's inquiries have brought to light the fact that artificial cultivations of the pine took place as early as 1423 and throughout the sixteenth and seventeenth centuries. Where they were carried on within the natural pine zone, they succeeded and produced strong and healthy timber, but outside its limits the trees have, as a rule, disappeared—owing, probably, to the same reason which led to the failure of more recent pine cultures in such localities, viz., the use of seed produced by unsuitable parents. The German Government is making every effort to supply the best and most suitable seed procurable. The life of the pine, driven back in the course of thousands of years to inhospitable fastnesses, where no deciduous species can, in the natural course of events, follow it, is even there one of continuous struggle against enemies, many of which have doubtless gained in destructive power through the interference of man, who, however, is at the same time able to ameliorate many of the evils. Renewed inquiries as regards causes, effects and remedies have of late been made in Germany.

In its early youth the pine is attacked by *Lophodermium pineastri*, developing a most dangerous and infectious disease, the pine scab. The literature regarding this disease is fairly voluminous, but so far has only proved the limitation of exact knowledge. It is positively known that the *Lophodermium* causes the disease, that it attacks the sound leaves of pines of from one to seven years old, that its mycelium perforates the leaves, kills them, and develops in the dead leaves further fructifying germs. The fungus is also found in fallen leaves in mature forests, but the question is by no means settled whether we have in this instance to deal with a separate variety, or whether, in such localities, it exists in the character of a saprophyte, able under certain conditions to attack the leaves of the young growth in its virulent form.

We know that the syringing with copper solution of the plants in a nursery is an effective remedy, but its application on a large scale fails by the very magnitude of the undertaking.

Oberförster Haak made extensive experiments with the culture of the fungus in a malt extract solution, and ascertained that he could sometimes, but rarely, produce effective germination from leaves of old trees, but never with the same consistency and abundance as from young growth. After many failures, he succeeded at last in securing fructification on layers of moss kept constantly wet, and he produced the disease artificially. He has proved that considerable moisture is necessary for the development of the disease, but, worse luck, the mycelium can lie dormant for a long time and wait its opportunity, and it seems more than likely that the disease originates in the pine litter.

Polymorphus annosus attacks the pine at a somewhat more advanced age. This danger has already been fully dealt with in previous publications.

Then we have the pine spinners and the nun moth. An extensive nun plague in Germany and Austria has just ended. The calamity has caused heavy and extensive losses where no measures were adopted to fight it, whereas no appreciable damage was done where means were taken at an early stage to meet the enemy. The operations have undoubtedly been very expensive, but their cost is not to be compared with the losses suffered where all interference was neglected.

Oberförster Putcher of Dresden has travelled extensively over the nun-infected areas in Saxony, Silesia, East Prussia and Bohemia, in order to study the question in all its bearings, and

his observations are of great weight and authority. In what manner the natural balance was destroyed cannot be ascertained with any degree of certainty, but it is evident that the calamity did not start from a general centre like a locust plague, but that the development was entirely local. The incredible increase in the number of nun-moths took place simultaneously in the various countries, and all reports of sudden invasions are purely imaginary. The nuns come out of their pupæ on the first warm day after a coldish period, and the sudden appearance of enormous masses of them gave colour to the theory of invasion. The fact that the first reports of invasions on a large scale coincided with the first really warm day of the season, and that this sudden rise in temperature happened simultaneously in the various countries attacked, entirely disapproves the theory of invasion.

The natural duration of a nun plague is usually accepted as three to four years, but from the time the first moths appear till the end of the calamity is probably nearer eight years.

The question naturally arises, whether it be possible to lessen this period by active interference, or whether, on the contrary, it might not act as a stimulus and prolong the plague. As a matter of fact, neither result follows. The *laisser faire* policy in East Prussia, and the energetic measures adopted in Saxony did not prolong or shorten the duration of the plague by a single day. They ended at the same time, but the losses in East Prussia were enormous, while Saxony practically suffered none. Nature causes the beginning of the plague and engineers its end.

Tachines and Ichneumides, and other enemies undoubtedly destroy countless moths, larva and pupæ, but the most radical destructive agent is the sleeping sickness. Some nuns escape the disease the first year but fall certain victims in the second.

During the previous plague, rings of non-drying caterpillar glue were largely applied in Prussia, under the then existing belief that this measure would put an end to the calamity; but the efforts, made when thousands of eggs had been deposited on each tree, and therefore too late to be of practical use, naturally proved futile, and the future application of such rings was condemned wholesale.

The general use of glue rings was adopted in Saxony not as a destructive but merely as a protective measure, and again they were applied in the early stages of the calamity. They resulted in preventing an excessive increase of the moth, till Nature, the

destroyer, took its final hand in the game. Whenever such preventive action has been followed, the damage done by the nun plague has been insignificant.

The Scots pine has even now not run the entire gamut of enemies and diseases to which it is more specially liable, and in its more advanced age, broadly speaking from 40 years upwards, it is exposed to ravages by the pine stem-rot fungus.

Dr A. Moeller, in his treatise regarding the necessity and possibility of an effective combat with *Trametes pini*, adopted Hartig's original observations, and, somewhat enlarging thereon, laid down that the sap-wood was entirely free from all attacks, and that the spores of the fungus could find an effective lodgment only in exposed heart-wood; the broken branches, in which mature wood had already formed, affording convenient doors to the interior of the tree.

This theory, Moeller's as it is called, was severely questioned. It was stated that, if it were correct, no fungus-attacked trees could exist in the pine forests of Upper Silesia, which for sixty to eighty years had grown up closely and could not therefore have formed heart-wood bearing branches before the completion of their growth in height. Moreover, sporophore brackets were produced attached to *bona-fide* sap-wood. However, on detailed inquiry, it was found that in these cases the trees had, in the early stages of their growth, been severely barked and deeply scarred by stags, and that the circulation of sap had entirely stopped in the cicatrix which had formed. Even now, in the forty years old forest where every third tree shows the scar of the old wounds, only these are attacked by the fungus, and with one exception the brackets are found on branch stumps. However, Dr Moeller had to modify his statements somewhat, and to include as possible points of infection sapwood in which the growing functions had ceased. The brackets of the Trametes form only on the dead stumps of branches insufficiently impregnated and protected by resin, and, as Hartig expresses it, the fungus uses the dead wood of these branches as bridges, through the unaffected and unattackable living sap-wood, to the heart-wood of the tree.

The most effective way of dealing with the disease is naturally by the removal of the tree attacked, and in Prussia, between 1905 and 1908, 116,000,000 cubic feet of timber, or nearly 25 per cent. of the total yield in pine timber, were felled on this account, and thrown on the market.

According to our present state of knowledge, it is useless to try to retain trees already attacked by the fungus; they are incurable and only deteriorate. However, their removal takes time, and in the meantime measures should, Dr Moeller advocates, be taken without delay to render them innocuous as hosts for the further spreading of the disease. The only conceivable method is the removal of the sporophore brackets, painting the wounds caused with Ermisch's caterpillar glue, known in the trade as Schwammtod (fungus death), or some similar substance, to prevent the reformation of sporophores.

The Prussian Government is taking most energetic and systematic measures in this respect, having spent nearly £20,000 thereon during the four years 1905-8. It is expected that by the end of 1912, or very soon after, the whole of the 332 forest divisions reported as affected in 1904 will be declared free; with few exceptions all attacked trees will have been felled, and, barring oversights, sporophore brackets will have ceased to exist. It has been argued that, with the milliards of spores a single bracket is able to produce, these oversights suffice for the spread of the fungus over a whole forest area. There is nothing to be said against the milliards of spores, for Dr Moeller himself ascertained that one sporophore of about 15 sq. inches emitted 150 million spores in one hour, and repeats this emission for months. The danger of infection is, in spite of these terrible figures, limited and reduced in the exact ratio that infection centres are destroyed and diminished.

A periodical inspection of all pine forests over sixty years of age, at intervals of not over five years, and a careful search for infected trees has been directed. Such trees will be conspicuously marked for immediate removal.

With these energetic measures, it is hoped to make *Trametes pini* before long a rare fungus in State forests, and the feasibility of interference in the management of private forests, in the same direction, is already under consideration.

Explanation of Plates.

The pictures on the plates are true photographic representations of the trees they depict. They were, in the first instance, re-photographed to a convenient size on Velox paper. The main lines of these photos were carefully followed by experienced

Fig. 13.

Fig. 14.

Fig. 15.

Fig. 16.

CONTINENTAL NOTES — GERMANY.

(For explanation see text.)

[*To face page* 207.

artists, and the underlying pictures destroyed by a chemical process, leaving only the drawings.

FIG. 1. *Lapland.* Near the northern limit of conifers. Lat. 68·1° N. Height above sea-level, 1476 ft. Old; grown free, amongst birch trees. Photographed by *Henrik Hesselmann*, Stockholm.

FIG. 2. *Sweden, Dalarne.* About lat. 61° N. Over 150 years old; height 81 ft., diameter 18 ins. Grown free on the forest boundary. Photo by *Henrik Hesselmann.*

FIG. 3. *Norway, Hakedals Varks Skoge.* Lat. 60° N. Height above sea-level, 984 ft.; about 135 years old; height 85½ ft., diameter 12 ins.; standard. The old forest grew from natural reproduction. Photo by *Wilhelm Kildal.*

FIG. 4. *Livonia*, district of *Pernau.* Lat. 58° N. Considerably over 100 years old; height 98 ft., diameter 25 ins. Grown in a pine and spruce selection and natural forest.

FIG. 5. *Bavarian Alps, Mottkopf.* 3610 ft. above sea-level. Lat. 47° 35′ N. Over 100 years old; grown free; subject to snow. Photo by *Læsch*, Government Director.

FIG. 6. *Wuertemburg Blackforest, Calmbach.* Lat. 48° 45′ N. Over 100 years old; standard left. Photo by *Haug*, forest officer.

Fig. 7. *South France, Auvergne* near *Murat.* Lat. 45° N., long. 3° 5′ E. Height above sea-level, 3281 ft.; over 100 years old. One of first magnitude; grown in an open forest. Photo by *Dr P. K. Schott.*

FIG. 8. *Kur-Hesse, Wolfgang* near *Hanau.* Lat. 50° 8′ N. 130 years old; standard. Photo by *Fenner, forstmeister.*

FIG. 9. *Scotland, Inverness-shire.* Lat. 57° 30′ N., long. 6° W. Very old. Height about 72 ft., diameter about 35½ ins. Photo by *Fraser Story.*

FIGS. 10 to 20 are all from photos taken by Dr G. A. Kienitz, the son of the researcher and author, in the forest circle *Chorin* in the *Mark-Brandenburg, Prussia.* Lat. 53° N., long. 19° E. Height above sea-level, 164 ft.

FIG. 10. Represents a tree 140 years old, 82 ft. high, with a diameter of 18 ins.; selected standard. Grown in fairly open forest. Pine soil, Class III.

FIG. 11. Shows a pine tree 150 years old, 67 ft. high, with a diameter of 23½ ins. Grown in the open, near to south boundary of a beech forest. Pine soil, Class II.

FIG. 12. Exhibits a tree 150 years old, 87 ft. high, with a diameter of 33 ins. Grown near and under similar conditions to the one depicted in Fig. 11.

FIG. 13. Depicts a tree 140 years old, with a height of 63 ft. and a diameter of 27½ ins. Grown in the open, on the eastern border of an equi-aged pine forest. Pine soil, Class III.

FIG. 14. Shows a tree 140 years old, with a height of 79 ft. and a diameter of 24¾ ins. Grown under the same conditions as those of Fig. 13.

FIG. 15. Gives a representation of a tree grown under similar conditions, and of the same age—140 years; height 102 ft., diameter 33 ins.

FIG. 16. The young pine shown here is the result of a sporadic reproduction on the borders of a young growth of beech and oak; age 22 years, height 17 ft., diameter 6¼ ins. Soil, Class II.

FIG. 17. The tree depicted here was produced in the same manner. The pine depicted in Fig. 11 is the nearest old tree, and probably the parent; height 26 ft., diameter 3½ ins.; the age is 22 years.

FIG. 18 (*a* and *b*). Sporadic growth (of the same), age 22 years. The young tree shown in (*a*) is 27 ft. high, and has a diameter of 4¼ ins., that in (*b*) 26¼ ft. height, and 7 ins. diameter.

FIG. 19. Shows a tree grown sporadically on an open space; 20 years old, 20 ft. high, with a diameter of 3 ins. Soil, Class IV.

FIG. 20. Depicts a young pine of the same age, and grown under the same conditions, with a height of 20 ft. and a diameter of 5 ins.

25. Forestry at the Edinburgh University.

(*With Plate.*)

THE PRACTICAL COURSE AT RAITH.

The first or elementary course in forestry at the University of Edinburgh is delivered during the winter session. In order to illustrate the lectures the students, when possible, make excursions to neighbouring woods on the Saturdays throughout the session. In this way a general acquaintance is made with the various species of forest trees, with methods of forming plantations, planting, with the appearance of the young plants, etc. The various silvicultural systems on which woods are grown are also illustrated where possible.

These object-lessons enable the student to obtain some idea of what forest management aims at. It does not, however, give him any opportunity of carrying out, himself, ordinary forestry operations such as the sowing of seed in the nursery, lining out transplants, planting out the latter to form woods, measuring the volume of standing timber, or acquiring the rudiments of that most important portion of a forester's equipment, a knowledge of how to thin woods. And yet, unless the student has an opportunity of doing all these works himself, with his own hands, and is carefully instructed how to do them whilst he is a student, it is unlikely that he will be capable of properly supervising others in performing these operations, and be in a position to

Fig. 17.

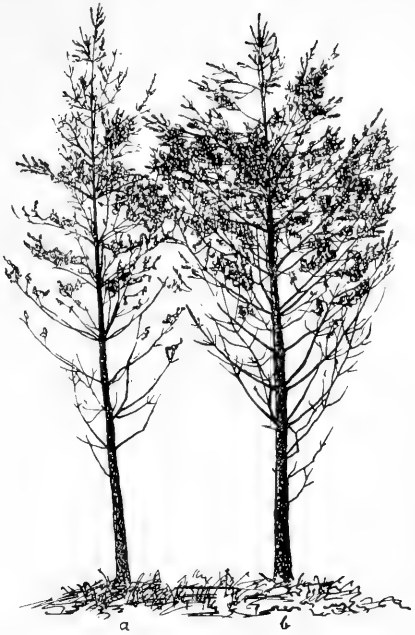


Fig. 18.

Fig. 19.

Fig. 20.

CONTINENTAL NOTES—GERMANY.

(For explanation see text.)

[*To face page* 208.

prevent careless and inefficient work. With the object of affording the students an opportunity of carrying out a course of practical work, the lecturer in forestry at Edinburgh this year inaugurated a scheme to supplement the theoretical instruction, as given in the lecture-room, by some practical illustrations of how things were done in the woods.

With the kindly support and active assistance of Mr R. C. Munro Ferguson, M.P., who offered the lecturer the use of Raith woods, it has been possible this year to initiate a ten days' practical forestry work. Mr Munro Ferguson undertook to provide the party with accommodation, and his staff put everything necessary at the disposal of the caterer of the messing arrangements.

A party of twenty arrived at Raith early on Friday, the 24th March, and, the climatic conditions proving fortunately fair, carried out a programme of strenuous work.

The programme set before the party, which is detailed below, is well adapted to give the student taking a first forestry course a satisfactory knowledge of the practical side of the first principles of forestry management.

The Programme of Work.

March 24.—Nursery Work: lining out 4- and 5-year-old oak and beech transplants in nursery lines. Previous to starting the work, brief notes on nursery management were given to the students. The party then set to work to line out the plants, the students working in four separate parties, and each man taking his turn to perform the different operations under the general supervision of the lecturer and the guidance of the forester, Mr J. Grant, and a couple of skilled labourers.

March 25.—Planting out birch, blue Douglas, mountain pine and Spanish chestnut. This work was mostly underplanting with plants of fair size. The soil in places was stony or filled with roots, necessitating the use of the pick. The whole of the party were engaged in the work, each man digging his own pits and planting them up.

In the two days' work 1800 beech transplants and 1500 oak were lined out in the nurseries; 2070 beech, blue Douglas, mountain pine and Spanish chestnut were planted out in the woods.

March 26.—Sunday.

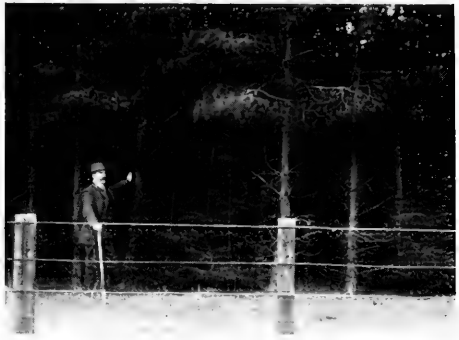
March 27–28.—The programme for these two days was to measure up and calculate the volume (total and by quarter-girth) of the Dundonald Muir wood of 32½ acres, consisting of Scots pine and spruce with a few hardwoods; age, 49 years. The diameters of the trees were taken with callipers, and the heights of a certain percentage of the Scots pine and spruce measured with the Brandis hypsometer.

The students were first put into a section of the wood, and worked as one party, with three callipers, in order to make them acquainted with the methods of using the instruments. The four parties were then told off to different sections, and callipered the whole of the trees in their own compartment, and took a percentage of the heights. In carrying out the latter piece of work, the orders were to take the height to the top of the trees and also at the 3-inch diameter limit in the stem. Thus two sets of calculations were made to obtain the volume of the trees. The results noted down in the field books were worked out at home by each party, and handed in towards the end of the week.

The field work in the Dundonald Muir wood was finished by midday on the 28th; and the party spent the afternoon inspecting some fencing work under the guidance of Mr Graham, clerk of the works, and the haulage of logs by the traction engine, being conducted by Mr Ritchie, assistant factor, and Mr Grant.

March 29–31.—The work to be done consisted in thinning a portion of the New Carden young wood, 32½ acres; age 27 years. This wood consists of Scots pine, spruce, and a few larch, oak, beech and ash. The wood was very thick. A section was taken in hand, and the first operation consisted in removing all the lower and dead branches from the trees so as to be able to get about in the wood. The parties then marked all dead trees with chalk. After inspection by the lecturer and Mr Grant, to see that no green trees had been marked, the whole of the dead trees were felled, cleaned of branches, and the poles taken out on to the neighbouring sides. These operations took the party two days to perform. A few notes were then given on the principles of thinning in a wood grown for pit props, etc. The students were then subdivided into pairs, and each pair took a narrow strip and marked with chalk all the trees which they thought should be removed in the thinning.

THINNING A SCOTS PINE WOOD.



THE WOOD UNTOUCHED.

WITH THE DEAD TREES REMOVED.

THE THINNING FINISHED.

[*To face page* 210.

Nursery Work.

Planting.

Testing the Soil for Planting.

Callipering the Trees.

Plate VI.

The work of each subsection was inspected by the lecturer and forester, and such trees as were approved were marked for felling with red paint. The reasons for rejecting trees marked by the students were fully explained to them. All trees passed for felling in each strip were then cut out by the subsections.

In the time at the disposal of the party a thinning was completed over half the section of the wood from which the dead trees had been cut out.

April 1.—A visit was paid to Maukinrich (Raith Muir), where the soil was tested with the object of determining the best species to plant on the area. Pits were sunk in various parts of the ground to observe variations in the soil. At a depth of 2 to 2½ feet a deep, hard, impermeable, blue clay was found. The growth in height, etc., and appearance of the trees in the neighbouring woods was inspected, and it was considered that the best plants to put in would be ordinary spruce and Menzies spruce.

This piece of work brought the practical course to an end, and the party returned to Edinburgh well pleased with the amount of work got through.

The fact that the whole of the period passed without a hitch of any kind was due to the excellence of the arrangements made for the party by Mr Munro Ferguson and Lady Helen, who allowed the laundry at Raith to be turned into what proved an excellent dormitory. At a farewell dinner, held on the last night, hearty votes of thanks to them both were passed by the party; as also to the factor, Mr J. Meiklejohn, and Messrs Mickie, Graham and Grant. To the forester, Mr Grant, the students owe an especial debt, for he accompanied them throughout the whole of the work, and was ever ready to show them how to hold, and use, a spade, bill or axe, whilst he imparted to them valuable items of woodcraft at all times.

26. Probationers for the Indian Forest Service.

The following letter has been sent by the India Office to the Universities of Cambridge and Edinburgh, and is published by permission of the India Office :—

India Office to the Vice-Chancellor, Cambridge University, and the Vice-Chancellor and Principal, Edinburgh University.

INDIA OFFICE,
2nd February 1911.

SIR,

I am directed by the Secretary of State for India in Council to inform you that, as the result of careful consideration of the existing regulations as to the training of probationers for the Indian Forest Service, he has decided to modify them in accordance with the following decisions at which he has arrived :—

Any University which possesses a Forest School approved by the Secretary of State shall be permitted to train Forest probationers. This shall have effect as regards probationers selected in and after 1912.

The Secretary of State is prepared to approve for this purpose the Forest Schools existing at the Universities of Oxford, Cambridge and Edinburgh.

A course of training in practical forestry in Germany or elsewhere, a certain standard of knowledge in an Indian vernacular, and any other special qualifications that the Secretary of State may prescribe, shall be imposed upon all probationers.

The studies of the probationers shall be controlled on behalf of the Secretary of State by the Director of Indian Forest Studies (hereafter styled the Director).

The Director shall be a selected officer of the Indian Forest Service, shall be paid such salary as the Secretary of State may determine, and shall hold office for a term of five years.

The duties of the Director shall be—

(1) To arrange for and direct the training in practical forestry of the probationers, and to exercise supervision over them while so engaged ;

(2) To consult with all Universities where there may be Forest probationers as to the special studies to be undertaken by them, and as to the examinations or tests of proficiency to be required of them ;

(3) To give lectures, if so required by the Secretary of State, on Indian forestry to Forest probationers at an approved Forest School.

In order to enable the Forest probationers who have been selected, or who will in 1911 be selected, to complete their training, the payments noted in the margin, which are at present made for various purposes at Oxford by the Secretary of State, shall continue to be made to the end of the midsummer term, 1913, and from that date shall be discontinued; and for such period the Director shall give lectures in Indian forestry at Oxford to Forest probationers, and shall discharge all other duties that are at present discharged by the Indian Professor of Forestry at that University, whose appointment shall cease from the date of the appointment of the Director. The post of Assistant Professor, now vacant by the death of Mr Fisher, is abolished. If the officer in charge of the Oxford school up to midsummer 1913 reports that he requires assistance, this may be provided by the temporary deputation of a Forest Officer at home on leave, or otherwise as may be convenient.

Grant for teaching Geology, £100
Placed at the disposal of the Forest Delegacy for other purposes, . . . £100
Rent, rates, and taxes of house for teaching, museum, etc., . . £95
Forest garden, . . . £100

The ordinary period of the probationary course for all candidates shall for the present be two years, including seven months abroad.

The provisions of the existing regulations as to the probationers' allowances shall be retained.

His Lordship is prepared to permit probationers, who are selected in and after 1912, to undergo their probationary course at $\frac{\text{Cambridge}}{\text{Edinburgh}}$ University, on being satisfied that the University authorities are willing to provide a suitable course in Indian forestry, with a $\frac{\text{diploma}}{\text{degree or diploma}}$ obtainable within two years; to consult with the officer appointed by the Secretary of State as Director of Indian Forest Studies on the subject of the special studies and tests of proficiency which may be desirable; and in other respects to fall in with the proposals described in the above-quoted resolutions.

I have, etc.,

R. RITCHIE.

[The number of probationers appointed in 1907 was 18; in 1908, it was 16; in 1909, it was 12; last year it was 10; and for the current year it is 5. We believe the reduction in numbers to be due to over-recruitment in previous years, and it appears unlikely that, at any rate for some years to come, the present number will be exceeded. This small number of appointments gives an average of $1\frac{2}{3}$ students to each of the three Universities now permitted to train candidates for the Indian Forest Service. We hope that, for these few students, the three Universities named may each find it possible to maintain the high standard of training hitherto provided by the Government of India, at Coopers Hill and recently at Oxford, for candidates for their Forest Service. If not, the Service must inevitably suffer.—Hon. Ed.]

NOTES AND QUERIES.

Grants from the Development Fund.

We understand that the Development Commissioners have approved of the purchase of an area in Scotland, to be converted into a Demonstration Forest, as soon as they are satisfied that a suitable tract of land can be obtained; and the Secretary for Scotland has appointed a Committee:—

"To report as to the selection of a suitable location for a Demonstration Forest Area in Scotland: the uses, present and prospective, to which such area may be put (including the use that may be made of it by the various forestry teaching centres in Scotland): the staff and equipment required for successful working: the probable cost: and the most suitable form of management.

"To report as to any further steps, following upon the acquisition of the said area, which, in the opinion of the Committee, it is desirable should be taken with a view to promoting silviculture in Scotland, due regard being had to the interests of other rural industries."

Chairman—Sir John Stirling-Maxwell, Bart. *Members*—The Right Hon. Lord Lovat, C.B., etc., The Right Hon. R. C. Munro Ferguson, M.P., J. D. Sutherland, Esq., Sir John Fleming, LL.D., Sir Matthew Wallace and R. H. N. Sellar, Esq. *Secretary*—H. Warre Cornish, Esq., of the Scotch Education Department.

An application of the University of Edinburgh for grants to develop the higher teaching of forestry which it at present provides is, we understand, now under consideration by the Commissioners, who have, we believe, already recommended to the Treasury a grant of £2000, to be spread over five years, for the provision of a Forest Garden in connection with the University and the East of Scotland College of Agriculture.

The partial attainment of objects for which the Society has

steadily worked during the past twelve years is therefore now in sight.

In reply to a question asked in the House of Commons, on 19th April, as to schemes sanctioned up to date by the Commissioners, Mr Hobhouse said that an advance of £25,000, recommended by them for purposes of forestry in Ireland, was to be spent on purchasing several areas of vacant land, in various parts of the country, on each of which a scheme of afforestation is to be carried out.

In addition to the above, a Treasury grant has been obtained for the purpose of saving some of the larger woodland remnants on purchased estates in Ireland. On this subject Mr Birrell replied as follows to a question asked in the House of Commons:—

"A sum of £6000 has been voted by Parliament in each of the years 1909-10 and 1910-11 for forestry work to be undertaken by the Department of Agriculture and Technical Instruction for Ireland; and planting and other operations are in active progress at five centres where lands have been acquired by the Department under the terms of the Irish Land Acts.

"The total area being dealt with amounts to nearly 4000 acres, and is distributed as follows:—County Galway, 1277 acres; County Tipperary, 1197 acres; County Wexford, 646 acres; County Cavan, 405 acres; County Londonderry, 254 acres. In addition to these areas there are 800 acres of forest lands in County Wicklow and County Wexford utilised in connection with the Department's forestry school at Avondale, County Wicklow. Forestry is one of the purposes to which County Councils may apply the proceeds of rates, not exceeding in all 2d. in the pound, which they can levy under the Agriculture and Technical Instruction (Ireland) Act, 1899, and the Technical Instruction Acts, 1889 and 1891. In addition, the Irish Land Act, 1909, prescribes that the instalments of the purchase annuity in respect of any parcel of land purchased by a County Council or by a Rural District Council shall be raised as a county charge or as a district charge, as the case may be. The Department is co-operating with County Councils with regard to forest areas suitable for being dealt with by these bodies. Forestry schemes approved by the Department are in operation in two counties, and the adoption of schemes in other counties is under consideration."

Four-Weeks' Course for Foresters at Aberdeen University.

The instruction in forestry at Aberdeen now includes courses for practical foresters. The first of these was held at Marischal College last autumn, under the Aberdeen and North of Scotland College of Agriculture. The classes extended over four weeks, commencing 16th August. The attendance was very satisfactory, fourteen men having enrolled.

The Very Rev. George Adam Smith, Principal of the University, who takes a very active interest in the subject, presided at the first lecture. He welcomed the men to Aberdeen, and expressed his satisfaction that so many men, some of them old in their profession, should have come forward. In the afternoon, the Principal conducted the men over King's College in Old Aberdeen, and afterwards entertained them to tea at his residence, Chanonry Lodge.

The work extended over the whole day, and consisted of lectures, microscopic and other laboratory work, and excursions. The lecture work dealt largely with silviculture, but also included Forest Botany, Forest Entomology, etc. Throughout the course, opportunity was afforded the men of discussing questions among themselves. The class was conducted by Mr Dawson, assisted by Mr C. O. Farquharson, M.A., B.Sc., and Mr W. R. Sherriffs, M.A., B.Sc., who had special charge of the botanical and entomological work in the laboratory.

A course is being arranged for the coming autumn, commencing on 15th August, and a complete prospectus is being prepared. Arrangements are also being made for lodging the men in one of the residences connected with the University.

State School of Forestry in the Forest of Dean.

From the Official Report for 1909-1910.

The work of the school has progressed satisfactorily. In October 1909 Mr Popert examined the eight students of the senior class, but only six obtained full certificates, one was granted a partial certificate, and one failed to pass. The eight students of the junior class were also examined ; these did well. In November 1909 a seventh class of ten students was admitted, and there are eighteen men now in the school. A better class of men has been obtained since the age was raised to a minimum of 20 years. They are not only better at school work but are better workmen in the forest.

Since the school started thirty-two men have obtained the full certificate, and two have received a partial certificate. Of the thirty-two with full certificates—

One is forester in British East Africa.
One is assistant pole inspector, Postal Department.
Four are woodmen in Crown Forests.
One is foreman of the school gang in Dean Forest.
Twelve are labourers in Dean Forest.
Nine are foresters or woodmen on private estates.
One is taking a further course of instruction at Armstrong College, and is likely to go as forester to East Africa.
One is managing his mother's farm, his father having recently died.
Two obtained situations on leaving the school but left them, one for farm work, while the other is now in a timber merchant's office.

Of the two men who obtained partial certificates, one is employed in the woods on a private estate, and the other has left forest work.

The new building has proved very suitable. The school nursery is now in full working order, and is fully stocked. The Abbotswood experimental plantations have been completed.

A visit was paid to the school by Mr Hutchins, chief conservator of the British East Africa Forest Department. As a result of his visit one passed student was appointed by the Secretary of State for the Colonies as forester at £120, rising by annual increments of £10 to £200. The names of two other students were registered with a view to offers of employment as vacancies occur.

The Larch Sawfly.

The Lake District correspondent of *The Times* reports that the larch sawfly, which some years ago did such serious damage to the larch plantations in Cumberland, has again made its appearance in the Lake district. The pest has proved most destructive to the larch forests in the United States (*cf.* p. 222), and in Northern Europe, and its re-appearance in Cumberland naturally causes some alarm. The fly was first noticed on 20th May, and the larvæ were in June hatching out rapidly and defoliating the trees.

Reference is invited to articles on this destructive fly on p. 43 of vol. xx., and on p. 42 of vol. xxiv.

Imports of Timber and Other Classes of Woods.

For the twelve months ending 31st December 1909 and 1910.

[*From the Board of Trade Returns.*]

	Quantity.		Value.	
	1909.	1910.	1909.	1910.
Timber (Hewn).	Loads.	Loads.	£	£
Russia	420,232	379,605	758,915	781,863
Sweden	25,617	16,792	45,304	36,084
Norway	29,835	30,131	64,037	63,463
Germany	94,842	132,533	279,725	392,562
United States	151,677	164,709	820,421	907,160
British E. Indies	23,675	36,484	398,137	619,374
Canada	34,045	33,147	253,114	259,094
Other Countries	20,505	32,957	234,545	432,069
Total	800,428	826,358	2,854,198	3,491,669
Hewn: Pit-props or Pit-wood	2,627,633	2,820,576	2,929,640	3,136,828
Total Wood, Hewn	3,428,061	3,646,934	5,783,838	6,628,497
Timber (Sawn or Split, Planed or Dressed).				
Russia	2,612,068	2,798,922	6,469,627	7,347,760
Sweden	1,043,037	1,217,339	2,533,667	3,234,663
Norway	397,260	329,498	1,220,688	1,103,179
United States	498,067	412,814	1,826,374	1,627,438
Canada	1,050,106	1,105,545	3,051,227	3,237,588
Other Countries	121,363	129,511	368,041	458,561
Total	5,721,901	5,993,629	15,469,624	17,009,189
Total of Hewn and Sawn	9,149,962	9,640,563	21,253,462	23,637,686
Staves (all sizes)	126,339	167,208	546,187	694,032
Mahogany (tons)	76,202	95,776	609,352	785,992
Other sorts	196,702	174,541	1,182,578	1,081,144
Grand total of Wood and Timber	—	—	23,591,579	26,198,854

Manufactured Wood.

	£	£
Furniture and Cabinet ware	391,236	406,335
House frames, fittings and Joiners' work	185,487	206,528
Other sorts (including Wood ware and Wood turnery)	1,477,535	1,725,607
Total	2,054,258	2,338,470

In their annual report, Messrs Foy, Morgan & Co. state that, since 1905, the cost of sawn and planed goods imported into the United Kingdom has increased by 5 per cent., owing to diminished capacity for production due to the gradual depletion of the forests, to the increasing local demands within the exporting countries, and to the opening of new markets in the Colonies and elsewhere.

Forestry at the Royal Agricultural Show, Norwich.

The Royal Agricultural Society has offered prizes, including its gold medal, for plantations and home nurseries in Norfolk, Suffolk and Cambridgeshire. The judges appointed are Professor Fraser Storey and Mr Alexander Slater. Prizes are also to be given in a variety of classes for exhibits in the forestry section of the show, Mr J. F. Annand being one of the judges.

Exotic Conifers in Britain.

Notwithstanding the long time that has elapsed since its publication, we desire to invite the attention of our readers to a valuable paper on the above subject by Dr Somerville, which was contributed by him to the Congress of Forestry Experimental Stations, Vienna, in 1903, and was reprinted in the *Journal of the Board of Agriculture* for December of that year (price 4d.). The report, which covers 28 pages, contains extremely useful records of the height and girth measurements of conifers and numerous exotic trees growing in this country. Dr Somerville says that in compiling his tables he has made free use of Mr Dunn's "Census," published in the *Journal of the Royal Horticultural Society*, volume xiv., 1891.

Rainfall at Inverliever.

Mr James Whitton, Superintendent of Parks and Curator of Botanic Gardens at Glasgow, has forwarded from Mr Boyd records of rainfall for the year 1910, at the two stations of Cruachan and Ford on the Inverliever estate. At the former, placed at a height of 280 feet above sea-level, the total fall was 82 inches; January with 12 inches showing the greatest

fall, and June with 2 inches the least. Rain fell on 237 days in the year. At Ford, only 150 feet above sea-level, the total fall was nearly 71 inches; February with nearly 10 inches having the greatest fall, and June with $2\frac{1}{2}$ inches the least. Rain fell on 245 days, in spite of the smaller total.

The Timber Supply of the United States.

The Department of Agriculture, Washington, has issued a circular on this subject. It estimates that the original forests of the country have been reduced by cutting, clearing, and fire, from an acreage of 850,000,000 to 550,000,000, of which 100,000,000 are public lands. A further reduction by 100,000,000 acres of the present total, owing to the necessity for more farm land, is considered probable, but the opinion is expressed that 450,000,000 acres, if properly developed and guarded, would produce sufficient wood for a population much greater than the present. The total yearly consumption, not counting losses from fire, storms, and insects, is calculated at 20,000,000,000 cubic feet, two-fifths of which are lumber, shingles, or firewood. Forests are being cut three times as fast as they grow, and, while the absolute exhaustion of the timber supply may never be reached, unrestricted exploitation has already had serious results. The yield of white pine, for instance, which was once considered inexhaustible, has decreased by 45 per cent. since 1900, and by 70 per cent. since 1890. The consumption of wood per head in the United States is 250 cubic feet, against 37 in Germany and 25 in France.

Leaf-Shedding of Conifers, due to *Botrytis cinerea*.

Leaflet No. 234, issued by the Board of Agriculture, describes the disease caused by the above-named fungus, which has been recorded as attacking the following trees:—Douglas fir, silver fir, spruce, larch, and *Wellingtonia*. It has also been observed on juniper and Scots pine. The leaflet, which may be obtained free of charge and post free on application to the Secretary, Board of Agriculture and Fisheries, 4 Whitehall Place, London, S.W., comprises an illustration and a description of the preventive measures recommended.

Insect Depredations in North American Forests.

The following is extracted from the *Journal of the Board of Agriculture* for June 1910:—

"A Bulletin recently issued by the United States Department of Agriculture (Bureau of Entomology, No. 58, Part V.) refers to the very extensive damage done to forest trees in North American forests by insects; Dr A. D. Hopkins, the officer in charge of Forest Insect Investigations, estimates that the loss due to insect pests represents 1 per cent. annually of the total stand of merchantable timber in the United States. This figure, based on the estimated area and stand of the present forests of the United States, and the average stumpage value, is equal to a value of about 13 million pounds sterling annually.

"Among the pests which have done widespread damage is the large larch sawfly (*Nematus erichsoni*), which is of special interest owing to its recent extension in Great Britain. As was stated in the recent article in this *Journal*, March 1910,[1] p. 982, this insect is believed to have destroyed, since 1880, from 50 to 100 per cent. of the mature larch over vast areas in the north-eastern United States and south-eastern Canada.

"Until about eleven years ago nothing had been done towards preventing this enormous damage. Since then investigations have been conducted by the Bureau of Entomology of the United States Department of Agriculture, and satisfactory progress has been made in ascertaining the principal insect enemies of the forests of North America, in determining their life-history, and in devising practical methods of control. In the first instance, a number of the most destructive insects were found to be new to science, while as regards the more important known species little information was available as to their habits; but it is considered that the advice now available would, 'if properly utilised for practical application, evidently prevent from 10 to 30 per cent. of the annual losses at a very small cost.'

"The work that has been done is, however, only a beginning, and more purely scientific work on the life-history of insects is needed to provide a foundation of facts on which practical recommendations can be based. The need for trained experts is also very strongly urged."

[1] See *Transactions*, vol. xxiii. p. 186.

A Lime-Sulphur Wash for Use on Foliage.

The *Journal of the Board of Agriculture* for June 1910 contains an article on the above subject by Mr E. S. Salmon, F.L.S., Mycologist to the South-Eastern Agricultural College, Wye, Kent. A very concentrated form of the wash is made by boiling together the following quantities of lime and sulphur:—

Quicklime (in lumps) . .	50 lbs.
Flowers of Sulphur . .	100 lbs.
Water	50 gallons.

Before use as a spray on the foliage of plants, the concentrated wash obtained as above requires to be diluted. The amount of dilution which is necessary in order to avoid "scorching," varies with the character of the foliage or plant to be sprayed, and can only be ascertained by experiment.

The Federated Malay States.

We have before us the report on forest administration for the year 1909, by Mr A. M. Burn-Murdoch, Conservator of Forests, F.M.S. and S.S.

At the close of the year, the area gazetted under the Forest Enactment was 749 square miles, or 2·74 per cent. of the total area of the Federated States. In Perak, where immediate reservation is said to be imperative, forest reservation appears to be very much behindhand. The more valuable and accessible forests are disappearing, in the rush for rubber land, at a rate which is, perhaps, hardly generally realised, and the necessity for immediate selection of valuable timber reserves, before it is too late, should be obvious to even those who look upon forests as a useless encumbrance, instead of as they really are, a very valuable asset. But, on the whole, satisfactory progress with "reserve" proposals has been made by the Department, though it cannot be said that the hoped for results have yet been attained. The Government object to lock up any accessible land which might be opened out for planting, but unfortunately the percentage of reserves is so low that a certain amount must be reserved whether accessible or not, so long as it contains valuable forest, especially chengal. Good progress has been made in the demarcation and upkeep of boundaries, and in the survey of Reserved forests, while

communications have been improved and some necessary buildings have been erected.

Regeneration is effected partly by natural seeding, and partly by the planting of cleared areas. The rate of growth of the various species is being observed by means of the periodical girth measurement of certain marked trees. An area of 55,133 acres is systematically managed in accordance with approved working-plans.

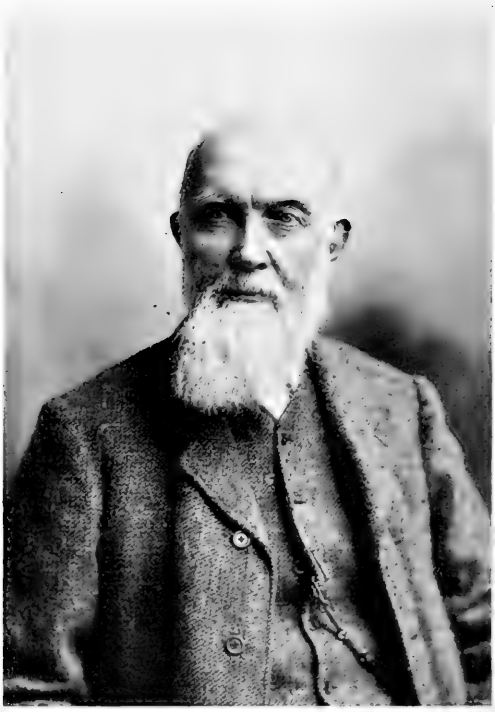
We congratulate the Government of the States and Mr Burn-Murdoch on the result of the year's work.

Mahogany.

Mr C. D. Mell, Assistant Dendrologist, United States Department of Agriculture, writes as follows:—

"In reading the very interesting paper entitled 'When Afforestation comes,' by Sir John Fleming, LL.D., which appeared in vol. xxiii., Part 2, of the *Transactions* of the Royal Scottish Arboricultural Society, I observed that a common error among timber merchants and foresters in this country is no less freely propagated in England. I refer to the use of the word "mahogany," which Dr Fleming prefers to use to designate substitutes for real West Indian mahogany (*Swietenia mahagoni*, Jacq.). This is a monotypic genus, unless *Swietenia macrophylla*, king of Southern Asia, will finally be accepted as a valid species of this genus. All other woods whose trade names are "mahogany" do not deserve to be called mahogany, any more than alder should be classed with and named birch. Some of the African and South American mahoganies are not so closely related to true mahogany as the alder is to the birch. Yet these substitutes are sold as mahogany. The term mahogany given to certain species of West African woods referred to by Dr Fleming is very general in its application, for there are no less than ten different species of trees in that region that yield timber shipped to England and the United States under the general trade name of African cedar or African mahogany. The noble tree to which Dr Fleming alludes, by saying that it 'is to the forest what the rose is to the garden,' is the West Indian mahogany, and all other woods that resemble it and are now palmed off on the public as such, should, in my opinion, be called by their correct proper names.

PLATE VII.



MR JAMES KAY.

[*To face page* 225.

Forest Conservation in the United States.

The Supreme Court, Washington, has found to be constitutional the reservation by the Federal authorities of forests in various parts of the country, without the consent of the States in which such forests are located.

This decision sustains the validity of the modern conservation policy inaugurated by Mr Roosevelt.

Forestry in Canada.

At the opening of the Dominion Forestry Convention at Quebec, the Governor-General, Earl Grey, said: "I hope that one result of this Convention will be to induce those to consider the forest as a friend who in early years may have considered it only as an enemy. Upon the conservation of the forests depend alike the uniform level of navigable streams, the fertility of the soil, and consequently the wealth and happiness of the nation."

Retirement of Mr James Kay.

(*With Portrait.*)

After a service of forty-seven years, Mr James Kay, wood-manager on the Bute estate, has just passed into retirement, and the sincere wish of his many friends will be that he may long be spared to enjoy the well-earned rest which, by the kindness of his employer, he is now enabled to take.

Born and brought up on the Hamilton estate, Mr Kay served three of the heads of that House, but before entering the service of the late Marquis of Bute he spent five years on the Lee and Carnwath estates, in the employment of the late Sir Norman Macdonald Lockhart, Bart. He joined the Royal Scottish Arboricultural Society in 1867, so that he is now one of its oldest members, and he was elected an honorary member in 1904. Throughout his long membership Mr Kay has taken an active part in the work of the Society, and, though he is now in his seventy-sixth year, his interest in its doings is as keen as ever. Of an inventive turn of mind, he has devised some useful forest implements, and several of these are illustrated and described in the *Transactions*. Amongst them may be mentioned a dendrometer (vol. v., p. 170), a transplanting machine for removing large trees (vol. vii., p. 186), and a straining post

for wire fences (vol. x., p. 32). He has also contributed to the *Transactions* a number of useful articles on forestry and allied subjects. Ever an ardent meteorologist, Mr Kay has for about 30 years kept a continuous record of the rainfall and other weather phenomena at his residence, Barone Cottage, Rothesay, and it may be mentioned that it was he who rescued from the flames the meteorological records of the town of Rothesay, which can now boast of possessing a continuous rainfall record from 1800 to the present time. A. D. R.

REVIEWS AND NOTICES OF BOOKS.

Schlich's Manual of Forestry. Volume III., *Forest Management.* By Sir Wm. Schlich, K.C.I.E., F.R.S., etc., Professor of Forestry, University of Oxford. Fourth Edition, Revised. Bradbury, Agnew & Co., London. Price 5s.

A new edition of Sir William Schlich's erudite and comprehensive work on "Forest Management" appears at a most opportune moment, when questions relating to afforestation and to the introduction of scientific methods into forestry are being urged upon the Government, the members of the Development Commission, and forest owners. It is certain that action will shortly be taken along lines suggested by various representative committees, especially in the direction of the carrying out of forest surveys, the collection of forest statistics, and the application of sound principles of management either to one or more existing forest areas, or to woods hereafter to be created. Whatever may be done in this direction, we know of no English work which explains so clearly as Sir William Schlich's does, how all these various matters can best be handled. Commencing with the collection of statistics, by means of which alone data can be made available, enabling the forest owner to apply to forestry the financial tests which are recognised as imperative in all other commercial undertakings, the author proceeds to explain clearly the manner in which method and order may be introduced into the working of existing forests, based on a careful estimation of the capital or growing stock actually present on the ground, and on a correct calcu-

lation of the interest or yield to be annually produced by it and thus to become available for realisation.

For the purpose of expounding these various matters, Sir William Schlich divides his manual into three main sections or parts, dealing respectively with *Forest Mensuration*, *Forest Valuation*, and the *Preparation of Working-Plans*. The last part includes both the theory on which the science is based (the foundations of Forest Management), and the practical application of that theory (the actual preparation of the working-plan). The first part, Forest Mensuration, deals with the determination of the dimensions, volume, age and increment of single trees and of whole woods: information which is indispensable to the scientific forester for the calculation of the material standing on a given area, the yield which a wood can give, and the value of single trees and whole woods or forests. In other words, it is information which enables the owner to determine the full value of his forest capital or growing stock, and the interest in produce, or the "yield" at his disposal. But the portion of this subject which will more strongly appeal to our readers, especially in view of coming events, is that which deals with the preparation of "Yield Tables"; that is to say, of tabular statements which give the course of the development of a wood from early youth up to a certain age, either from year to year, or for intervals of a certain number of years. "The data contained in such tables enable the forester to determine the quantity of timber and firewood produced on lands of varying yield capacity, upon the supposition that the progress of the wood has not suffered from any extraneous interference. Hence, they serve to determine the yield which may be expected, and to gauge the financial results of the industry if the land is planted with one or the other species."

There can be no question in our minds, that at the present time "the most urgent need of British forestry is the collection of statistics, by means of which the financial results of the industry can be estimated"; and in the chapter dealing with Yield Tables the kind of statistics required, and the manner in which these can best be collected, are most clearly set forth. Unfortunately, such tables can be prepared with any degree of accuracy only for woods which are practically fully stocked, taking into consideration the species, quality of locality, and the adopted method of treatment; and as woods which comply

fully with such requirements may not perhaps be found numerous enough in Great Britain to yield sufficiently reliable results, the collection of the necessary statistics may be somewhat delayed. Nevertheless, the opportunity afforded by the carrying out of the survey recommended in the Memorandum submitted by the Royal Scottish Arboricultural Society to the members of the Development Commission, might well be taken advantage of in order to collect such "Yield Table" statistics as may be possible. We would also invite the attention of our readers to an article on the Coombe Plantation, Keswick, which appeared in a recent number of the *Journal of the Board of Agriculture*,[1] as an example of what can be done in this direction.

The importance of Yield Tables, and their practical utility in the determination of the financial results of forestry, are well exemplified in Part II. of Sir William Schlich's manual, dealing with "Forest Valuation," and perhaps we cannot do better than quote a couple of examples showing the practical application of the various mathematical formulæ worked out in the body of the book. On pages 124 and 125 the author shows, by the use of Yield Tables, how it is possible to calculate what sum of money a proprietor may be justified in paying for a given piece of land, according to the species he may intend to plant, provided he is satisfied with a given per cent. at compound interest on his investment. Thus the author shows (the problem being worked out in detail, step by step) how, in a given locality, it would be profitable to pay £20, 4s. an acre for land to be cultivated with Scots pine, to be worked on a rotation of eighty years; whilst, all other conditions remaining the same, he would not be justified in paying more than £18, 6s. for the same area of land if it were to be planted with beech. Again, on page 161, the author shows how the following useful problem may be satisfactorily worked out:—"Is it more profitable to use a given acre of land for agriculture or forestry under a given set of conditions?" This latter problem belongs to that all important branch of scientific forestry, "Forest Statics," which weighs and considers the comparative merits of the different methods of treatment to which forests may be subjected: so that when several methods of treatment lead to the realisation of the desired object, it is left to the owner to base his decision on

[1] *The Journal of the Board of Agriculture*, vol. xvii., No. 4: "Coombe Plantation, Keswick," by R. L. Robinson, B.A., B.Sc.

the consideration of which of them will give him the highest rate of interest on his invested capital. This subject is most clearly and concisely dealt with in the work under review.

Sir William Schlich devotes the second half of his manual of Forest Management to a study of the various matters connected with the preparation of forest working-plans; that is to say, to the drawing up of the necessary forest regulations prescribing, in the case of a given forest, the application of certain cultural rules and the execution of certain works in order to produce a desired result. As the author explains: "If a forest is to yield a return, either annually or periodically, it must be in a certain state. In order to determine what this state should be under a given set of conditions, it is useful to construct an ideal pattern, such as would be presented by a forest which has grown up uninfluenced by external interfering circumstances. The ideal state differs, of course, for every method of treatment, in accordance with the objects at which the management aims. In all these cases, a forest which corresponds in every way to the objects of management is called a *normal forest*. It enables the forester to study the laws which must govern the management, and it serves as an ideal to be aimed at, though it may never be altogether reached, and at anyrate not permanently maintained." A perfectly normal forest is, therefore, a purely ideal creation. Probably no such forests actually exist, although many may approach the normal condition when they have been under a regular system of organised treatment for a long period. Nevertheless, a correct understanding of the constitution of the growing stock in the normal or ideal forest under each and every method of treatment is essential, since upon it is based the whole business of the preparation of the working-plan. The purpose of a working-plan may, in fact, be said to be to bring the existing forest as soon as possible, and as nearly as possible, to the normal state, and thereafter to maintain it in that condition.

Confining himself to the consideration of forests which are managed on economic principles, the author gives a very clear and concise exposition of what is understood by the "normal" forest, and how this normal state depends on a correct interpretation of its various factors:—the increment, the rotation, the distribution of the normal age-classes, the normal growing stock, and the normal yield. All these various matters constitute the general principles or foundations of forest

management, but the chapters which will perhaps be read with the greatest interest by the practical scientific forester, are those dealing with the determination of the rotation, with the size and distribution of the age-classes, and with the area to be cut over annually, under the different methods of treatment.

Having thus obtained a clear picture of the constitution of the ideal or normal forest, the reader is at once led on to undertake the preparation of the working-plan proper, or the scheme which lays down the execution of the various measures which are necessary, so that the management of the forest to be dealt with may be carried out in an orderly manner. A working-plan (such as the author contemplates) has for its object "to lay down, according to time and locality, the entire management of the forest, so that the objects for which the forest is maintained may be as fully as possible realised. And this must be done in an economic manner, for *extravagance has no place in forestry*." Moreover, "the forest working-plan must be based on the principles of silviculture; it must not contravene them." Bearing these remarks in mind, the preparation of a working-plan may be said to consist of two main operations: the preliminary work, which gives the forester a picture of the existing condition of the forest, enabling him to compare this with the ideal or normal forest, and the preparation of the working scheme which prescribes the works required to bring the forest, as nearly as possible, to the normal state. The preliminary works include the reconnaissance of the area, the choice of the method of treatment, the formation of working circles, the analysis and description of the crop, the calculation of the volume of material, and the determination of the exploitable age; all of these lead up to the drawing up of the working scheme and the determination and regulation of the yield under the method of treatment selected. The author very correctly confines himself to describing the most important only of the numerous methods which have been devised for the calculation of the "Possibility," by which is meant the quantity of material which may be felled in a forest annually or periodically for the time being, without encroaching on the normal forest capital or growing stock. We are glad to find that adequate space is provided for the description of the procedure to be followed in calculating the Possibility in the particular cases which would probably be of most frequent occurrence at the present moment in the British Isles, in the

existing condition of our forests; that is, when a Conversion from one silvicultural system to another is called for. Similarly, the Selection method, a somewhat primitive system, which at present finds considerable favour in the British Isles, is likewise fully dealt with. We cannot, however, altogether subscribe to the author's remarks regarding the futility of attempting to prescribe the Possibility in the Selection-worked forest by anything more elaborate than an area method, with perhaps the addition of a diameter check. We are of opinion, that the method enforced in this manner is attended with the drawback that there is no means, other than by personal inspection, of checking its correct application. The only extraneous control that can be exercised over its application, is with regard to the area cut over: and all the prescriptions on this subject might be rigidly adhered to, while the far more important cultural rules were being misapplied. Hence, where possible, it is, in our opinion, always preferable to determine the quantity of material that may annually or periodically be removed with safety, and to limit the fellings to this maximum quantity while subordinating them to cultural rules.

There is one more minor matter to which we would here refer. The question of evolving a generally accepted forest terminology has been receiving considerable attention during recent years in English-speaking countries. In the United States of America, the matter has been placed on a sound footing by the publication of a very useful booklet,[1] giving a list of the technical terms prescribed for use in all Government forest reports in that country. In India (where, thanks to the enormous areas of State forests, methodically worked and organised by a body of highly trained foresters, scientific forestry occupies a recognised position), the same has been attempted by the tentative issue of a glossary of forest technical terms, which may in due course receive official sanction.[2] Under these circumstances, it is a pity that no attempt has been made by the Schools of Forestry in the British Isles, and those in our Indian dominions, to arrive at some agreement on the subject of a suitable and mutually acceptable nomenclature. As it is, the definitions given for the

[1] *Terms used in Forestry*, U.S. Department of Agriculture, Washington.

[2] *A Glossary of Technical Terms for Use in Indian Forestry*. Superintendent, Government Printing Department, Calcutta.

terms "*working circle*," "*cutting series*" and "*working section*" are not those generally accepted by the Indian Schools of Forestry.

In conclusion, the view may be expressed by the uninitiated, that Sir William Schlich's ideas of all that forest management implies are altogether too theoretical and too idealistic to find practical application in this country. It is an undeniable fact that this work clearly shows that forest management is something more than the mere art of tree-growing, and we readily admit that forest management, as taught by Sir William Schlich, is a *Science*, demanding a mathematical mind, applied to complicated studies, in order that the financial aspects of the business may be fully realised. But surely the present haphazard and deplorable condition of forestry in this country, judged from a financial point of view, is such as to fully justify Sir William Schlich's able attempt to clearly indicate how the business may be placed on more scientific foundations. On the other hand, the author never loses sight of the practical nature of the business, a fact which is fully emphasised throughout the book, notably in the introductory remarks (page 241), and in the section dealing with the choice of the rotation (page 201). That scientific forest management on the lines laid down by Sir William Schlich is both possible and profitable, has been clearly proved in those continental countries in which the system has been given protracted practical application: a fact which many members of our Society are able to testify to as a result of various continental tours. Under these circumstances, we have no hesitation in bringing Schlich's *Manual of Forest Management* to the favourable notice of all those who may be interested, either directly in the practical management of existing woodlands, or indirectly, in furthering the advancement of scientific forestry in the United Kingdom. C.—

Schlich's Manual of Forestry. Vol. II., *Silviculture.* By Sir Wm. Schlich, K.C.I.S., Ph.D., F.R.S., F.L.S., M.A. 4th Edition, revised 1910. London: Bradbury, Agnew & Co.

A fourth edition of the volume dealing with Silviculture of this excellent manual has made its appearance, and may be ocnsidered a marked improvement on its predecessors in one respect—the illustrations. The text has undergone revision in

one or two places, but it is perhaps in the serviceable illustrations which have been added that the chief increase in the value of the book is to be found.

The former editions, it will be remembered, included diagrams of various forms of fencing, forest implements and illustrations on methods of planting out transplants. In the present volume, additional illustrations on these matters have been added, whilst some most useful diagrammatic representations of the various silvicultural systems are included. These will be found of high utility to the student who wishes to make himself acquainted with the different systems.

In the portion of the work dealing with the Formation and Regeneration of Woods, Sir William Schlich has incorporated some useful photographs illustrative of different classes of woods in various stages of growth. Natural regeneration in various stages coming in beneath the shelter-wood is shown very well in some of the photographs. The reproduction of some of the negatives, or the negatives themselves, however, leave something to be desired.

The part entitled "Silvicultural Notes on British Forest Trees," has been augmented by the inclusion of remarks on *Robinia* and the walnut amongst the hardwoods, and the Menzies or Sitka spruce, white spruce, *Thuia plicata*, and *Tsuga Albertiana* amongst the conifers. The notes on other species have also, in some instances, been revised and lengthened.

Under the Douglas fir, the author has some interesting remarks on the damage occasioned to this tree by storms. In Bagley Wood, near Oxford, trees planted eleven years ago and 30 feet high were thrown in December 1909. Even the plants in a plantation made three years ago were laid low three times during the winter of 1909-10, and this in spite of their enjoying a fair amount of shelter from the west and south. Sir William holds the opinion that the tree is slow in developing a sufficient root-system in Britain, so that it is easily thrown by the wind, in especially wet weather; and even if not thrown the leading shoots suffer from being broken or bent.

The author puts in a plea for the silver fir. After describing the growth of the Taymount plantation of Douglas fir, planted by the late Mr M'Corquodale about 1860, he writes: "He (M'Corquodale) held the opinion that the silver fir, if grown and treated in the proper way, would be the most useful and profit-

able tree to plant in this country, an opinion verbally expressed by him to the author in 1888. Until now the silver fir has been so frequently a failure in Britain, because it has been planted on cleared ground instead of under shelter. If the latter method is adopted in future, much better results are likely to be obtained, a statement which is supported by the author's experience in the Coopers Hill Experimental Plantations."[1]

E. P. S.

The Estate Manager. By RICHARD HENDERSON, Member by Examination of the Royal Agricultural Society of England, the Highland and Agricultural Society of Scotland, and the Surveyors' Institution, etc., etc. Edinburgh and London: William Green & Sons, 1910.

It is quite impossible for any one man to be an expert in every subject, and the author of *The Estate Manager* would surely have done better if he had called in more extensively the aid of recognised specialists in the various subjects dealt with in his book. For example, a little expert advice would have done much to improve the section devoted to forestry matters, although it is freely admitted that it contains much useful information of a general kind about trees and planting.

In the introductory chapter of the book, the author discusses the training necessary for young estate managers, and deals with what, in his opinion, are the shortcomings and defects of the present system of training in the Agricultural Colleges.

Several ably-written chapters are devoted to the treatment of such subjects as surveying and levelling, estate buildings, fences, hedges, roads and field drains. The author is fully alive to the importance of proper provision being made for the comfortable housing not only of the farmer but of the labourer also, and the chapters in which he describes the arrangement and construction of farm buildings are well worth perusal. Although it may seem paradoxical to say so, many of the Scottish farm buildings of past days seem to have been structures of a really *too* substantial and costly character, insomuch that when alterations in their arrangement are rendered necessary in consequence of changed conditions of farming, further heavy expenditure has often to be faced.

[1] On this subject see *Transactions*, vol. xxii. p. 106.—HON. ED.

With reference to the section of the book with which we are more immediately concerned, namely, that relating to forestry matters, it may be remarked that the author deals in a very interesting manner with the advantages attending the formation of large compact areas of woodland on estates, when the production of timber is the primary object in view. However, I certainly cannot subscribe to the views he holds regarding soils and tree-growth. If I understand him aright, he indicates (page 341) that after a forest is established, the trees are quite independent of surface-soil conditions, once their roots strike into the subsoil. This is surely going against all the recognised ideas of continental and other scientists who have studied the question, and is contrary to fact. The author seems quite to overlook the fact that the feeding rootlets may and do return to the surface for nutrient materials. He forgets that the condition of the surface-soil must also affect the fertility of the under layers or subsoil. It has been proved beyond dispute in continental investigations, that with bad surface-soil conditions in the forest there is a loss of increment and predisposition to disease. In fact, the whole success of silviculture, in the opinion of continental forestry *savants*, hinges on this question of the proper protection of the soil and the maintenance thereby of its fertility. It is quite true, as the author points out, that the timber crop is independent of tillage and manure (in the agricultural sense), but he fails to notice that this is because a natural substitute is provided both for tillage and manure in the fall of leafage, and by the leafy canopy shading the soil and preventing the natural manure from being dried up and dissipated by sun and wind. It is for this reason that so much stress is laid by the continental forester on the shade-enduring and soil-protecting qualities of certain species. Soil protection is all the more necessary because only poor and medium soils are available for forestry purposes.

Regarding the selection of species for the formation of estate woodlands, the author's statements are much too vague and general to be of any practical use to intending planters.

Probably this section of the work is not intended to serve the purpose of a text-book on the subject of forestry; but, as I have already indicated, although the chapters contain a great deal of very interesting and useful information about trees, this information is of much too general a nature, and the author

would, in my opinion, have made his book much more valuable to those having charge of estate woodlands, if he had had expert assistance in preparing it. The book is well got up, printed in clean type, and has been carefully edited.

J. F. A.

Webster's Foresters' Diary and Pocket Book for 1911. London: William Rider & Son. Price 2s. 6d.

This useful little annual has been brought up to date, and is well worth the price at which it is offered.

Sur une théorie nouvelle de la captation de l'azote atmosphérique par les plantes *Par* E. HENRY.

This small pamphlet contains a paper published by Prof. Henry, in the "Annales de la Science agronomique française et étrangère" for 1909, on a new theory of the fixation of atmospheric nitrogen by plants. The new theory which forms the subject of the paper, was published by Mr Jameson in the Journals issued by the Agricultural Research Association, Aberdeen, for the years 1905 and 1906 respectively. Prof. Henry commences his paper with a brief but interesting historical sketch of the work already done on nitrogen fixation. He then proceeds to subject the facts put forward by Mr Jameson to a critical examination, and comes to the conclusion that Mr Jameson has not established the ground upon which his theory is based. The assimilation of nitrogen by plants is a question of absorbing interest and importance, and as Prof. Henry discusses the subject from the point of view of forest trees and agricultural crops respectively, his paper forms instructive reading to the student of both forestry and agriculture.

R. A. BERRY.

Syon House Trees and Shrubs. 38 + viii. pp. By A. BRUCE JACKSON. West, Newman & Co., 1910.

This is a catalogue of hardy trees and shrubs growing in the grounds of Syon House, Brentford, the Middlesex seat of the Duke of Northumberland. An alphabetical arrangement has been adopted. The systematic name, with the authority for it,

is followed by the popular name, if there be one. The Natural Order of each genus is given, and the geographical distribution of each tree or shrub in the wild state is indicated. The date of introduction of the trees into English cultivation is included, and the height and girth at five feet from the ground are also given.

The trees have all recently been re-measured and their identification has been verified. A leaden label of the most approved type has been attached to each tree. A reference letter indicates the locality in which each specimen is to be found.

Special interest attaches to these gardens, which date, as botanical gardens, from the sixteenth century; but it may be hoped that other owners will follow the excellent example set at Syon House. The correct labelling of the specimens in a durable manner is a matter of first importance, and a list of them such as that before us would add greatly to the interest and value of any collection.

How to Know the Trees. By HENRY IRVING. With Frontispiece in colour and many Illustrations, 180 pp. Price 3s. 6d. net. Cassell & Co.

In his introduction the author expresses the hope that his "notes, descriptive and photographic, will serve as aids to those who desire a closer acquaintance with our common trees; ability to distinguish one kind from another at any season; some knowledge of the individual character and habit; and added to these, the attainment of a sympathetic regard for them through grateful appreciation of their gentle companionship and generous service." This little book should prove useful to teachers of nature knowledge, and to all lovers of trees.

Diseases of the Sweet Chestnut.[1] By E. HENRY, Professor at the French School of Forestry.

In the north-eastern region of the United States the sweet chestnut is now being attacked by a fungus which, from the rapidity with which it is propagated and the extent of the damage it causes, surpasses anything of a like nature previously experienced.

Dr W. A. Murrill, of the Botanic Garden, New York, has

[1] *Les Maladies des Chataigniers, aux etats-unis et Europe.*

named the fungus *Diaporthe parasitica*. It appeared three years ago, and the disease immediately assumed an epidemic character. Numerous instances have occurred of attack by both insects and fungi which have reached Europe from over seas; who can say that our own chestnuts will not soon become infested with this new parasite?

The disease is spread by means of spores carried by wind, birds, squirrels, insects, or otherwise. The spores enter the tree through wounds on the trunk or branches. From the point of entry the mycelium spreads in all directions into the liber and cambium, until it completely encircles the trunk or branch. Several of the outer wood-rings may be penetrated by it, and it probably enters the medullary plates in search of the reserve material that they contain; but the chief seat of the disease is the inner bark and the cambium layer.

In the early stage, the presence of the disease is not easily detected. It usually first attacks small branches, which are speedily encircled by it; and, when this has been effected their foliage turns yellow and subsequently withers. The attack then becomes very conspicuous; it is developed in a clearly defined ring, the effect of which might have been produced by a deep incision round the trunk or branch. The girdled stems or branches do not, however, usually completely die until the second year of the attack. There has been no previous instance of aerial fungi killing, within the space of two years, and over large areas, trees of the dimensions shown in the photographs received from America. No fewer than 1400 attacked trees have been felled in Brooklyn Park, New York, and in another of the city's parks there are 4000 sweet chestnuts, of which many are already dead, while it seems improbable that any of those still living will ultimately survive.

The sweet chestnut is extensively cultivated as a forest-tree in the United States. Its timber being very durable, it is much used for posts, poles, and railway sleepers, while it is also valued by cabinet-makers. After the White (Weymouth) pine, it is, probably, the most profitable of the forest-trees grown in the States.

M. Henry describes certain diseases which, in Europe, attack chestnut trees, especially grafted trees, grown for the sake of their fruit, but also attack those grown for the sake of their timber. F. B.

OBITUARY.

The late Professor Mayr.

The sad news of the death of Professor Heinrich Mayr, of the University of Munich, will be received with feelings of the deepest regret by his numerous friends and fellow members of the Royal Scottish Arboricultural Society.

Whilst delivering a lecture to his class in the Forestry School of Munich, on the 19th of January last, he was suddenly struck down with a severe illness, and expired on the 25th at the early age of 56 years. The burial took place in the Waldfriedhof on the afternoon of Friday, the 27th January. Numerous wreaths were sent, among which was one from the Society.

Professor Mayr was born on the 29th of October 1854. He graduated in 1872 and joined the staff of the University two years later, starting as a teacher in the faculty of philosophy. His next appointment was to a professorship in the Imperial University of Tokyo. On returning to Europe he became assistant to Professor Robert Hartig, in Munich, and was finally appointed Professor of Silviculture and Forest Utilisation in his University. He possessed many orders and decorations of high degree.

Professor Mayr was a great traveller, having made at least three journeys round the world, which occupied six years. The first journey was undertaken on behalf of the Bavarian Government, and was begun in July 1885, when he visited America in order to study and report on its trees and forests. These investigations gave origin to his well-known book on the forests of North America. After spending some time there his journey was continued to Japan, China, Java and India. The whole tour occupied a space of two years. Almost immediately on his return to Munich he again set out for Japan *via* America to occupy a Professor's Chair in Tokyo. It was while in Japan that the results of his two visits to America were published in book form, entitled *Die Waldungen von Nord Amerika*. During his stay in Japan, Mayr explored the country from north to south, investigating its forest flora, and his results were published

in Japan under the title *Die Abietineen des japanischen Reiches.* The beautiful illustrations in this book were drawn from nature by the author, and the stones or their lithographic reproduction were prepared by him, as at that time it was difficult to get such work done in Japan. After spending over three years in Japan he returned to Bavaria, and on the homeward journey several months were spent in visiting China and Ceylon. The third visit to Asia and America was begun in December of 1902 when, on account of his extensive experience and knowledge, Mayr was chosen to accompany Prince and Princess Rupprecht and Prince Georg of Bavaria on a tour round the world.

In his various travels Mayr was the first European forester of scientific training to penetrate into many of the more remote and inaccessible forest regions of the world. His last, and probably most important, book entitled *Fremdländische Wald- und Parkbaüme für Europa* is truly a monumental work, embodying as it does the results of his wide travels and his conclusions, based on first-hand observations and years of hard and patient study, as regards the suitability of exotic species for our parks and forests.

In 1894, the Bavarian Government placed an area of 100 acres, near Grafrath, at his disposal, in order that he might experimentally test the value of exotic species when grown under forest conditions in Europe. Many of his experiments had already been started at Grafrath, twenty-five years earlier, when he was assistant to Professor Robert Hartig. The use and interest of such experiments, and their educative value, is well known to the members of the Society who, two years ago, visited this area. The late Professor was also in charge of the department concerned with the introduction and cultivation of exotic species in the Bavarian State forests.

It is impossible to estimate the loss to science and especially to forestry caused by the early death of Professor Mayr, who was so suddenly struck down while still in his prime. His loss will be deeply regretted, and his memory held in the highest esteem, by his numerous colleagues, pupils and friends, and especially by those members of the Royal Scottish Arboricultural Society who had the pleasure of knowing his kindly disposition and of appreciating his charming personality.

A. W. B.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON

HIS MOST EXCELLENT MAJESTY THE KING.

PROCEEDINGS IN 1910—*Continued.*

THE GENERAL MEETING.

The General Meeting of the Royal Scottish Arboricultural Society was held in the Highland and Agricultural Society's Showyard at Dumfries, on Thursday, 21st July 1910, at 2.30 P.M. Sir JOHN STIRLING-MAXWELL, Bart., President of the Society, presided over a large attendance of Members.

ADDRESS TO THE KING.

The CHAIRMAN intimated that the following Address had been sent to the King:—

To the King's Most Excellent Majesty.

May it please your Majesty,

We, the Council of the Royal Scottish Arboricultural Society, humbly approach your Majesty on your accession to the Throne, with the desire to offer our respectful condolence with your Majesty, the Queen Mother and the other Members of the Royal Family, in the death of your lamented Father, King Edward VII., whose short but glorious reign has been fruitful in the blessings accompanying peace and good-will, which it was his constant endeavour to secure, not only for his own people, but for all Nations—and whose sudden removal has profoundly stirred the British Empire with a sense of inestimable loss.

We especially desire to remember, with gratitude, His Majesty's interest in the welfare of our Society to which he graciously extended his Patronage, and the continued

prosperity of which we feel sure your Majesty will desire to promote.

We respectfully assure your Majesty of our loyalty and devotion to your Throne and Person, and express our trust that your Majesty and Queen Mary will be long spared to reign over a loyal, prosperous and happy people.

JOHN STIRLING-MAXWELL, *President.*
R. MUNRO FERGUSON, *Hon. Secretary.*
R. GALLOWAY, *Secretary.*

The reply received was in the following terms:—

SCOTTISH OFFICE,
WHITEHALL, 4th *July* 1910.

SIR,—I am commanded by the King to convey to the Council of the Royal Scottish Arboricultural Society His Majesty's thanks for the expressions of sympathy with the Royal Family, on the occasion of the lamented death of His late Majesty King Edward the Seventh, and for the loyal and dutiful assurances on the occasion of His Majesty's accession to the Throne, contained in their Address which I have had the honour to lay before His Majesty.

I am,
SIR,
Your obedient Servant,
PENTLAND.

The President of the
Royal Scottish Arboricultural Society.

MINUTES.

The Minutes of the Annual Meeting, which was held in Edinburgh on 11th February last, were held as read and adopted.

APOLOGIES.

Apologies for absence were intimated from Sir Kenneth Mackenzie; The Right Hon. R. C. Munro Ferguson, M.P., *Honorary Secretary*; Sir David Stewart of Banchory; Sir Arthur Mackenzie of Coul; Mr James Johnstone, Ayr; Colonel Bailey, and Messrs Methven, Annand, Whitton, Scott and Crozier, Members of Council.

The Development Act.

The Chairman, after referring to the recent Excursion to Lochaber, said that with regard to the Development Act of 1909, the Council was strongly of opinion that the interests of forestry would not be likely to receive fair or full consideration from the Development Commissioners unless some body—corresponding more or less to the Board of Agriculture—were created to take charge officially of the interests of forestry. No such body at present existed in this country, and at the request of the Council, he approached the Chancellor of the Exchequer with the request that he would appoint a Board of Forestry at the earliest possible moment, so that the applications to the Development Commission might have the sanction and support, and the advantage also of being weeded out by such a Board. The Chancellor of the Exchequer was reluctant to add to the expenses of Government by creating a new Board, and did not lend a willing ear to the proposal, although prepared to go into the matter further. The Chancellor felt that the fact that one of the Council of the Society, Mr Haldane, and an expert forester, in the person of Mr Wilmot, were among the Development Commissioners was a sufficient guarantee that the interests of forestry would be fully considered, but he (Sir John) did not think the Chancellor quite appreciated the point at which the Council were striving, that, although plenty of applications would reach the Commissioners, it did not follow that any of these applications would bring out the real pressing needs of forestry at this moment. For a good many years the Society had held the belief that two primary steps should be taken. The first was the establishment of a Demonstration Area somewhere in Scotland — where there could be a complete School of Forestry in touch with the growing forest, and where the results of experiments could be scientifically accumulated. The second step they thought necessary was that there should be a survey of the ground suitable for afforestation. It did not follow that either of these matters would come directly before the Development Commissioners, and therefore at the request of the Council he was to press this matter of the appointment of a Board of Forestry again upon the Chancellor of the Exchequer, and he hoped they might have the assistance of the Development Commissioners in putting the case, for he was sure it was the

wish of the Commissioners that the money at their disposal should be used so as to produce the greatest possible benefit. As regards the question of a survey, the Council had adopted the suggestion made at last Annual Meeting that, as the Government in this country moved slowly, it would be a good thing if the Society were to take up the question of survey on its own account by surveying a sample area in one or more places in Scotland which would bring to light the difficulties of such a survey and also the best methods according to which it might be made. They had devoted a sum of £100 to the purpose. They were of opinion that the best chance of having it well done was to put it into the hands of some one competent man, who might be willing to devote time to it and to view the subject, with the assistance of expert opinion, as a whole. It was felt that the survey would be of no use if it was a mere return of acreage which might be expected to grow trees, because they knew that the real problem was not merely to plant and to cut, but to dovetail in with other interests which now have a hold upon the ground in this country. Therefore their survey became of an economic character. In this matter the Council felt there was no one to whom they could better turn than Lord Lovat—whose interest in forestry and other parts of economic life in Scotland was well known, and whom he would ask to explain the lines on which he meant to make his survey.

Lord Lovat said that it was a very intricate subject, and they would not expect a very coherent narrative. He felt that the work would be much better devoted to surveying one single area rather than to add one of those many pious opinions, which had been put forward from time to time as to the total area that could be afforested in Scotland. Some people put the area at two million acres, and others at twelve, and probably every shade of opinion was to be found between these two figures. His idea was to take a block of land of from twenty to thirty thousand acres and see how much of it could be planted with advantage, and how it would affect the other interests of that district. They were apt to forget that forestry was only one of the interests in the country, and they could not expect to turn over vested interests, and agricultural and sporting interests, suddenly without causing considerable commotion, and, in places, putting a large body of the community against them.

They would go into the survey in a thoroughly practical way, and consider the economic effect on agriculture and other kindred interests. They would be able to say how much land in Scotland could be afforested, and they could then say to the Development Commissioners—"Here is a bit of land on which we have had the best planting experts, authorities have looked into the economic question, and we have had authorities on rating, sporting, and agricultural interests, and we say this land can be planted advisedly." They would have something concrete to offer to the authorities. When asked to undertake the survey, he did so on condition that he would not require to begin the work at once, and that he would have the whole-hearted assistance of the Society and the advantage of their expert advice in the technical part of the work. Without boasting, he thought the Society contained the best authority in every branch, and if they could only get the specialists shoved into the work, they might hope to give an opinion in the end, which, if it did not command the good-will of everyone, would, at all events, be looked at with some respect. In his own mind he had selected the area to be surveyed, but he did not wish to name it because several proprietors were interested, and although he was certain of being able to count on the good-will of the proprietors in forwarding any national object, he would rather go and see them himself before stating where the area was. They had made a preliminary visit to the place, and certain of the members were satisfied that the area selected would be a typical one. He did not wish to take one that was better than another, because by doing so they would lose the object they had in view. They had selected an area with a certain amount of low-lying ground, a proportion of middle ground, and some high ground. One fact they must face was the amount of land that would be thrown out of gear, and in that respect he thought the area selected would be a normal one. They must also pay attention to the rating question. Whatever views they held on the subject of the land and sport, etc., they could not avoid the fact that fifty per cent. of the rating area was in sporting rents, and they could not hope to carry the body politic with them unless they could show all sides of the question, because it would undoubtedly mean a lowering of the sporting, sheep-raising, and other values. Some people were of opinion that exotics would grow on the

highest mountains. He hoped that if the survey arrived at anything it would be only founded on facts. He would call on many Members for opinions, and he hoped they would be able to give him their time and assistance on the spot. The £100 granted by the Society would go a considerable way towards carrying out the work, because enthusiasts were willing to do work without pay.

The Chairman thanked Lord Lovat for his remarks.

Judges' Report on the Essays.

In the absence of the Convener of the Judges, the Secretary gave in their awards as follows:—

Class I.

1. Suitability of any exotic Conifer for cultivation as a Forest Crop, and nature of the locality found, in the experience of the writer, to be most suitable for it. The Douglas Fir. By W. H. Whellens, Forester, Comlongon Nursery, Ruthwell. The Judges did not think that this essay was of sufficient merit to obtain the special prize of £5, 5s. offered for the subject, but they recommended an award of £1.
2. The same Subject as above. The Corsican Pine in Dorset. By "Bourne Hill."—No Award.
3. Report on the Woodlands of Tilgate Estate. By Ewan S. Grant, Forester, Tilgate Estate, Crawley, Sussex. Award—No. 2 Silver Medal.
4. An Attack of the Large Larch Saw-Fly (*Nematus Erichsonii*) and what has been done to cope with it on Thirlmere Estate. By A. W. B. Edwards, Hollie Bank, Thirlmere, Grasmere. Award—No. 2 Silver Medal.
5. "On Soils." By William Hall, Church Cottages, Bilton near York. Award—Bronze Medal.

Class II.

1. Collection of Notes of Silvicultural Interest based on personal observation. By "Pfleget den Wald er ist des Wohlstands sichere Quelle."—No Award.
2. The making of Field Gates. By "Assistant Forester."—No Award.

The Chairman thanked the Judges for their Report, which was adopted.

Forestry Exhibition at Dumfries.

The Judges' Awards in connection with the Exhibition were intimated as follows :—

Competition No. I.

Specimens of Timber of Scots Pine (*Pinus Sylvestris*), Larch (*Larix europæa*), and Norway Spruce (*Picea excelsa*).

Open Section.

1st Prize, £2, 10s., J. Ernest Kerr of Harviestoun Castle. Dollar.
2nd Prize, £1, 10s., The Marquis of Graham.
3rd Prize, £1, W. J. H. Maxwell of Munches.
4th, Highly Commended. The Duke of Buccleuch (Langholm Estate.)

Local Section.

1st Prize, £1, The Duke of Buccleuch (Langholm Estate),
2nd Prize, 15s., „ „
3rd Prize, 10s., The Earl of Mansfield.

Competition No. II.

Specimens of Timber of any Three Coniferous Timber Trees other than the above.

Open Section.

1st Prize, £2, 10s., H. J. Younger of Benmore.
2nd Prize, £1, 10s., The Duke of Buccleuch (Langholm Estate).

Competition No. III.

Specimens of Timber of Ash (*Fraxinus excelsior*), Oak (*Quercus robur*), and Elm (*Ulmus montana*).

Open Section.

1st Prize, £2, 10s., The Duke of Buccleuch (Langholm Estate).
2nd Prize, £1, 10s., Sir Herbert Maxwell of Monreith.

LOCAL SECTION.

1st Prize, £1, The Duke of Buccleuch (Langholm Estate.

Competition No. IV.

Specimens of Timber of any Broad-Leaved Trees other than the above.

OPEN SECTION.

1st Prize, £2, 10s., H. J. Younger of Benmore.
2nd Prize, £1, 10s., The Earl of Mansfield.
3rd Prize, £1, The Duke of Buccleuch (Langholm Estate.)

Competition No. VII.

Gate for Farm Use, manufactured from Home-Grown Timber.

1st, £1 . . . The Duke of Buccleuch (Langholm Estate).
2nd, Bronze Medal . Alex. Lowe, Forester, Lockerbie House.

Competition No. VIII.

Gate manufactured from Home-grown Timber.

1st, £1 . . . Alex. Lowe, Forester, Lockerbie House.
2nd, Bronze Medal . Robert Cowan, Hoddam Castle, Ecclefechan.

Competition No. IX.

Self-closing Wicket-Gate, manufactured from Home-grown Timber.

1st, £1 . . . The Earl of Mansfield.
2nd, Bronze Medal . Alex. Lowe, Forester, Lockerbie House.

Competition No. XI.

Full-sized Section of Rustic Fence, made from Larch or other Thinnings.

1st, Bronze Medal . The Earl of Mansfield.

Competition No. XV.

Collection of Fungi injurious to Forest Trees and Shrubs.

1st, No. 1 Silver Medal. Hugh R. Munro, Assistant Forester, Kingswood, Murthly.

Competition No. XVII.

Any Useful Invention or Marked Improvement on any of the Implements or Instruments used in Forestry.

1. No. 1 Silver Medal. The Duke of Roxburghe, p. Fred Moon, for Machine Nursery Hoe.
2. Bronze Medal . Robert Cowan, Hoddam Castle, for Wire Strainer.
3. Bronze Medal . The Duke of Roxburghe, for Enlarged Photographs of Tackle used to get Timber out of a Glen on to Public Road.
4. Bronze Medal . W. H. Whellens, Comlongon Nursery, for Gate-Opener attached to Wicket-Gate.

Competition No. XVIII.

For any approved Article either wholly or mainly made of Wood.

1. No. 1 Silver Medal. Alex. Lowe, Forester, Lockerbie House, for Rustic Summer-House.
2. Bronze Medal . Alex. Pollock, Tarbolton, Ayr, for Three Pairs Rustic Oak Garden Vases, made of Wood grown on "the Bonnie Banks of Ayr."
3. Commended . Thomas Sharpe, Forester, Monreith, for Box made of Scots Pine.

In addition to the Prizes awarded in the Competitive Section, the Judges also recommended, and the Meeting approved of, the

following awards in the Section for Articles for Exhibition only :—

The Forestry Department of the West of Scotland Agricultural College, a No. 1 Silver Medal, for a Collection of Tools, Implements, and Specimens.

The Duke of Buccleuch (Langholm Estate), a No. 2 Silver Medal, for Exhibits of Cross Section of Douglas Fir and Creosoted and Uncreosoted Fencing Posts.

The Duke of Buccleuch (Drumlanrig Estate), a No. 2 Silver Medal, for Exhibits of Stobs treated with Naphtaline, Field-Gate, etc.

Thomas Sharpe, Monreith, Port William, £1, for Specimens of the Timber of Hardwoods and Conifers in Frame, Wire-Strainer and other Tools.

John Munro, Foreman Forester, Kingswood, Murthly, a Bronze Medal, for Cones and Foliage of different kinds of Conifers.

Matthew Feaks, Benmore, Kilmun, £1, for a Collection of Hand Specimens of Timber of different kinds of Trees grown on Benmore Estate, and Specimen of *Peziza Willkommii* on Japanese Larch.

Sir John Stirling-Maxwell, Bart., a Gold Medal, for Specimens illustrating Experiments in Tree-Planting at High Elevations on Peaty Soil.

The thanks of the Society were accorded to the Highland and Agricultural Society for granting the usual facilities for the Exhibition, and for providing the Prize Money for the Open Section of the Timber Competitions. Thanks were also accorded to Mr JOHN LEARMONT, Nurseryman, Dumfries, for taking charge of the arrangements on the spot.

Mr WATT, Nurseryman, Carlisle, drew attention to the exhibit of Messrs J. Heins, Sons, Nurserymen, Halstenbek, Germany, and expressed the hope that in future trade exhibits would be excluded from the Society's Exhibition. The President in reply pointed out that home nurserymen might have enjoyed the same privilege as Messrs Heins, but said that the Council would no doubt act upon Mr Watt's suggestion.

Mr R. DUNCAN, Forester, Dryfeholm, said that in connection with the exhibits of gates, etc., he thought there ought to be two classes, one for gates made by joiners or regular tradesmen, and

one for gates made by working foresters. He thought it was unfair to expect foresters to compete in workmanship with trained joiners, and to get over this difficulty he suggested that there should be two classes. The President thanked Mr Duncan for his suggestion, which he said would be carefully considered by the Council.

Excursion to Lochaber.

Mr Buchanan, Convener of the Excursion Committee, reported that the recent Excursion had been well attended, and had been one of the most interesting and instructive of the home Excursions that the Society had ever held. The Members were greatly indebted to the President for the trouble he had taken in preparing the descriptive guide, and for the help he had given the Committee during the outing. They were much interested in his experimental plantings on inverted turf on peaty soils at Corrour, of which some illustrations were on view in the Exhibition. The Council's recommendation was that next year the Excursion should be held in the Border district. Mr Watt said that as a representative from the Border he would be glad to give the Society a welcome. The report was approved of and the matter remitted to the Council with powers.

School for Forest Apprentices.

In regard to Dr Nisbet's resolution on this subject, which he gave notice of at the Annual Meeting, and which was remitted to the Council for consideration and report, the Chairman said that this matter was brought before the Council, not for the first time, and had received sympathetic consideration, and they had endeavoured in their dealings with public departments to put this idea of a school in the forefront of their policy. They all recognised the need for it, and one of the main reasons why a demonstration forest was so much required was that it would form the natural home of such a school. He regretted the Council had no progress to report in this matter, although they had repeated their application to the Government. Governments moved very slowly, but the Development Commissioners were now meeting, and it was hoped this would be one of the first things that would come out of their deliberations and their distribution of money.

A vote of thanks to the Chairman closed the Meeting.

Royal Scottish Arboricultural Society

SYLLABUS OF COMPETITIONS—1911.

[*The Judges are empowered to fix the value of the Prizes to be awarded according to the respective merits of the Essays.*

All Essays, Reports, Models, or other Articles intended for Competition must be lodged with the Secretary not later than 13*th May* 1911. *Each such Essay, Report, Model, or Article must bear a* Motto, *and be accompanied by a sealed envelope bearing outside the* same Motto, *with the Class in which the Writer competes, and containing a* Card *with the* Name *and* Address *of the Competitor.*

Essays should be written on one side of the paper only; the left-hand quarter of each page should be left as a blank margin. The lines should not be crowded together.

Manuscripts for which prizes have been awarded, or which have been wholly or partly reproduced in the Transactions, *become the property of the Society and are not returned to their authors.*

Judges cannot compete during their term of office.

Successful Competitors may have either the medals or their converted values, which are as follows:—Gold, £5; No. 1 *Silver,* £3; No. 2 *Silver,* £2; No. 3 *Silver,* £1; *Bronze,* 10s.]

The following subjects are named for competition in 1911 :—

Class I.—For Open Competition.

I. Suitability of any exotic Conifer for cultivation as a Forest Crop, and nature of the locality found, in the experience of the writer, to be most suitable for it. (*Five Guineas* offered by David W. Thomson, Esq., Nurseryman, Edinburgh.)

II. The relative powers to bear shade of one, two, or all of the following species :—Douglas Fir, Menzies Spruce (*Picea sitchensis*), White American Spruce, *Sequoia Sempervirens*, Lawson's Cypress, *Abies grandis*, Giant Hemlock (*Tsuga Mertensiana*), *Thuya gigantea;* and the order in which the above Species should be placed in a list of shade-bearing trees comprising also Silver Fir, Beech, Spruce, Hornbeam. The Report to be based on personal experience only. (*Five Guineas* offered by JOHN METHVEN, Esq., of Messrs Thomas Methven & Sons, Nurserymen, Edinburgh.)

III. Successful raising, by the writer, or on the Estate with which he is connected, of a Young Forest Crop by the method of "Direct" Sowing. The conditions of Soil and Soil Covering to be fully stated. (*A Medal.*)

IV. Comparative results obtained up to the time at which the Young Crops have become thoroughly established, by various methods of Planting, with various Species and Sizes of Plants. (*A Medal.*)

The Report to be based on personal experience; soil and other local conditions to be fully described.

V. The raising and management of Thorn Hedges, and the Comparative Merits of Various Local Methods. The writer must differentiate between Hedges as Fences for Agricultural Purposes, and Hedges as Fences for Plantations. As regards the latter, the writer must discuss the relative advantages or disadvantages of Hedges as compared with other forms of Fencing. (*A Medal.*)

VI. Successful raising, by the writer, or on the Estate with which he is connected, of a young Forest Crop in a frosty locality, with details as to Soil Covering, Species, and Measures of Protection adopted. (*A Medal.*)

VII. An approved Report on the Woods of which the competitor is Forester. Reporter to state the extent of the woods, the species of trees grown, soil, situation, age, management, etc. (*A Medal.*)

VIII. Successful Underplanting of Larch or other Light-crowned Species, on an Estate with which the writer is, or has been, connected. (*A Medal.*)

The Report to be based on experience, the cases referred to being cited.

IX. Details of Measures successfully practised by the writer to exterminate any important Parasitic Fungus or Insect Pest, or to mitigate the Damage done by it. (*A Medal.*)

X. Details of Mechanical means employed by the writer, or on the Estate with which he is connected, for moving Timber from the interior of Woods to their margins, or to roads. (*A Medal.*)

XI. The erection and maintenance of a Saw-mill (either temporarily or permanently placed), or of any other Machinery for the Manufacture of Timber, used by the writer, or on the Estate with which he is connected — with details of outturn and cost. (*A Medal.*)

XII. Details of Measures successfully adopted for the natural regeneration of a timber-crop of Scots Pine, Larch, or other species. (*A Medal.*)

XIII. An approved Essay on the Botanical characteristics of some typical forest tree. The Essay to be accompanied by Illustrations. (*A Medal.*)

XIV. An approved Essay on Soils: — (*a*) preparation prior to planting; (*b*) the advantages of soil-protection accruing from density of crop; (*c*) the improvement to the soil arising from mixing the main crop with various species of shade-bearing trees. (*A Medal.*)

XV. An approved Essay on the best method of Planting at high altitudes and in exposed situations, together with the best Species of Trees to plant there with the object of procuring (*a*) shelter for stock, and (*b*) a profitable timber-crop. (*A Medal.*)

XVI. Report on the comparative Durability and Suitability for Fencing of various kinds of Timber after it has been creosoted in open tank. (*A Medal.*)

XVII. An approved collection of short Notes of silvicultural interest, based on personal observation. (*A Medal.*)

XVIII. An approved Essay or Report on any other subject connected with Forestry. (*A Medal.*)

CLASS II.—FOR ASSISTANT FORESTERS ONLY.

I. Details of the Measures successfully practised by the writer to exterminate any important Insect Pest or Parasitic Fungus, or to mitigate the Damage done by it. (*A Medal.*)

II. An approved collection of Notes of silvicultural interest based on personal observation. (*A Medal.*)

III. An approved Essay or Report, based on personal experience, on any practical work connected with Forestry. (*A Medal.*)

ROBERT GALLOWAY
Secretary.

19 CASTLE STREET,
EDINBURGH,
November 1910.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON

HIS MOST EXCELLENT MAJESTY THE KING.

PROCEEDINGS IN 1911.

THE ANNUAL MEETING.

The Fifty-eighth Annual General Meeting of the Royal Scottish Arboricultural Society was held in the Goold Hall, 5 St Andrew Square, Edinburgh, on Friday, 3rd February 1911, at 2.30 P.M. Sir JOHN STIRLING-MAXWELL, Bart., of Pollok, President, occupied the chair, and there was a good attendance of Members.

MINUTES.

The SECRETARY, Mr Robert Galloway, S.S.C., submitted the Minutes of the General Meeting, held at Dumfries, on 21st July last, which were approved.

NEW HONORARY MEMBER.

The PRESIDENT proposed the election of Mr A. T. GILLANDERS, F.E.S., author of *Forest Entomology*, to the Honorary Membership of the Society. He said, I expect that Mr Gillanders' book, which is of a most practical character, is well known to most of the Members; and I think it entitles him to this honour. Mr Gillanders is also a hard-working member of our Council, and a gentleman to whom the Society is very much indebted for the assistance he has given.

Report of the Council

The Secretary read the Report of the Council to the Annual Meeting, which was in the following terms:—

Death of the King.

The death of King Edward VII., on 6th May last, deprived the Society for a time of a Royal Patron. A loyal and dutiful Address, as recorded in the Minutes of the July meeting, was duly presented to His Majesty King George V., who, at a later date, intimated that he had been graciously pleased to become Patron of the Society, in succession to his illustrious father.

Membership.

The Membership of the Society at last Annual Meeting was 1352. 101 names have been added to the roll in the course of the year, and 84 have been removed owing to death, resignation, or lapsing, leaving a net increase of 17, and raising the total membership to 1369. Amongst those who died in the course of the year were the following:—Alex. Milne, Edinburgh; Sir John Kinloch; Gen. Sir J. Clark Rattray; D. F. Mackenzie; James Robertson; W. A. Tait, Edinburgh (joint author of *The Arboriculturists in North Germany*); Professor Fisher, Oxford; Sir Robert Dundas; Thomas Smith, Culzean; and Prof. H. Mayr, Munich.

Syllabus and Prizes.

There were 21 subjects of competition included in the Syllabus for 1910. Seven Essays were received and submitted to the Judges, but only four of these obtained awards, as follows:—one, £1; two No. 2 Silver Medals; and one Bronze Medal. The Syllabus of Competitions for 1911 was issued along with the January part of the *Transactions*.

Donors.

The thanks of the Society are again due to the Highland and Agricultural Society for the renewal of their grant of £20 for prizes to be awarded for home-grown timber exhibited at Inverness; to Mr D. W. Thomson and Mr John Methven for renewing their offer of prizes for Essays; and to various donors of books and pamphlets to the Library.

Transactions.

The January Part was, as usual, issued punctually to all Members whose subscriptions for last year were paid before the close of the year. Unfortunately, a few continued to resist

the repeated appeals made to them, and their copies have meantime been held back, but will be forwarded in exchange for the amount due.

Local Branches.

The Annual Report of the Local Branches will be submitted in the course of the Meeting.

Forestry Exhibition.

The Annual Exhibition was held in the Showyard of the Highland and Agricultural Society at Dumfries. On that occasion the Committee were fortunate in securing a large number of exhibits, and a site near the main entrance to the Show, which made the Exhibition more accessible and attractive. Mr Milne Home presided over the Local Committee, and Mr John Learmont, Nurseryman, Dumfries, took charge of the arrangements on the spot. The Judges were Dr Borthwick, Mr William Wilson, Timber Merchant, Auchenleck, and Mr G. U. Macdonald, Woodbine Cottage, Peebles. Their awards were intimated at the meeting held at Dumfries, and were included in the proceedings of that meeting. A report of the Exhibition will be found on page 102 of vol. xxiv. of the *Transactions*. In all, 19 money prizes and 16 Medals were awarded, one of the latter being a Gold Medal to the President for specimens illustrating experiments in tree-planting at high elevations on peaty soil. The Exhibition is to be held in Inverness this year, under the auspices of the Northern Branch. The revised schedules have been issued to Members. It has been suggested that there should be a Competition for the best kept private Estate Nursery in the Show district, and the Council is conferring with the Northern Branch on the subject.

General Meeting.

The General Meeting was held in the Showyard at Dumfries, on 21st July, at which there was a large attendance. The usual report of the proceedings will be found appended to the *Transactions* issued last month.

Annual Excursion.

The Annual Excursion was held last year in Lochaber, the headquarters being the Lochiel Arms Hotel, Banavie, where sixty-seven Members assembled. The estates visited were Corrour, Ardverikie, Invergarry and Achnacarry. The weather was, upon the whole, very favourable, and the Excursion was looked upon, by those who took part in it, as having been one of the most interesting and instructive home Excursions they had attended. A full report of the proceedings will be found on page 73 of

vol. xxiv. of the *Transactions*. The thanks of the Society are particularly due to the President, for the trouble he took in connection with the preparation of the Guide and the Report, and to him and the other proprietors for granting permission to visit their estates, and for their generous hospitality to the Members while there. At the Meeting at Dumfries, it was decided to visit the Border district this summer.

Consulting Foresters.

Following upon the discussion at last Annual Meeting, the Council formally authorised the Secretary to keep a list of Consulting Foresters, whose services should be available to proprietors and others.

Large Larch Sawfly.

As desired by the Board of Agriculture, the Council issued to Members the Board's Memorandum on the subject of this pest, which was discovered in Cumberland about five years ago, and was believed to be spreading in the North of England and South of Scotland, as well as elsewhere. The Memorandum gave explanations as to how the pest might be identified, and requested those who might find it in their neighbourhood to send immediate information to the Board. It was hoped that in this way measures might be devised to mitigate or stamp out this pest.

Distinguished Visitors.

On 20th September last Professor HEINRICH MAYR of Munich, who was understood to be in delicate health, unexpectedly called upon the Secretary accompanied by Mr Dawson, of Aberdeen. Dr Borthwick and Mr Dawson drew out a programme for Professor Mayr, and accompanied him to Murthly, Scone, Durris, Brodie Castle, Bins-ness and Novar. Professor Mayr expressed great admiration for Scotland as a field for afforestation, and it was understood that he would write an article upon his tour for the *Transactions*. The Council regrets, however, to intimate that news has been received of the death of Dr Mayr, which took place on 25th January last. Intimation of this event was kindly telegraphed to the Secretary by Mr W. F. Soltau, the British Consul, who was authorised to send a wreath to the funeral in name of the Society. A card has since been received from Professor Mayr's family, acknowledging the wreath and the Council's expressions of sympathy.

On 3rd October, Dr H. SHIRASAWA, Chief of the Imperial Forest Experimental Station, Meguro, near Tokio, Japan, who was introduced by Professor Balfour, visited this country, and the

Secretary, accompanied by Dr Borthwick, took him to Dalkeith, Newbattle, Arniston and Penicuik as the guest of the Society. He subsequently, accompanied by Dr Borthwick, visited other parts of Scotland, including Balmoral.

The Council decided that, in future, the Secretary, with consent of the Convener of the Excursion Committee or the Convener of the Finance Committee, should have power to make arrangements to entertain such distinguished visitors.

Honorary Membership.

By the death of Mr D. F. Mackenzie, a vacancy was caused on the Home list of Honorary Members, and the Council unanimously recommended the election of Mr A. T. GILLANDERS, F.E.S., Alnwick Castle, Northumberland, to the vacancy, and this recommendation has since been confirmed by the Society. The death of Professor Mayr causes a vacancy on the Foreign list of Honorary Members.

Council.

The death of Mr Mackenzie and the resignation of Mr Fred Moon caused two vacancies on the Council in the course of the year. The Council filled up the first vacancy by appointing Mr WILLIAM DAVIDSON, Forester, Panmure, Carnoustie, and the second by the appointment of Lord LOVAT, and, in terms of the Rules, these appointments will hold good until the time when Mr Mackenzie and Mr Moon would have retired in ordinary course.

Scottish National Exhibition, Edinburgh, 1908.

The Council has pleasure in reporting that the Society's application to the Scottish National Exhibition for repayment, out of the surplus, of the outlays in connection with the Exhibition held in Edinburgh two years ago, has been successful, and that the Secretary has received payment of the £150 asked for. The Council recorded in its Minutes its thanks to the Liquidator and the Advisory Committee for recognising the Society's claim.

Scottish National Exhibition, Glasgow, 1911.

A suggestion was made by Dr NISBET that the Society should have a Forestry section in the Glasgow Exhibition similar to that held in Edinburgh in 1908, and the Committee appointed for the purpose having reported in favour of the proposal, it has been agreed that such a section is to be organised. A special Committee has accordingly been appointed, and the necessary Schedules inviting exhibits have been issued to Members. It is hoped that there will be a generous response to this invitation.

A suitable pavilion is to be erected and leased to the Society at a reasonable rent, upon a site which the Exhibition authorities have granted free of charge The Council has limited the outlay to £200. The Committee is now on the outlook for a suitable attendant to organise and take charge of the section during the time that the Exhibition is open.

Experiments with Railway Sleepers.

On the suggestion of Mr MUNRO FERGUSON, negotiations have been entered into with the various railway companies with the view of getting them to make experiments with creosoted sleepers made of beech, oak and other home-grown timbers. Most of the Companies have intimated their willingness to co-operate in the matter, and it is hoped that some valuable information may eventually be obtained on the subject.

Sample Survey.

Following upon the suggestion made at last Annual Meeting, the Council resolved to expend a sum not exceeding £100 in making a Survey of one or more areas of land for afforestation purposes, which would give a lead to the Development Commissioners by showing, on a small scale, what should be done throughout the country, and at their request Lord Lovat agreed to superintend the work. At the General Meeting, held at Dumfries, Lord Lovat fully described the procedure which he proposed to adopt in connection with the Survey. The actual work in the field has now been practically concluded, and it is expected that the various reports will be put in type very soon. Lord Lovat has included most of the great glen from Fort William to Inverness, and his General Survey for this district will show about 60,000 acres of plantable land. The Detailed Survey and Forest Plan will deal with about 10,000 acres of this area round Fort Augustus. It is understood that the Report will deal with questions of disturbance of existing industries, rating, labour, transport, game damage and other problems which require to be considered in connection with schemes of afforestation, and, when fully discussed and approved, it will be a valuable record and guide for future operations.

Development Act.

On 19th February last, the Council passed the following Resolution:—

"The Council of the Royal Scottish Arboricultural Society supports the Deputation from the Society which met the Chancellor of the Exchequer, and thanks Mr Lloyd George for his reception of the Deputation, and for the excellent outline of

silvicultural policy laid down by him in his Budget speech. The Council urges that the Government should, as soon as possible, give practical effect in Scotland to the intentions expressed by the Chancellor of the Exchequer in his reply to the Society's Deputation and in his Budget speech—

(*a*) By creating a Board of Forestry;
(*b*) By providing Demonstration Forests and Forest Gardens, and by otherwise assisting the development of University and other Educational enterprise; and
(*c*) By carrying out, as an essential preliminary to any great scheme of National Afforestation, a Survey of all areas throughout the country suitable for commercial planting."

On 25th May, it was decided to amend the Resolution by the addition of a request that the Forestry Board should have an office in Scotland where the best areas available for afforestation are situated, and that Scottish forestry should be adequately represented on the Board. The amended Resolution reads as follows:—

"The Council of the Royal Scottish Arboricultural Society respectfully urges that the Government should, as soon as possible, give practical effect in Scotland to the intentions expressed by the Chancellor of the Exchequer in his reply to the Society's Deputation, which he was good enough to receive on 22nd March 1909, and in his Budget speech thereafter, by creating a Board of Forestry, with an adequate representation of Scottish Forestry upon it, and an Office in Scotland, where the largest areas of land suitable for Afforestation are situated, which would provide Demonstration Forests and Forest Gardens, and otherwise assist the development of University and other Educational enterprise, and would carry out, as an essential preliminary to any great scheme of National Afforestation, a Survey of all areas throughout the country suitable for commercial planting."

A small Deputation was also appointed to wait upon the Chancellor of the Exchequer and the Development Commissioners in support of the Resolution. The President subsequently reported that he had been in communication with the Chancellor on the subject of the Society's Resolution, who appeared to indicate that the expense of creating a Board of Forestry would be considerable, and could be avoided as there were two experts on forestry upon the Development Commission. A special meeting of the Council was subsequently held, when the Representation to the Development Commission, which appears in the January *Transactions*, was adjusted and forwarded to the Commissioners, with the various particulars regarding the Society required by the Act. The reply received, to the effect that the Board of Agriculture were understood to be preparing

a scheme dealing with the forestry requirements of Great Britain as a whole, was also printed in the *Transactions*. Later, the President and the Honorary Secretary had a meeting with the President of the Board of Agriculture on the subject, but the matter was afterwards taken up by the Scottish Office and the Scotch Education Department with whom negotiations have been proceeding. The Council has also had an opportunity of sending witnesses to appear before the Development Commissioners, in support of the Representation. The following reply has since been received from the Development Commission.

DEVELOPMENT COMMISSION,
12th January 1911.

Sir,—I am directed by the Development Commissioners to advert to your communication forwarding a letter, dated 10th September 1910, addressed to them on behalf of the Council of the Royal Scottish Arboricultural Society by the President, Sir John Stirling-Maxwell, with reference to the expenditure of grants from the Development Fund on forestry in Scotland.

2. The Commissioners caused copies of the President's letter to be transmitted to the Board of Agriculture and Fisheries, and to the Scotch Education Department, and they referred it for consideration to their Forestry Committee. They have learnt with pleasure that the Royal Scottish Arboricultural Society accepted the invitation of the Forestry Committee to give evidence before them, and that Sir John Stirling-Maxwell, the Right Hon. R. C. Munro Ferguson, M.P., Lord Lovat, Captain Stirling, and Mr R. Galloway attended the meeting of the Committee on the 3rd January 1911, as witnesses on behalf of the Society.

3. The Commissioners have considered the report on the Society's proposals, presented to them by the Forestry Committee, and have given special attention to the application for a grant towards the cost of carrying out a national Survey throughout Scotland, in order to ascertain areas suitable to afforest.

4. While favourably impressed with the Survey carried out for the Society by Lord Lovat in Inverness-shire, which they regard as valuable pioneer work, the Commissioners cannot help thinking that a national Survey would soon become out-of-date. They believe, however, that local Surveys similar to that carried out in Inverness-shire, might usefully be undertaken, as occasion arises, by the staff and students at a central Demonstration Area of the kind the Society desires to see established.

5. The Commissioners have concurred in proposals put forward by the Scotch Education Department, for the appointment of a Committee in Scotland to consider preliminary questions connected with the provision of a Demonstration Area. In the event of such an area being established in Scotland, the Commissioners

might be prepared to consider the question of recommending advances out of the Development Fund towards the cost of local Surveys.—I am, Sir, your obedient Servant,

H. E. DALE,
Secretary.

THE SECRETARY,
ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

The Secretary for Scotland had intimated to the President that he proposed to appoint a small Committee to make preliminary investigations into the Society's proposals, and to suggest a suitable area or areas for the Demonstration Forest, and make other suggestions as to how the Society's scheme should be carried out, and to formulate an application to the Development Commission. The Council approved generally of the outlines of the proposed procedure suggested by the Scottish Office, on condition that it received guarantees that the administration of the Development grant would be placed in competent hands. The Council has further considered the matter to-day, and has decided that the Society would not be justified in lending its assistance unless it receives a guarantee that any grant given for a Demonstration Forest will be administered by competent persons, and an assurance that the Survey will be proceeded with at once.

About 1100 copies of the Society's Representation were distributed to Scottish, London and Dublin newspapers, County Councils and other bodies interested in the subject, and replies have been received from a number of County Councils to the effect that they have written to the Development Commission supporting the Society's Representation.

Conference with the English Society.

At the request of the Royal English Arboricultural Society, a small Deputation was appointed to meet a similar Deputation from the English Society to confer on various matters of mutual interest. A meeting was held in London, on 3rd January last, and a Memorandum of the proceedings will be appended to this report. (See Appendix A.)

FINANCES.

Mr JOHN METHVEN, Convener of the Finance Committee, submitted the Abstract of Accounts for the year ended 31st December last (see Appendix C), and read the Auditor's Docquet appended. He said, I think we may hold the Accounts as read. There are only one or two points of interest in the Accounts that I might draw your attention to. We have been fortunate enough to receive from the management of the late Edinburgh Exhibition the sum of

£150 expended on the Forestry exhibits there. I think we owe them our grateful thanks for awarding us this sum out of the surplus. One other interesting point is that the actual surplus of income during the past year was £129, and also that the total sum at the credit of the Society now amounts to more than £2200. I think that is exceedingly satisfactory. I have much pleasure in moving the adoption of this report.

Mr A. D. Richardson suggested that the cost of the Medals awarded for Essays and for Exhibits should be shown separately, and pointed out the omission from the *Transactions* of any notice of the work that had been done by Dr Henry in connection with plant-breeding, which he said was of the very greatest importance from both an arboricultural and horticultural point of view. He thought the *Transactions* would be much improved by taking notice of such work as Dr Henry's.

The President said he sympathised with what Mr Richardson had said. The *Transactions* ought to afford the Members the means of keeping pace with what has been doing in other parts of the world, and the point raised was one which he would look into, and which he hoped would be dealt with satisfactorily.

Dunn Memorial Fund and Excursion Fund Accounts.

The Secretary submitted the report by the Auditor and Treasurer on the Dunn Memorial Fund and the Excursion Fund. The Dunn Memorial Fund, he said, showed a credit balance of £24, 5s. 6d. The Excursion Fund balance last year was £37, 0s. 11d., and there was now a balance of £54, 11s. in hand. (See Appendices B and D.)

Aberdeen and Northern Branches.

With regard to the reports from Aberdeen and Northern Branches, the Secretary said that they would be printed as usual, and as there was a good deal of very important business to follow, they might be held as read. This was agreed to. (See Appendices E, F, G, and H.)

Chairman's Remarks.

The Chairman said, I should like to make a few remarks about the reports. Looking back to last year, I think, on the whole, the record is one of steady advance and fairly productive work. When you did me the honour of putting

me in this chair last year, I tried to find out what the most pressing needs of forestry in Scotland appeared to be for the moment, and two matters which came to the front were the need of instruction in autumn for working foresters and men in charge of woodlands at such a time as they could attend lectures. That was one matter. The other was the need of taking some practical step in the direction of a Survey, which has been long advocated by the Society without any response on the part of the authorities. In both these matters there has been an advance during the year. Mr Dawson has started, at Aberdeen, a class for working foresters, which has been in every way successful, and I hope the step will be the beginning of a great development of work on these lines. We have also, in this Society, taken up for ourselves this matter of a Survey, and with the help of Lord Lovat and Captain Stirling we have actually been able to get, within the year, results far beyond anything expected when the suggestion was first thrown out that we might make an attempt in that direction. Lord Lovat will speak about the Survey himself, and therefore I have nothing more to say about it now, but that we have great reason to be grateful to him for the immense amount of time he has devoted to this subject. I want to say one word about the Development Grant and the negotiations in connection with it. It would be wearisome to go over them in detail, but I should like to point out that all our difficulties spring from the fact that we have not been able to persuade the Government to realise that a large subject like forestry cannot be dealt with effectively, unless it is made the subject of a Department organised to deal with it, which has power to take charge of it, and which is able to centralise all the different efforts which have been made. We have, unfortunately, not yet persuaded the Government to give us a Board of Forestry. We shall continue to press for such a Board, which has from the beginning been the policy of the Society. Meanwhile, however, money has been devoted by Parliament to the development of forestry, and the Development Commissioners, who hold the money, have to be approached through some public Department. As there is no Department of Forestry, we are approaching them through the Education Department for Scotland. I should like to say that Lord Pentland and his Department have met us in the matter very frankly, and I think with a very good

disposition. I have not the smallest doubt in my own mind that they wish to carry through, so far as they can, the programme which this Society has set before the Development Commissioners. On the other hand, we know the difficulties which any Department would have to confront when it comes to the actual practical work, and your Council feel that they ought not to give the assistance of this Society unless they can make sure that the development attempted will really be of an effectual and business-like character. Our assistance has been asked for, but we feel we cannot give it unless we have some definite assurance that when a grant is given for the development of forestry it will be entrusted to men who are competent to administer it. And we also feel that we cannot lend our assistance unless we have a clear assurance that the Survey, which we have at our own expense begun, shall be taken up by the Government. I do not think I need labour either of these conditions. As regards the matter of the Survey, I only want to say this that the object of our Society is to see an advance made in afforestation in Scotland. Afforestation cannot begin until we have had a Survey, to show which are the right places for planting in Scotland. Therefore if we keep back that Survey we keep back afforestation. I feel quite clear in my own mind, and I am glad to say the Council agree with me in thinking, that if we allow this question of the Survey to be put in the background at this stage, we shall find that afforestation makes no beginning for another twenty-five or thirty years. For fifty-seven years this Society has been working away at this subject. Nothing whatever has been done by Government in these fifty-seven years, although there have been fair words from time to time from every Government which has been put in office, and I think we shall be fools indeed if, at this critical moment, we give our assistance, unless we are sure that the policy to be pursued is to be effective and good. I have nothing more to say on the reports, and I beg to move their adoption.

The Motion was unanimously agreed to.

Office-Bearers.

Mr James Whitton proposed the re-election of Sir John Stirling-Maxwell as President, which was unanimously

agreed to. The following were then elected to fill the vacancies on the list of Office-Bearers, viz.:—Vice-Presidents—Dr A. W. Borthwick and Sydney J. Gammell of Drumtochty. Councillors—George Leven, John Broom, John F. Annand, John W. M'Hattie, Brodie of Brodie, William Dawson and John Methven. The Hon. Secretary, the Secretary and Treasurer, the Hon. Editor, the Auditor, and the Honorary Consulting Officials and Local Secretaries were re-elected. (See Appendix I. for list of Office-Bearers for 1911.)

Excursion.

The Secretary said:—In the unavoidable absence of Mr Buchanan, Convener of the Excursion Committee, I have to say that the Excursion this year is to be held in the Border district. We have already had intimation that Lord Minto will be glad to see the Society at his place, and from what the Duke of Roxburghe's factor at Langholm has said, we believe we shall be made welcome there. No doubt there are other places which we shall find interesting and well worth a visit. The Committee invite suggestions. The date of the Excursion has not yet been fixed. Last year we made a new departure. We went at the end of June for the particular reason that we were then able to avoid the crush of visitors in the Highlands, and to get the hotels to ourselves. The Committee will be glad to hear whether that time is likely to suit for another year.

The President.—The general conclusion I came to last year was that the end of June was fully more convenient than July.

Mr Whitton.—I move that the same period be fixed this year. I think all the Members at last Excursion concurred in the opinion that it was a good time.

The President.—It is rather safer for weather.

Mr Price, factor for Lord Minto.—The weather is invariably good in the Border district in June. I should recommend the beginning of June. It is the date of the Hawick Riding, and for the last fifteen or sixteen years I have never known them have a wet day.

Mr Whitton's motion was agreed to.

Scottish Exhibition at Glasgow, 1911.

Mr Whitton reported that the Committee had arranged for free space, and had made a contract with Messrs F. D.

Cowieson & Co., Glasgow, for the hire of a pavilion some 60 feet by 30 feet, a little larger than the Edinburgh one. The arrangements regarding the bringing forward of the material had been published. The Committee hoped there would be a hearty response to its appeal for exhibits.

Exhibits at Inverness.

With reference to the Forestry Exhibition in the Highland and Agricultural Society's Show at Inverness, Sir Andrew Agnew said that, in addition to the usual Competitions, there was a question as to whether a prize should be given for the best kept Estate Nursery, but the Council had not decided the point until they should receive the opinion of the Northern branch as to whether such a Competition would likely be taken advantage of.

The President said he thought it was a good plan to mention the matter here, so that Members might communicate anything they thought about it.

The Sample Survey.

Lord Lovat, reporting with reference to the Sample Survey, said:—We started work in October, and we have had a great many people employed since. We discovered that in the Loch Ness valley some 60,000 acres were capable of bearing trees. The Survey has been undertaken with the object of going into the whole of the economic necessities of the district as well as its silvicultural possibilities. We have consulted the best authorities locally. We have been very well supported by the local landowners, who have given us every assistance in their power. We have gone thoroughly into the question of the amount of employment that can be given in the district, the number of new settlements that can be made on the soil, and generally all the details which come up in connection with the establishment of an enterprise of such magnitude. Mr Dawson, Mr Nisbet, Mr Stebbing and a great many foresters in this part of the country have all associated themselves with the work. The Report will be submitted to the Council of the Society, probably about the end of March. I think when one argues the point for some time one clears one's mind as to what form a Survey should take. On the subject of this particular Survey,

I have no doubt in my own mind now exactly in what way a Survey of Scotland should be done. I am satisfied that you want two Surveys. Captain Stirling and myself consider that, before launching out into any great expenditure of money in planting in Scotland, the Central Authority should carry out a Survey of at all events a portion of the waste land available. This Survey should include (*a*) a broad general investigation of the silvicultural possibilities of Scotland as a whole; (*b*) the particular and detailed consideration of certain definite forest centres, carefully selected, as suitable for silviculture, for the establishment of wood industries, and for the support of a permanent population. The General Survey would deal only with the land with regard to its silvicultural value. It would be of the nature of a flying Survey, with the idea more of fixing localities on which individual forest centres could be established, rather than an attempt to give the total number of isolated acres which would grow trees. The more important Survey would not in any way be dependent on the completion of the whole of the first Survey, but would be dependent on it only to the extent of using it as a means by which the forest centres could be marked down for investigation. That is the policy we advise the Society to pursue. We feel that though we wish in every way to co-operate with the Development Commission, we should certainly hold our hand till we are quite clear on two points. There is the point as to the *personnel* raised by the Chairman. Certainly, we should be perfectly satisfied that this Development Commission is not going to put off Scotland by merely buying an Inverliever. They must undertake a Survey of Scotland with the central object in view of getting trees into the ground. I think we feel we have waited a great deal too long. What we have to do is to see that the Society throws its weight into the balance, in order to secure a whole definite scheme—(first) a training establishment; (second) a Survey, possibly on the two lines I have indicated; and (third) within the nearest possible time in the future – a beginning with a scheme of State afforestation or some general afforestation on a large scale.

Proposal to alter Law XIV.

Mr A. D. Richardson moved the adoption of the following motion:—For the alteration of Law XIV—(*a*) To delete the words

Date of Election.

*1901. HALLIDAY, John, Timber Merchant, Rothesay.
1911. HAMILTON, Alexander, Assistant Forester, Pilsley, Bakewell, Derbyshire.
1907. HAMILTON, Andrew, Naval Architect, 124 Shiel Road, Liverpool.
1908. HAMILTON, David R., Catcune Mills, Gorebridge.
*1882. HAMILTON, Donald C., Forester, Knowsley, Prescot.
1909. HAMILTON, John, C.A., 34 York Place, Edinburgh.
*1899. HAMILTON, The Right Hon. Baron, of Dalzell, Dalzell House, Motherwell.
1892. HANNAH, George, Overseer, Estate Office, Boynton, Bridlington.
1905. HANSON, Clarence Oldham, Deputy Conservator, Indian Forest Department, Latimer Lodge, Cinderford, Gloucestershire.
1907. HARBOTTLE, William, Assistant Forester, Woodhouse, Loughborough, Leicestershire.
*1903. HARDIE, David, Factor, Errol Park, Errol.
*1880. HARE, Colonel, Blairlogie, Stirling.
*1896. HARLEY, Andrew M., Forester, 5 Thayer Street, Manchester Square, London.
1908. HARLOND, Henry, Park Forester, Sutton Coldfield, Warwickshire.
1911. HARRIER, James B., Forester, Innes House, Elgin.
*1910. HARRISON, Alexander, Apprentice C.A., 3 Napier Road, Edinburgh.
1905. HARROW, R. L., Head Gardener, Royal Botanic Garden, Edinburgh.
1897. HART, John, Factor, Mains of Cowie, Stonehaven, Kincardineshire.
*1880. HAVELOCK, W. B., The Nurseries, Brocklesby Park, Lincolnshire.
1911. HAWES, A. F., A.B., M.F., Experimental Station, Burlington, Vermont, U.S.A.
1911. HAWLEY, Ralph Chipman, A.B., M.F., Assistant Professor of Forestry, Yale Forest School, 360 Prospect Street, New Haven, Conn., U.S.A.
*1908. HAY, Athole Stanhope, of Marlefield, Roxburgh.
1905. HAY, Henry Ferguson, Forester, Cholmondeley Estate Yard, near Malpas, Cheshire.
*1892. HAY, John, Overseer, Dollars Estate Office, 8 Rennie Street, Kilmarnock.
1904. HAY, Sir Duncan Edwyn, Bart. of Haystoun, 42 Egerton Gardens, London, S.W.
1905. HAY, William Black, Assistant Forester, Bondgate, Harewood, Leeds.
1896. HAY, Wm. P., Merchant, Rosebank, Loanhead, Midlothian.
1869. HAYMAN, John, Glentarff, Ringford, Kirkcudbrightshire.
1902. HAYNES, Edwin, Editor *Timber Trades Journal*, 164 Aldersgate Street, London.
1909. HECTOR, Thomas Gordon, Estate Clerk, Philorth Estate Office, Fraserburgh.
1907. HENDERSON, John, Assistant Forester, Gateside, Balbirnie, Markinch.
*1908. HENDERSON, John G. B., W.S., Nether Parkley, Linlithgow.
1908. HENDERSON, R., Assistant Forester, c/o Mrs Charlwood, Bury Creath, Banstead, Surrey.

Date of Election.

1893. Henderson, R., 4 High Street, Penicuik, Midlothian.
1893. Henderson, William, Forester, Clonad Cottage, Tullamore, King's County.
*1906. Hendrick, James, B.Sc., F.I.C., Marischal College, Aberdeen.
1898. Hendry, James, 5 Thistle Street, Edinburgh.
1910. Henkel, John Spurgeon, Assistant Conservator of Forests, Midland Conservancy, Knysna, Cape Colony.
1908. Henry, Augustine, M.A., etc., Reader in Forestry, 23 Chesterton Road, Cambridge.
1911. Henry, George J., 66 Queen Street, Edinburgh.
*1901. Hepburn, Sir Archibald Buchan-, Bart. of Smeaton-Hepburn, Prestonkirk.
*1874. Herbert, H. A., of Muckross, Killarney, Co. Kerry, Ireland.
*1884. Heywood, Arthur, Glevering Hall, Wickham Market, Suffolk.
1904. Hill, George, Assistant Forester, Fothringham, Forfar.
*1904. Hill, J. Smith, The Agricultural College, Aspatria.
*1903. Hill, Robert Wylie, of Balthayock, Perthshire.
*1905. Hillier, Edwin L., F.R.H.S., Nurseryman and Landscape Gardener, Culross, Winchester.
*1902. Hincks, Ralph Tichborne, J.P., D.L., Foxley, Hereford.
1907. Hinds, John, Forester, Stockeld Park, Wetherby, Yorks.
1906. Hislop, Robert, Assistant Forester, 11 Bawdsey Street, Bawdsey Manor Estate, near Woodbridge, Suffolk.
1895. Hoare, Sir Henry Hugh Arthur, Bart. of Stourhead, Bath.
1909. Hobart-Hampden, A. G., Indian Forest Service, Ferns, Great Hampden, Great Missenden.
1909. Hodgson, Joseph, Assistant Forester, Fisher Place, Thirlmere, Grasmere.
*1908. Hog, Steuart Bayley, B.A., Newliston, Kirkliston.
1866. Hogarth, James, Forester, Culhorn, Stranraer, Wigtownshire.
1908. Hogg, Alexander, Assistant Forester, Nibbetstane, Durris, Drumoak.
*1905. Holms, John A., Formaken, Erskine, Renfrewshire.
1910. Holzapfel, John William, B.Sc. and N.D.A., Student in Forestry, Kenton Farm, Kijabe, British East Africa.
1909. Honeyman, John, Overseer, Kemback Estate, Cupar, Fife.
*1902. Hood, Thomas, jun., Land Agent, Ras-el-Khalig, Egypt.
*1908. Hope, Captain Thomas, of Bridge Castle, Westfield, Linlithgowshire.
*1871. Hope, H. W., of Luffness, Drem, Haddingtonshire.
1907. Hopkinson, James Garland, Factor, Drumtochty Estates Office, 11a Dee Street, Aberdeen.
*1876. Horsburgh, John, 21 Dick Place, Edinburgh.
1908. Houston, Samuel, 118 Allison Street, Crosshill, Glasgow.
*1911. Howard de Walden, Baron, The Dean, Kilmarnock.
1909. Howe, James, Assistant Forester, Midhope, Hopetoun, South Queensferry.
1902. Howe, John Arnold, Overseer, Home Farm, Mount Stuart, Rothesay.
1905. Hudson, W. F. A., M.A., Lecturer on Forestry, Agricultural College, Glasgow.

ascertain how the Inland Revenue officials interpret the clause as to Valuation and Deductions for Management, and to see that proper precedents were established. Mr PRATT pointed out that one question he would like members to keep in view was whether replanting of thin cover formed a statutory deduction.

5. Mr PRATT submitted the following Motion:—"That in the opinion of the two Societies heavy death duties were a deterrent to systematic silviculture." Sir JOHN STIRLING-MAXWELL suggested that if the Societies proposed to ask the Government to make any change on the death duties, it should be on the understanding that no relief should be given unless in respect of woodlands kept under systematic management. Mr FERGUSON pointed out that this was what the Scottish Society had asked for before and had practically obtained, but that the proposed arrangement had been upset at the last moment on representations made by English Members of Parliament, who pointed out the hardship which proprietors of hedge-row timber would suffer, because such timber would continue to be valued under the old system. It was agreed to allow this matter to rest meantime.

6. Mr PRATT submitted the following Resolution:—"That the Societies agree to the principle that private owners of woodlands managing their woods on approved principles of forestry be granted a rebate on their income tax annually." The Scottish Members did not think that there was any hardship upon owners of woodlands with regard to income tax. The English Members, on the other hand, appeared to think that they had a distinct grievance, and as the delegates could not agree, the motion was not pressed.

7. *Railway Rates.*—Mr ELWES pointed out the unfairness of the railway companies' charges in respect of home-grown timber as compared with imported timber. Sir JOHN STIRLING-MAXWELL, who said he was a railway director, admitted the grievance, but said the matter should be taken up with the railway companies, who he thought would be glad to hear the Societies' representations. It was pointed out that the foreign timber was imported in large quantities, and in a form more easily handled than the home-grown timber, and that this accounted to a great extent for the increased charges on the home timber. Mr PRATT fully admitted this, but said that

the English grower asked for fixed rates for large consignments as for foreign timber, not special quotations, and until this was done it could not be ascertained whether a wood was paying, and that no afforestation would be wise till the cost of export of the proposed produce was definitely ascertained. It was agreed that the two Societies, jointly, should approach the Conference of Railway Companies with specific cases where differentiation of rates acted against home timber, and should endeavour to arrange a tariff for home timber in large quantities, at reasonable rates, on lines similar to those for imported timber.

It was agreed that the above Memorandum should, on approval, be signed by the Presidents of both Societies for submission to the Councils of the respective Societies.

JOHN STIRLING-MAXWELL.
E. R. PRATT.

APPENDIX B.

ABSTRACT OF ACCOUNTS

IN CONNECTION WITH

THE MALCOLM DUNN MEMORIAL FUND, 1910.

RECEIPTS.

Balance in Bank at close of last Account, . .	£21	9	0
Dividend on £100 3 per cent. Redeemable Stock of Edinburgh Corporation, payable at Whitsunday and Martinmas, 1910, £3, *less* Tax 3s. 6d., ...	2	16	6
	£24	5	6

PAYMENTS.

Nil.

Balance carried forward, being sum in National Bank of Scotland on Account Current, ...	£24	5	6

Note.—The Capital belonging to the Fund consists of £100 3 per cent. Redeemable Stock of Edinburgh Corporation.

EDINBURGH, 21*st January* 1911.—Examined and found correct. The Certificate by the Bank of above balance, and Edinburgh Corporation Stock Certificate, have been exhibited.

JOHN T. WATSON,
Auditor.

6. Income Tax Recovered,			3 6 1
7. Scottish National Exhibition 1908:—			
Donation out of Surplus towards Society's Expenses in connection with the Forestry Section			150 0 0
			£1013 19 8

and Hall for Annual Meeting,			£26 16 5	
Auditor,			3 3 0	
Hon. Editor for Assistant, £27, 10s.; for German and French Notes for *Transactions*, £10,			37 10 0	
Secretary and Treasurer,			125 0 0	
Advertising, Insurance, and Premium on Secretary's Bond of Caution,			4 16 4	
Councillors' Railway Fares,			5 5 0	
Postages and Miscellaneous Outlays, viz.:				
Postages of Parts I. and II. of Vol. XXIII. of *Transactions*,	£34 4 6			
General Postages, Commissions on Cheques, and Petty Outlays,	37 6 6			
			71 11 0	
6. Sum transferred to Capital,				65 17 9
7. Balance of Revenue carried to next year, subject to payment of cost, etc., of January *Transactions*,				427 6 3
Arising thus—				
Balance at credit of Account Current with National Bank of Scotland, Ltd.,		£17 1 0		
Sum on Deposit Receipt with Do.,		410 0 0		
Balance due by Treasurer,		0 5 3		
		£427 6 3		
				£1013 19 8

EDINBURGH, 23*rd January* 1911.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1910, of which the above is an Abstract, and have found them correct. The Securities, representing the Society's Funds as above, have also been exhibited to me.

JOHN T. WATSON, *Auditor.*

APPENDIX C.—Abstract of Accounts for Year ending 31st December 1910.

I.—CAPITAL.

CHARGE.

1. Funds at 31st December 1909,		£1885 0 0
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 105½,	£527 10 0	
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 112,	560 0 0	
£400 North British Railway Company 3 per cent. Debenture Stock, at 83¾,	335 10 0	
£400 North British Railway Company, No. 1, 4 per cent. Preference Stock, at 105½,	422 0 0	
	£1845 0 0	
Furniture, etc., in Society's Room,	40 0 0	
	£1885 0 0	
2. Life Members' Subscriptions in 1910,		67 4 0
New Members,	£54 12 0	
Ordinary Members by commutation,	12 12 0	
3. Sum transferred from Revenue,		65 17 9
		£2018 1 9

DISCHARGE.

1. Proportion of Life Members' Subscriptions transferred to Revenue,		£133 1 9
Unexhausted £857 10 5 / 77 7 6	$\frac{1}{5}$ of Full Life Subscriptions, £115 9 8 $\frac{1}{10}$ of Commuted Subscriptions, 17 12 1	
2. Decrease in value of Railway Stocks at 31st December 1910,		45 10 0
3. Funds, etc., at 31st December 1910		
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 103¼	£516 5 0	
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 108½,	541 5 0	
£400 North British Railway Company 3 per cent. Debenture Stock, at 80¾,	323 0 0	
£400 North British Railway Company, No. 1, 4% Preference Stock, at 104¾,	419 0 0	
	£1799 10 0	
Furniture, etc., in Society's Room, say	40 0 0	
		1839 10 0
		£2018 1 9

II.—REVENUE.

CHARGE.

1. Balance in hand at 31st December 1909,		£213 5 4
2. Ordinary Members' Subscriptions,		426 9 6
Arrears at 31st December 1909, £24 3 0		
Add Arrears written off but since recovered, 1 2 6		
	£25 5 6	
Subscriptions for 1910, £426 12 0		
Less Received in 1909, 4 10 6		
	422 1 6	
Subscriptions for 1911 received in 1910,	9 0 0	
	£456 7 0	
Deduct—		
Cancelled or written off as irrecoverable at 31st December 1910, £12 14 6		
Arrears at 31st December 1910, 17 3 0		
	£29 17 6	
	£426 9 6	
3. Proportion of Life Members' Subscriptions transferred from Capital,		133 1 9
4. Dividends and Interest,		70 16 3
5. *Transactions*, etc., sold,		17 0 9
6. Income Tax Recovered,		3 6 1
7. Scottish National Exhibition 1908:—		
Donation out of Surplus towards Society's Expenses in connection with the Forestry Section		150 0 0
	£1013 19 8	

DISCHARGE.

1. Printing, Stationery, etc.,		£192 17 3
Vol. XXIII. Part I. *Transactions*, £75 14 6		
Authors' Reprints, 2 17 6		
	£78 12 0	
Vol. XXIII. Part II. of *Trans.*, £101 17 6		
Authors' Reprints, 4 4 0		
	106 1 6	
	£184 13 6	
General Printing and Stationery, £40 17 6		
Forestry Periodicals, Binding, etc., 4 10 2		
	45 7 8	
	£230 1 2	
Less Receipts for Advts. in *Trans.*,	37 3 11	
	£192 17 3	
2. Prizes (Money, £30, 10s.; Medals, £12, 15s.; Books, 15s.),	£44 0 0	
Less Donation from the Highland and Agricultural Society, for Prizes awarded for Home Grown Timber exhibited at Dumfries,	18 0 0	
		26 0 0
3. Forestry Exhibition at the Highland and Agricultural Society's Show at Dumfries—		
Printing,	£9 11 6	
Advertising,	0 16 0	
Extra Tabling, Racks, etc.,	3 0 10	
Wages, etc.,	2 2 5	
Incidental Expenses,	2 2 10	
		17 16 8
4. Contribution to Aberdeen and Northern Branches, £5 each,		10 0 0
5. Expenses of Management,		271 1 8
Rent of Room and Taxes for 1909 and 1910, and Hall for Annual Meeting,	£236 16 5	
Auditor,	3 3 0	
Hon. Editor for Assistant, £25, 10s.; for German and French Notes for *Transactions*, £10,	37 10 0	
Secretary and Treasurer,	125 0 0	
Advertising, Insurance, and Premium on Secretary's Bond of Caution,	4 16 4	
Councillors' Railway Fares,	5 5 0	
Postages and Miscellaneous Outlays, viz.		
Postages of Part I. and III. of Vol. XXIII. of *Transactions*, £14 4 6		
General Postages, Commissions on Cheques, and Petty Outlays, 37 6 6		
	71 11 0	
6. Sum transferred to Capital,		65 17 9
7. Balance of Revenue carried to next year, subject to payment of cost, etc., of January *Transactions*,		127 6 3
Arising thus:—		
Balance at credit of Account Current with National Bank of Scotland, Ltd.,	£17 1 0	
Sum on Deposit Receipt with Do.,	100 0 0	
Balance due by Treasurer,	9 5 3	
	£127 6 3	
	£1013 19 8	

EDINBURGH, *23rd January* 1911.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1910, of which the above is an Abstract, and have found them correct. The Securities, representing the Society's Funds as above, have also been exhibited to me.

JOHN T. WATSON, *Auditor*.

APPENDIX D.

Excursion Account.

Abstract of Accounts—Year 1910.

Balance brought from last Year, ...		£37	11 0
Deduct—Auditor's Fee for 1909, ...	£2 2 0		
Cost of material for Bavarian Album in duplicate and binding . .	3 19 0		
		6	1 0
		31	10 0

Excursion to Lochaber.

Amount collected		268	4 7
		£299	14 7

PAYMENTS.

Hotel Bill at Banavie	£144 14 0		
Railway Fares :—			
Fort William to Banavie . .	£0 12 11		
Banavie to Corrour . . .	11 16 3		
Banavie to Tulloch . . .	6 2 8		
Banavie to Mallaig . . .	8 15 9		
	£27 7 7		
Steamer on Canal	32 0 0		
Hiring to Adverikie	21 15 6		
Lunch at Mallaig	3 4 0		
Gratuities and Incidental Outlays . . .	7 6 0		
Printing Excursion Programme, Guide, etc., .	8 16 6		
		245	3 7
Balance (subject to Auditor's Fee) carried forward to next year, being sum in National Bank of Scotland on Current Account, ...		£54	11 0

Edinburgh, 31*st January* 1911.—Examined with Vouchers and Memorandum Book and found correct. Bank Certificate of above balance of £54, 11s. also exhibited.

John T. Watson,
Auditor.

APPENDIX E.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY (ABERDEEN BRANCH).

REPORT 1910.

The Committee beg to submit the Fifth Annual Report of the Branch.

The affairs of the Branch have been conducted on the same lines as in the preceding year.

The Membership of the Branch has been slightly increased during the year, ten new Members having joined. The meetings and excursions have been somewhat better attended; but the Committee would point out that the attendance of Country Members is not so good as it might be. They would be glad to have any suggestions as to how this could be remedied, so that all the Members of the Branch might have opportunities of meeting.

During the year, three meetings of the Branch have been held, on 11th December 1909, and on 21st May and 16th July 1910. Papers were read—by Sir John Fleming at the Annual General Meeting in December 1909, the subject of his address being "When Afforestation comes," and by Mr C. S. France and Mr John Rule at the meeting in May, the subjects of their papers being respectively, "Practical Forestry, with special reference to the Pruning of Forest Trees," and "The natural increment to be expected from a crop of larch and Norway spruce in decades of fifty to seventy years." An Excursion was made to Monymusk on 16th July 1910, and was attended by thirty-four Members and friends.

The Committee have again to record their thanks to Professor Trail, and the University Authorities, for being allowed to use the Botanical class-room for the meetings of the Branch.

GEORGE D MASSIE,
Honorary Secretary and Treasurer.

APPENDIX F.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY—ABERDEEN BRANCH.

STATEMENT OF ACCOUNTS, YEAR 1910.

GENERAL ACCOUNT.

INCOME.		EXPENDITURE.	
Balance at credit of last Account	£14 13 9	Rent of Hall	£0 16 0
Subscriptions from Members at 1s. each	4 6 0	Printing, etc.	1 5 0
Grant from parent Society	5 0 0	Advertising	0 11 9
Savings Bank Interest	0 6 9	Postages for year, and Commission on Cheques	1 2 9
		Balance at Credit, carried to Abstract	20 11 0
	£24 6 6		£24 6 6

EXCURSION ACCOUNT.

INCOME.		EXPENDITURE.	
Balance at credit of last Account	£1 4 11	Printing	£0 11 6
Savings Bank Interest	0 0 8	Hiring at Monymusk	2 9 0
Cash from 31 Members for Monymusk Excursion at 4s. each	6 4 0	Carlton Restaurant, etc.	3 3 0
Cash for 2 Lunch Tickets at 1s. 6d.	0 3 0	Postages and Telegrams	0 3 1
		Balance at credit, carried to Abstract	1 6 0
	£7 12 7		£7 12 7

ABSTRACT.

Balance at credit of General Account,	£20 11 0
Balance at credit of Excursion Account,	1 6 0
	£21 17 0

ABERDEEN, 17*th January* 1911.—I have examined the foregoing Statement of Accounts for Year 1910 of the Aberdeen Branch of the Royal Scottish Arboricultural Society, and have found the same correctly stated and fully vouched. The balance at the credit of the Society, at the end of the year, amounting to Twenty-one pounds seventeen shillings sterling, is deposited in the Aberdeen Savings Bank.

J. G. HOPKINSON, *Auditor.*

APPENDIX G.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY (NORTHERN BRANCH).

REPORT 1910.

The Committee have the honour to submit the Report on the work of the Branch for the third complete year of its existence.

For various reasons it was not found possible to arrange for more than one excursion during 1910. That took the form of an interesting visit to Mr Edward Wiseman's Nurseries in Elgin, which was attended by a fair representation of the Society.

The Committee regret to record that the interest shown by forest owners in the collection formed by the Trustees of the Inverness Museum is not as great as they would like it to be, but they hope that the elements of unrest which were evident during the year will, by their disappearance, enable Members to devote more attention to the work of the Society, and result in an increased interest in this department of the Branch's work.

The Roll of Members at the end of the year was 94, four Members having died, resigned, or discontinued their membership since the formation of the Branch.

The income of the Branch to the date of the return is £5, 15s.

From the Statement of Accounts appended to this report, it will be seen that there is a sum of £15, 11s. 2d. at the credit of the Branch, which sum is lying in bank in name of the Treasurer.

On behalf of the Committee of the Northern Branch of the Society.

ALEX. FRASER,
Honorary Secretary and Treasurer.

APPENDIX H.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY—NORTHERN BRANCH.

Abstract of Receipts and Expenditure for Year ending 31st December 1910.

RECEIPTS.

Balance from last Account	£12	17	5½
Members' Subscriptions to Branch during year	1	0	0
Contribution from Parent Society	5	0	0
Bank Interest for year	0	4	7
	£19	2	0½

EXPENDITURE.

Postages and incidents for years 1909 and 1910	£1	11	6		
National Telephone Company for calls, Elgin	0	2	6		
Paid Commission on Cheque	0	0	6		
				£1	14	6
Balance at credit of the Branch at 31st Dec. 1910				17	7	6½
Made up thus—						
Sum in Treasurer's hands	£1	16	4½			
Sum in Bank,	15	11	2			
				£19	2	0½

APPENDIX I.

Office-Bearers for 1911:—

PATRON.

His Majesty The King.

PRESIDENT.

Sir John Stirling-Maxwell, Bart. of Pollok, Pollokshaws.

VICE-PRESIDENTS.

W. H. Massie, Nurseryman, 1 Waterloo Place, Edinburgh.
Sir Kenneth J. Mackenzie, Bart. of Gairloch, 10 Moray Place, Edinburgh.
W. Steuart Fothringham of Murthly, Perthshire.
Robert Forbes, Overseer, Kennet Estate Office, Alloa.
A. W. Borthwick, D.Sc., Royal Botanic Garden, Edinburgh.
Sydney J. Gammell of Drumtochty, Countesswells House, Bieldside, Aberdeen.

COUNCIL.

Chas. Buchanan, Overseer, Penicuik Estate, Penicuik.
A. T. Gillanders, F.E.S., Forester, Park Cottage, Alnwick.
John D. Crozier, Forester, Durris Estate, Drumoak, Aberdeenshire.
James Whitton, Superintendent of City Parks, City Chambers, Glasgow.
William Davidson, Forester, Panmure, Carnoustie.
W. S. Haldane, of Foswell, 55 Melville Street, Edinburgh.
The Lord Lovat, D.S.O., Beaufort Castle, Beauly.
G. U. Macdonald, Overseer, Haystoun Estate, Woodbine Cottage, Peebles.
Robert Allan, Factor, Polkemmet, Whitburn.
Adam Spiers, Timber Merchant, Warriston Saw-Mills, Edinburgh.
James Cook, Land Steward, Arniston, Gorebridge.
Alexander Mitchell, Forester, Rosebery, Gorebridge.
Sir Andrew Agnew, Bart., Lochnaw Castle, Stranraer.
Frank Scott, Forester, Scone.
Geo. Leven, Forester, Bowmont Forest, Roxburgh.
John Broom, Wood Merchant, Bathgate.
John F. Annand, Lecturer on Forestry, Armstrong College, Newcastle-upon-Tyne.
John W. M'Hattie, Superintendent of City Parks, City Chambers, Edinburgh.
Brodie of Brodie, Brodie Castle, Forres.
William Dawson, M.A., B.Sc., Lecturer on Forestry, Marischal College, Aberdeen.
John Methven, Nurseryman, 15 Princes Street, Edinburgh.

HON. EDITOR.

Lieut-Colonel F. Bailey, F.R.S.E., 7 Drummond Place, Edinburgh.

AUDITOR.

John T. Watson, 16 St Andrew Square, Edinburgh.

HON. SECRETARY.

The Right Hon. R. C. Munro Ferguson, M.P., Raith House, Kirkcaldy.

SECRETARY AND TREASURER.

Robert Galloway, S.S.C., 19 Castle Street, Edinburgh.

HONORARY CONSULTING OFFICIALS.

Botanist—Professor Bayley Balfour, Royal Botanic Garden, Edinburgh. *Chemist*—Dr Alexander Lauder, 13 George Square, Edinburgh. *Cryptogamist*—Dr A. W. Borthwick, Royal Botanic Garden, Edinburgh. *Entomologist* — Prof. Stewart MacDougall, 9 Dryden Place, Edinburgh. *Geologist*—R. Campbell, M.A., B.Sc., Geological Laboratory, University of Edinburgh. *Meteorologist*—Andrew Watt, M.A., F.R.S.E., 122 George Street, Edinburgh.

TRUSTEES.

The Right Hon. R. C. Munro Ferguson, M.P., W. Steuart Fothringham of Murthly, and Sir John Stirling-Maxwell, Bart. of Pollok.

LOCAL BRANCHES.

Aberdeen.	Northern.
President.—Sydney J. Gammell of Drumtochty.	*President.*—Brodie of Brodie.
Hon. Secretary.—George D. Massie, Solicitor, 147 Union Street, Aberdeen.	*Hon. Secretary.*—Alex. Fraser, Solicitor, 63 Church Street, Inverness.

CORRESPONDENTS.

The following have agreed to act as Correspondents residing abroad:—

Canada, . Robert Bell, I.S.O., M.D., LL.D., D.Sc.(Cantab.), F.R.S. of Ottawa. Chief Geologist to Government of Canada, Ottawa.

India, . . F. L. C. Cowley Brown, Deputy Conservator of Forests, c/o Inspector-General of Forests, Simla.

British East Africa, . } Edward Battiscombe, Assistant Conservator of Forests, Nigeri, *via* Naivasha, East Africa Protectorate.

United States of America, } Hugh P. Baker, Forester, State College, Pennsylvania.

Cape Colony, . W. Nimmo Brown, M'Kenzie's Farm, Mowbray, P.O.

Western Australia, Fred Moon.

PHOTOGRAPHIC ARTIST.

A. D. Richardson, 6 Dalkeith Street, Joppa.

LOCAL SECRETARIES.

Scotland.

Counties.	
Aberdeen,	JOHN CLARK, Forester, Haddo House, Aberdeen.
	JOHN MICHIE, M.V.O., Factor, Balmoral, Ballater.
Argyll,	JOHN D. SUTHERLAND, Estate Agent, Oban.
Ayr,	ANDREW D. PAGE, Overseer, Culzean Home Farm, Ayr.
	A. B. ROBERTSON, Forester, The Dean, Kilmarnock.
Berwick,	WM. MILNE, Foulden Newton, Berwick-on-Tweed.
Bute,	WM. INGLIS, Forester, Cladoch, Brodick.
	JAMES KAY, retired Forester, Barone, Rothesay.
Clackmannan,	ROBERT FORBES, Estate Office, Kennet, Alloa.
Dumfries,	D. CRABBE, Forester, Byreburnfoot, Canonbie.
East Lothian,	W. S. CURR, Factor, Ninewar, Prestonkirk.
Fife,	WM. GILCHRIST, Forester, Nursery Cottage, Mount Melville, St Andrews.
	EDMUND SANG, Nurseryman, Kirkcaldy.
Forfar,	JAMES CRABBE, retired Forester, Glamis.
Inverness,	JAMES A. GOSSIP, Nurseryman, Inverness.
Kincardine,	JOHN HART, Estates Office, Cowie, Stonehaven.
Kinross,	JAMES TERRIS, Factor, Dullomuir, Blairadam.
Lanark,	JOHN DAVIDSON, Forester, Dalzell, Motherwell.
	JAMES WHITTON, Superintendent of Parks, City Chambers, Glasgow
Moray,	D. SCOTT, Forester, Darnaway Castle, Forres.
Perth,	JOHN SCRIMGEOUR, Doune Lodge, Doune.
Renfrew,	S. MACBEAN, Overseer, Erskine, Glasgow.
Ross,	JOHN J. R. MEIKLEJOHN, Factor, Novar, Evanton.
	Miss AMY FRANCES YULE, Tarradale House, Muir of Ord.
Roxburgh,	JOHN LEISHMAN, Manager, Cavers Estate, Hawick.
	R. V. MATHER, Nurseryman, Kelso.
Sutherland,	DONALD ROBERTSON, Forester, Dunrobin, Golspie.
Wigtown,	JAMES HOGARTH, Forester, Culhorn, Stranraer.
	H. H. WALKER, Monreith Estate Office, Whauphill.

England.

Beds,	FRANCIS MITCHELL, Forester, Woburn.
Berks,	W. STORIE, Whitway House, Newbury.
Cheshire,	WM. A. FORSTER, Belgrave Lodge, Pulford, Wrexham.
Devon.	JAMES BARRIE, Forester, Stevenstone Estate, Torrington.
Durham,	JOHN F. ANNAND, Lecturer on Forestry, Armstrong College, Newcastle-upon-Tyne.
Hants,	W. R. BROWN, Forester, Park Cottage, Heckfield, Winchfield.
Herts,	JAMES BARTON, Forester, Hatfield.
	THOMAS SMITH, Overseer, Tring Park, Wigginton, Tring.
Kent,	R. W. COWPER, Gortanore, Sittingbourne.
Lancashire,	D. C. HAMILTON, Forester, Knowsley, Prescot.

England.

Counties.	
Leicester,	JAMES MARTIN, The Reservoir, Knipton, Grantham.
Lincoln,	W. B. HAVELOCK, The Nurseries, Brocklesby Park.
Middlesex,	Professor BOULGER, 11 Onslow Road, Richmond Hill, London, S.W.
Notts,	WM. ELDER, Thoresby, Ollerton, Newark.
	W. MICHIE, Forester, Welbeck, Worksop.
	WILSON TOMLINSON, Forester, Clumber Park, Worksop.
Suffolk,	GEORGE HANNAH, The Folly, Ampton Park, Bury St Edmunds.
Surrey,	JOHN ALEXANDER, 24 Lawn Crescent, Kew Gardens.
Warwick,	A. D. CHRISTIE, Hillside, Frederick Road, Selly Oak, Birmingham.
Wilts,	ANDREW BOA, Land Agent, Glenmore, The Avenue, Trowbridge.
York,	D. TAIT, Estate Bailiff, Owston Park, Doncaster.

Ireland.

Dublin,	A. C. FORBES, Department of Forestry, Board of Agriculture.
	JAMES WILSON, B.Sc., Royal College of Science, Dublin.
	ARCH. E. MOERAN, Lissadell, Stillorgan Park.
Galway,	THOMAS ROBERTSON, Forester and Bailiff, Woodlawn.
King's County,	WM. HENDERSON, Forester, Clonad Cottage, Tullamore.
Tipperary,	DAVID G. CROSS, Forester, Kylisk, Nenagh.
	ALEX. M'RAE, Forester, Dundrum.

APPENDIX J.

Presentations to the Society's Library since the publication of last List in Volume XXIII. Part 2.

Books.

1. *Trees and How to Know Them.* By Henry Irving.
2. *The Estate Manager.* By R. Henderson.
3. *Schlich's Manual of Forestry.* Vols. II. and III., 4th Ed., revised.
4. *The Country Gentleman's Estate Book,* 1910.
5. *The New Zealand Official Year Book,* 1909.

The following, presented by Mr A. D. Richardson:

6. *Brown's Forester,* 1847.
7. *Water Supply in South Africa.* By Dr. J. C. Brown.
8. *Management of Crown Forests at the Cape of Good Hope.* By Dr J. C. Brown.
9. *Forestry in Norway.* By Dr J. C. Brown.
10. *Forestry of the Ural Mountains.* By Dr J. C. Brown.
11. *Glances at the Forests of North Europe.* By Dr J. C. Brown.
12. *The Schools of Forestry in Europe.* By Dr J. C. Brown.
13. *Pine Plantations in France.* By Dr J. C. Brown.
14. *Forests and Moisture.* By Dr J. C. Brown.
15. *Catalogue of Hardy Trees and Shrubs at Syon House, Brentford.* By A. Bruce Jackson.
16. *Town Planting.* By A. D. Webster.
17. *The Development of British Forestry.* By A. C. Forbes.
18. *Album of Photographs taken in Bavaria,* 1909.
19. *Building Timbers.* By J. Davis.
20. *Forest Fires.* By A. Jacquot. 1910.
21. *Bulletin of Royal Botanic Gardens, Kew,* 1910.
22. *Victorian Year Book,* 1908-9.
23. *New Zealand Official Year Book,* 1910.

Government and State Reports.

24. *Report on the Forests and Forestry Problems in Sierra Leone,* 1909.
25. Indian Forest Pamphlets and Leaflets:—
    (1) *Tables showing the Progress in Working-Plans.* Compiled by A. M. F. Caccia.
    (2) *Pettwum or Tricomali Wood.* By R. S. Troup.
    (3) *Burma Padauk.* By R. S. Troup.
    (4) *The larger Deodar Bark Borer.* By E. P. Stebbing.
    (5) *The Blue Pine Bark Borer.* By E. P. Stebbing.
    (6) *Note on Best Season for Coppice Fellings of Teak* (*Tectona grandis*). By R. S. Hole.

26. *Report of the Department of Lands, New Zealand*, 1908, 1909, 1910.
27. *Report of the Survey Operations, New Zealand*, 1908, 1909, 1910.
28. *Report of State Nurseries and Plantations, New Zealand*, 1909-1910.
29. *Annual Report of the Forestry Department of Madras*, 1908-1909.
30. *Indian Forest Memoirs*, vol. ii., part 1. By R. S. Troup.
31. *Indian Forest Records*, vol. ii., parts 2 and 3. By R. S. Troup.
32. *Eighty-eighth Report of H.M. Commissioners of Woods, Forests, etc.*, 28th June 1910.
33. *Report on Cyprus Forestry*. By D. E. Hutchins. 1909.
34. *Report of the Pennsylvania Department of Forestry*, 1908-1909.
35. *Various Reports of Ohio State University.*
36. U.S. Department of Agriculture Bulletins :—
    (1) No. 79. *Life History of Lodgepole Burn Forests.* By F. E. Clements. 1910.
    (2) No. 80. *Commercial Hickories.* By Anton T. Boisen and J. A. Newlin. 1910.
    (3) No 83. *Forest Resources of the World.* By Raphael Zon. 1910.
    (4) Circular No. 170. *Engelmann Spruce in the Rocky Mountains.*
37. Pennsylvania State College Bulletin 106—*The Apple in Pennsylvania.*
38. *Canadian Forestry Association Annual Report*, 1910.
39. *First Report of Commission of Conservation, Canada*, 1910.
40. Canadian Department of the Interior Bulletins :—
    (1) *Forest Fires and Railway.* By R. H. Campbell.
    (2) *Forest Fires in Canada.* By H. R. Macmillan and G. A. Gutches.
41. *Report of Progress and Stream Measurements for* 1909.
42. *Experimental Farms, Ottawa*, 1910.
43. *Indian Forest Memoirs*, vol. 1., part 3.
44. *Indian Forest Bulletin*, Nos. 1 and 2.
45. *Report of the Chief Conservator of Forests, Cape of Good Hope.*
46. *Report of State Forest Administration, South Australia* (2).
47. *Bulletin of the Bureau of Agricultural Intelligence and Plant Diseases, Rome*, 1910.
48. *Bureau of the Economic and Social Intelligence*, Nos. 1 and 2, *Rome*, 1910.
49. *Report of the Department of Agriculture, Victoria*, 1910.

Societies' Reports and Transactions.

50. *Lloyd Library Bulletins.*
51. *Transactions of the Highland and Agricultural Society*, vol. xxii., with Indices, 1910.
52. *Report of the Smithsonian Institution*, 1908.
53. *The Journal of the Royal Agricultural Society of England*, vol. xxvii.
54. *Scientific Proceedings of the Royal Dublin Society*, Nos. 24 to 29 of vol. xii.
55. *Economic Proceedings of the Royal Dublin Society*, No. 1, vol. ii.

56. *The Canadian Journal of Forestry.*
57. *Journal of the Royal Horticultural Society*, part 3, vol. xxxv.
58. *Medcdeelingen van Ryks' Herbarium*, 1910.
59 *Foresters and Gardeners Society of Argyll*, vol. ii.
60. *Nova Scotian Institute of Science*, vol. xii., part 2.
61. *Perthshire Society of Natural Science*, vol. v., part 2.
62. *Botanical Society of Edinburgh*, vol. xxv.
63. *Royal Dublin Society*, 1910.
64. *Glasgow Naturalist*, vol. i., parts 1 to 4 (Nov. 1909, Feb. 1910 Sept. 1910, Nov. 1910).
65. *Scottish Horticultural Society*, 1909 and 1910.

Reprints and Miscellaneous.

66. *Condiment and Perfume producing Plants.*
67. *Crataegus in Pennsylvania* II. By C. S. Sargent.
68. *Report on the Chestnut Tree Blight on a part of the Forests of Pennsylvania*, 1909.
69. *Several Back Parts of the Society's Transactions.* From Colonel Bailey.
70. *Quarterly Journal of Forestry.* London.
71. *Forestry Quarterly.* New York.
72. *American Forestry.* Washington.
73. *Journal of the Board of Agriculture for Ireland.*
74. *Journal of the Board of Agriculture.* London.
75. *Skogsvårdsföreningens Tidsskrift.* Stockholm.
76. *Tidsskrift for Skogbrug.* Kristiania.
77. *Timber Trades Journal.* London.
78. *Journal da Commerce des Bois.* Paris.
79. *Timber News.* London.
80. *Estate Magazine.*
81. *Agricultural Economist.* London.
82. *Indian Forester.* Allahabad.
83. *L'Alpe.* Bologna, October 1908.
84. *Revue des Eaux et Forêts.* Paris. (By purchase.)
85. *Allgemeine Forst- und Jagd-Zeitung.* (,,)
86. *Zeitschrift für Forst- und Jagdwesen.* (,,)
87. *Bulletin de la Société Forestière de Franche Comté et Belfort.* (By purchase.)

Royal Scottish Arboricultural Society.

(INSTITUTED 16th FEBRUARY 1854.)

LIST OF MEMBERS, &c.

As at 6th July 1911.

PATRON.

HIS MOST EXCELLENT MAJESTY THE KING.

PRESIDENT.

Sir JOHN STIRLING-MAXWELL, Bart. of Pollok.

FORMER PRESIDENTS.

YEAR.	
1854–56.	JAMES BROWN, { Deputy-Surveyor of the Royal Forest of Dean. Wood Commissioner to the Earl of Seafield.
1857.	The Right Hon. THE EARL OF DUCIE.
1858.	The Right Hon. THE EARL OF STAIR.
1859.	Sir JOHN HALL, Bart. of Dunglass.
1860.	His Grace THE DUKE of ATHOLL.
1861.	JOHN I. CHALMERS of Aldbar.
1862.	The Right Hon. THE EARL OF AIRLIE.
1863.	The Right Hon. T. F. KENNEDY.
1864–71.	ROBERT HUTCHISON of Carlowrie, F.R.S.E.
1872–73.	HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie.
1874–75.	JOHN HUTTON BALFOUR, M.D., M.A., F.R.SS. L. & E., Professor of Botany in the University of Edinburgh.
1876–78.	The Right Hon. W. P. ADAM of Blairadam, M.P.
1879–81.	The Most Hon. THE MARQUESS OF LOTHIAN, K.T.
1882.	ALEXANDER DICKSON, M.D., F.R.S.E., of Hartree, Regius Professor of Botany in the University of Edinburgh.
1883–85.	HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie.
1886–87.	The Right Hon. Sir HERBERT EUSTACE MAXWELL, Bart. of Monreith.
1888–89.	The Right Hon. THE MARQUESS OF LINLITHGOW, Hopetoun House, South Queensferry.
1890–93.	ISAAC BAYLEY BALFOUR, M.D., Sc.D., F.R.S., Professor of Botany in the University of Edinburgh.
1894–97.	The Right Hon. R. C. MUNRO FERGUSON, M.P.
1898.	Colonel F. BAILEY, R.E.
1899–02.	The Right Hon. THE EARL OF MANSFIELD.
1903–06.	W. STEUART FOTHRINGHAM of Murthly.
1907–09.	Sir KENNETH J. MACKENZIE, Bart. of Gairloch.

HONORARY MEMBERS.

Date of Election.

1886. AVEBURY, The Right Hon. Baron, D.C.L., High Elms, Down, Kent.

1904. BAILEY, Colonel F., R.E., F.R.S.E., 7 Drummond Place, Edinburgh. (Also Life Member by Subscription, 1887.)

1907. CASTLETOWN, Right Hon. Lord, of Upper Ossory, K.P., C.M.G., Granston Manor, Abbeyleix, Ireland.

1901. GAMBLE, J. Sykes, C.I.E., F.R.S., M.A., ex-Director of the Indian Forest School, Highfield, East Liss, Hants. (Also Life Member by Subscription.)

1911. GILLANDERS, A. T., F.E.S., Forester, Park Cottage, Alnwick, Northumberland. (Elected Ordinary Member in 1897.)

1905. HENRY, Auguste Edmond, Professor of Natural Science, etc., National Forest School, Nancy, France.

1886. HOOKER, Sir Joseph D., O.M., M.D., K.C.S.I., The Camp, Sunningdale, Berks.

1886. JOHORE, The Sultan of, Johore, Malay Peninsula.

1904. KAY, James, Retired Wood Manager, Barone, Rothesay. (Elected Ordinary Member in 1867.)

1907. KUMÉ, Kinya, Chief of the Imperial Bureau of Forestry, Department of Agriculture and Commerce, Tokio, Japan.

1903. NILSON, Jägmästare Elis, Föreståndare för Kolleberga skogsskola Ljungbyhed, Sweden.

1889. SARGENT, Professor C. S., Director of the Arnold Arboretum, Harvard College, Brookline, Massachusetts, U.S.A.

1889. SCHLICH, Sir William, K.C.I.E., Professor of Forestry, Oxford University.

1895. SCHWAPPACH, Dr Adam, Professor of Forestry, Eberswalde, Prussia.

1907. SIMMONDS, Frederick, M.V.O., 16 Abingdon Court, Kensington West.

1904. SOMERVILLE, Dr William, M.A., D.Sc., D.Œc., F.R.S.E., Professor of Rural Economy, Oxford. (Also Life Member by Subscription, 1889.)

1886. TAKEI, Morimasa, 58 Mikumicho, Ushima, Tokio, Japan.

1904. THOMSON, John Grant, Retired Wood Manager, Mount Barker, Grantown-on-Spey. (Also Life Member by Subscription, 1855.)

HONORARY ASSOCIATE MEMBERS.

Date of Election.

1903. BATTISCOMBE, Edward, Deputy Conservator of Forests, Nairobe, British East Africa.

1901. BRUCE, William, College of Agriculture, 13 George Square, Edinburgh.

1901. CROMBIE, T. Alexander, Forester, Estate Office, Longhirst, Morpeth.

1902. GILBERT, W. Matthews, The *Scotsman* Office, Edinburgh.

1902. SMITH, Fred., Highfield Mount, Brook Street, Macclesfield.

1901. STORY, Fraser, Professor of Forestry, University of North Wales, Bangor.

1901. USHER, Thomas, Courthill, Hawick.

LIFE AND ORDINARY MEMBERS.

* *Indicates Life Member.* *Italics indicates that present Address is unknown.*

LAW V. Members in arrear shall not receive the *Transactions*. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.

Date of Election.

1895. ABBOT, Thomas, Forester, Neidpath Castle, Peebles.
*1906. ABERCROMBY, Sir George William, Forglen, Turriff.
1902. ACLAND, Sir Charles Thomas Dyke, Bart., M.A., D.L., etc., Killerton, Exeter.
*1900. ADAIR, David Rattray, S.S.C., 19 Castle Street, Edinburgh.
*1907. ADAIR, John Downie, Nurseryman, 75 Shandwick Place, Edinburgh,
*1883. ADAM, Sir Charles Elphinstone, Bart. of Blairadam, 5 New Square. Lincoln's Inn, London, W.C.
*1904. ADAMS, Joseph Wm. Atkin, Resident Agent, Mill Hill, Middlesex.
1906. ADAMSON, John, Head Forester, Bell's Yew Green, Frant, Sussex.
*1874. ADDINGTON, The Right Hon. Lord, Addington Manor, Winslow, Bucks.
*1904. AGNEW, Sir Andrew, Bart., Lochnaw Castle, Stranraer.
1903. AILSA, The Marquess of, Culzean Castle, Maybole.
1906. AINSLIE, John, Factor, Stobo, Peeblesshire.
1902. AINSLIE, Thomas, Glenesk, Penicuik.
1908. AIRD, William, Mechanical Engineer, Woodend, Muirkirk, Ayrshire.
1902. AITCHISON, William, Assistant Forester, Weirburn Cottage, Grant's House.
1907. AITKEN, James, Assistant Forester, Dean Road, Kilmarnock.
1907. ALDRIDGE, Arthur, Assistant Forester, Riseley Road, Swallowfield, near Reading, Berks.
1905. ALEXANDER, Henry, Head Forester, Grimstone Estate, Gilling East, York.
*1883. ALEXANDER, John, 24 Lawn Crescent, Kew Gardens, Surrey.
1908. ALEXANDER, John, Nurseryman, 8 Chamberlain Road, Edinburgh.
1905. ALLAN, James, Forester, Lyde Green, Rotherwick, Winchfield, Hants.
*1903. ALLAN, Robert, F.S.I., F.H.R.S., Factor, Halfway House, Polkemmet, Whitburn.
1909. ALLISON, Thomas, Solicitor and Factor, Fort William.
1910. AMOS, Frank, Surveyor and Auctioneer, The Parade, Canterbury.
1907. ANDERSON, James, 467 Cameron Avenue, Detroit, Mich., U.S.A.
1906. ANDERSON, Robert, Foreman Forester, Bowmont Forest, Roxburgh.
*1901. ANDERSON, Robert, Bailiff, Phœnix Park, Dublin.
1909. ANDERSON, Robert Lawson, Forester, Balgate, Kiltarlity, Beauly, N.B.
1887. ANNAND, John F., Lecturer on Forestry, Armstrong College, Newcastle-on-Tyne.
1903. ANSTRUTHER, Sir Ralph, Bart. of Balcaskie, Pittenweem.
1903. ARCHIBALD, John Clark, Head Forester, Eden Hall, Langwathby R.S.O., Cumberland.

Date of Election.

*1906. ARDWALL, The Hon. Lord, M.A., LL.D., 14 Moray Place, Edinburgh.
1898. ARMSTRONG, Thos. J. A., Factor, Glenborrodale, Salen, Fort William.
1904. ARNOTT, William, Foreman Forester, Invercolan Cottage, Stormontfield, Perth.
1910. ARTHUR, John Maurice, I.A., "Glentore," Airdrie.
*1883. ATHOLL, His Grace the Duke of, K.T., Blair Castle, Blair Atholl.
1860. AUSTIN & M'ASLAN, Nurserymen, 89 Mitchell Street, Glasgow.

*1887. BAILEY, Colonel F., R.E., F.R.S.E., 7 Drummond Place, Edinburgh.
1908. BAILLIE, Lieutenant-Colonel A. C., Factor, etc., Kirklands, Melrose.
*1906. BAIRD, Henry Robert, D.L., J.P., Durris House, Drumoak, Aberdeen.
*1896. BAIRD, J. G. A., of Adamton, 89 Eaton Square, London, S.W.
1903. BAIRD, William Arthur, of Erskine, Glasgow.
1908. BAKER, Guy S., Assistant Conservator of Forests, British East Africa.
*1908. BALCARRES, Lord, M.P., Balcarres, Fife; and 7 Audley Square, London, W.
*1909. BALDEN, John, Estate Agent, Bywell Office, Stocksfield-on-Tyne.
*1884. BALFOUR OF BURLEIGH, The Right Hon. Lord, K.T., Kennet House, Alloa.
*1900. BALFOUR, Charles B., of Newton Don, Kelso.
*1886. BALFOUR, Edward, of Balbirnie, Markinch, Fife.
1906. BALFOUR, Frederick Robert Stephen, J.P., Dawyck, Stobo, Peeblesshire.
*1877. BALFOUR, Isaac Bayley, LL.D., Sc.D., M.D., F.L.S., Professor of Botany, Royal Botanic Garden, Edinburgh.
1892. BALLINGALL, Niel, Sweet Bank, Markinch, Fife.
1909, BAPTIE, William, Assistant Forester, Larachbeg, Lochaline, Morvern.
*1904. BARBOUR, George Freeland, of Bonskeid, Pitlochry.
1897. BARCLAY, Robert Leatham, Banker, 54 Lombard Street, London, E.C.
1903. BARNES, Nicholas F., Head Gardener, Eaton Hall, Chester.
1909. BARR, D., Manager (Thos. Kennedy & Co.), Dumfries.
1907. BARR, John, Assistant Factor, Erskine, Bishopton.
*1895. BARRIE, James Alexander, Forester, Harlestone, Northampton.
*1866. BARRIE, James, Forester, Stevenstone, Torrington, North Devon.
1907. BARRON, Colin Campbell, Wood and Grain Merchant, Nairn Mills, Nairn.
*1877. BARRY, John W., of Fyling Hall, Fylingdales, Scarborough, Yorks.
1909. BARTON, Ebenezer Johnstone, Assistant Forester, Damshot, Pollok Estate, Pollokshaws.
1874. BARTON, James, Forester, Hatfield House, Herts.
1904. BARTON, James Robert, Factor, 3 Coates Crescent, Edinburgh.
*1908. BAXTER, Edward Gorrel, J.P., Teasses, Lower Largo, Fife.
1908. BAXTER, James, Gardener, Gorddinog, Llanfairfechan, Carnarvonshire.
1910. BAYLEY, James Francis, W.S., 4 Hill Street, Edinburgh.
*1903. BAZLEY, Gardner Sebastian, Hatherof Castle, Fairford, Gloucestershire.
1904. BEAUMONT, Robert, Assistant Forester, c/o Mr Brown, Colliers End, North Ware, Herts.
*1897. BEGG, James, Rosslyne, Culter, by Aberdeen.

Date of Election.

*1883. Bell, Andrew, Forester, Rothes, Elgin.
1898. Bell, David, Seed Merchant, Coburg Street, Leith.
1907. Bell, David, Assistant Forester, Pilsley, Bakewell, Derbyshire.
*1910. Bell, Sir James, Bart., of Montgreenan, Kilmarnock.
1908. Bell, John R., Assistant Forester, Colstoun, Haddington.
1900. Bell, Robert, Land Steward, Baronscourt, Newtown-Stewart, Ireland.
1900. Bell, William, Forester, Balthayock, Perth.
*1871. Bell, William, of Gribdae, 37 Melbourne Grove, Dulwich, London, S.E.
1905. Bennett, John, Forester and Acting Sub-Agent, Town's End, Wolverton, Basingstoke.
1903. Bentinck, Lord Henry, M.P., Underley Hall, Kirkby Lonsdale.
*1904. Berry, Charles Walter, B.A., 11 Atholl Crescent, Edinburgh.
1889. Berry, Francis, Forester, Minto, Hawick.
1911. Bethell, Slingsby Westbury, Blackford, Rothienorman.
1907. Beveridge, James, Forester, Normanby, Doncaster.
1903. Binning, The Lord, Mellerstain, Kelso.
1909. Biscoe, T. R., of Newton, Kingillie, Kirkhill R.S.O., Inverness-shire.
*1897. Black, Alexander, The Gardens, Carton, Maynooth, Co. Kildare.
*1908. Black, Florance William, of Kailzie, Peeblesshire.
1904. Black, John, Factor, Cortachy Castle, Kirriemuir.
1911. Black, William, Timber Merchant, 37 Clerk Street, Brechin.
1908. Blacklaws, John, Head Forester, Seafield Cottage, Portsoy.
1908. Blair, Charles, Glenfoot, Tillicoultry.
1910. Blair, Captain Hunter, R.N., of Blairquhan, Ayrshire.
1903. Blair, Thomas, Farmer, Hoprig Mains, Gladsmuir.
1872. Boa, Andrew, Estate Agent, Glenmore, The Avenue, Trowbridge.
*1877. Bolckow, C. F. H., of Brackenhoe, Kentisknowle, Torquay.
1892. Bond, Thomas, Forester, Lambton Park, Fence Houses, Durham.
*1895. Boord, W. Bertram, Land Agent, Bewerley, Pateley Bridge, Yorks.
1909. Booth, Miss Cary, 39 Mozartstrasse, Grosslichterfelde, Germany.
*1898. Borthwick, Albert W., D.Sc., Royal Botanic Garden, Edinburgh.
1898. Borthwick, Francis J. G., W.S., 9 Hill Street, Edinburgh.
*1908. Borthwick, Henry, Borthwick Castle, Gorebridge.
1887. Boulger, Professor, 11 Onslow Road, Richmond Hill, London, S.W.
1906. Bowman, John, Assistant Forester, Kincluny, Durris, Aberdeen.
1883. Boyd, John, Crown Forester's House, Ford, Argyll.
1897. Braid, J. B., Forester, Witley Court, Great Witley, Worcester.
*1902. Braid, William Wilson, 20 Esslemont Road, Craigmillar Park, Edinburgh.
1907. Breadalbane, Marchioness of, Black Mount, Bridge of Orchy, Argyllshire.
*1911. Brebner, Robert F., Factor, Strathallan Estate Office, Machany, Perthshire.
1909. *Brews, William, Assistant Forester, Midhope, Hopetoun, South Queensferry.*
1910. Broadford, David, Assistant Forester, Goldsboro', Knaresboro'.

Date of Election.

1907. Brodie, Ian, of Brodie, Brodie Castle, Forres.
*1900. Broom, John, Wood Merchant, Bathgate.
*1900. Brown, Charles, Factor, Kerse, Falkirk.
1910. Brown, Francis Loftus Cowley Cowley-, Deputy Conservator of Forests, India Forest Service, Salem, South India.
1904. Brown, George, Timber Merchant, Buckhaven Saw-mills, Buckhaven.
1900. Brown, Gilbert, Wood Manager, Grantown, Strathspey.
1878. Brown, J. A. Harvie-, of Quarter, Dunipace House, Larbert.
1899. Brown, John, Overseer, Glenapp Estate, Ballantrae.
*1896. Brown, Rev. W. Wallace, Minister of Alness, Ross-shire.
1895. *Brown, Walter R., Forester, Park Cottage, Heckfield, near Winchfield, Hants.*
1900. Brown, William, Forester, Lissadell, Sligo, Ireland.
1905. Bruce, Alexander, Timber Merchant, 68 Gordon Street, Glasgow.
1907. Bruce, Charles, Assistant Forester, Beaumanor Park, Woodhouse, Loughborough, Leicestershire.
1901. Bruce, David, Forester, Earnock Estate Office, Hillhouse, Hamilton.
1910. Bruce, David, M.A., LL.B., 141 West George Street, Glasgow.
*1895. Bruce, Peter, Manager, Achnacloich, Culnadalloch, by Connel.
*1867. Bruce, Thomas Rae, Old Garroch, New Galloway.
1909. Brunton, James S., Forester, Hursley Park, near Winchester, Hants.
1904. Brunton, John, Head Forester, Langley Park, Norwich.
1907. Bryden, Thomas, Nurseryman, Dennison Nurseries, Ayr.
1897. Brydon, John, Seed Merchant and Nurseryman, Darlington, Co. Durham.
*1879. Buccleuch, His Grace the Duke of, K.T., Dalkeith Palace, Dalkeith.
*1879. Buchanan, Charles, Overseer, Penicuik Estate, Penicuik.
1911. Buchanan, John Hamilton, of Leny, Callander.
1906. Burnett, Sir Thomas, Bart., Crathes Castle, Crathes, N.B.
1909. Burnley-Campbell, Colin N., Ormidale, Colintraive, Argyllshire.
1909. Burn-Murdoch, Alfred Maule, Conservator of Forests, Kuala Lumpur, Federated Malay States.
1910. Burton, Richard Charles Fryer, District Forest Officer, George Town, Cape Province.
1904. Butler, Robert, Forester, Estate Office, Blenheim Palace, Woodstock, Oxfordshire.
1906. Butler, Walter James, Assistant Forester, Hillend Cottage, Minto, Hawick.
*1910. Butter, Charles A. J., Cluniemore, Pitlochry.
*1909. Buxton, Walter L., of Bolwich, Marsham, Norwich.

*1909. Caccia, Anthony M., M.V.O., 108 Banbury Road, Oxford.
*1902. Cadell, Henry Moubray, of Grange and Banton, B.Sc., F.R.S.E., F.A.S., J.P., etc., Grange, Linlithgow.
*1908. Calder, James Charles, of Ledlanet, Milnathort.
1906. Calderhead, William, Overseer, Eredine, Port Sonachan, Argyllshire.
1901. Cameron, Alex., Land Steward, Balmina, Cookstown.
1910. Cameron, Angus, F.S.I., Factor, Benmore, Kilmun, by Greenock.
1908. Cameron, Colin M., Factor, Balmakyle, Munlochy.

Date of Election.

1907. CAMERON, Donald Walter, of Lochiel, Achnacarry, Spean Bridge.
1911. CAMERON, Duncan C., Assistant Forester, Damshot, Pollokshaws.
1902. CAMERON, Ewan, of Rutherford, West Linton.
1908. CAMERON, John, Forester, Isel Hall, Cockermouth, Cumberland.
*1899. CAMERON, John J., Norwood, Hamilton.
1904. CAMERON, Robert, Forester, Ardtornish, Morven, by Oban.
1909. CAMPBELL, Alexander, Assistant Forester, Dalzell Farm, Motherwell.
1895. CAMPBELL, Alexander, Land Steward, Rosemill Cottage, Strathmartin, by Dundee.
1899. CAMPBELL, Alexander, Tullymully, Dunkeld.
1904. CAMPBELL, David S., Forester, Wilton Castle, Redcar, Yorks.
1908. CAMPBELL, Donald, Assistant Forester, Homestall Cottage, Ashurstwood, Sussex.
*1897. CAMPBELL, James Arthur, Arduaine, Lochgilphead, Argyllshire.
1900. CAMPBELL, James S., Forester, Ginsboro Hall, Ginsboro, Yorks.
1906. CAMPBELL, John, Land Steward, Forss Estates, Westfield, Thurso.
1908. CAMPBELL, Patrick William, of Auchairne, W.S., 25 Moray Place, Edinburgh.
1901. CAMPBELL Peter Purdie, Factor, Lee and Carnwath Estates Office, Cartland, Lanark.
1908. CAMPBELL, Robert, B.Sc., Geological Laboratory, Edinburgh University.
909. CAMPION, Edward, Assistant Forester, Stockeld Park, Wetherby, Yorks.
1903. CANCH, Thomas Richard, B.Sc., P.A.S.I., 3 Greenbank Crescent, Morningside, Edinburgh.
1911. CANE, William, Assistant Forester, Brown's Lodge, Pembury, Tunbridge Wells.
*1903. CAPEL, James Carnegy Arbuthnott, of Ballnamon, 34 Roland Gardens, London, S.W.
*1896. CARMICHAEL, His Excellency Sir Thos. D. Gibson, Bart. of Skirling, Governor-General, Melbourne, Australia.
1910. CARMICHAEL, James Brown, Student in Forestry, Thoresby, Ollerton, Newark, Notts.
1908. CARMICHAEL, James Louis, younger of Arthurstone, Arthurstone, Meigle.
1906. CARNEGIE, James, of Stronvar, Balquhidder.
1907. CARNEGIE, Robert, Foreman Forester, Forester's Cottage, Grantully, Ballinluig.
1903. CARRUTHERS, Major Francis John, of Dormont, Lockerbie.
*1898. CARSON, David Simpson, C.A., 209 West George Street, Glasgow.
1907. CASSELLS, Andrew, Assistant Forester, Baudon, Balbirnie, Markinch, Fife.
1904. CATHCART, Sir Reginald Gordon, Bart., Cluny Castle, Aberdeenshire.
1911. CAVERHILL, W. R., Factor, The Glen, Innerleithen.
1904. CAVERS, A. R. S., Menzies Estate Office, Aberfeldy.
1909. CHADWICK, James Melville, Findhorn House, Forres.

Date of Election.

*1906. CHALCRAFT, George Barker, "Hillside," Gimingham, near North Walsham, Norfolk.
1911. CHALMERS, Frank, Solicitor, 13 Riselaw Road, Edinburgh.
1897. CHALMERS, James, Overseer, Gask, Auchterarder, Perthshire.
1898. CHALMERS, James, Overseer, Estate Office, Ballochmyle, Mauchline.
1904. CHALMERS, Robert W., Assistant Forester, Earlyvale Estate, Eddleston.
1892. CHAPMAN, Andrew, Factor, Dinwoodie Lodge, Lockerbie, Dumfriesshire.
1909. CHAPMAN, William, Foreman, Canonbie Sawmill, Canonbie.
1908. CHERMSIDE, Sir Herbert, Newstead Abbey, Nottingham.
1906. CHISHOLM, Alexander M'Kenzie, Clerk of Works, Dalkeith Park, Dalkeith.
1897. CHISHOLM, Colin, Forester, Lundin and Montrave Estates, Hattonlaw, Lundin Links.
1909. CHISHOLM, George, Forester, Wishaw House, Wishaw.
*1882. CHOWLER, Christopher, Gamekeeper, Dalkeith Park, Dalkeith.
1884. CHRISTIE, Alex. D., Hillside, Frederick Road, Selly Oak, Birmingham.
1906. CHRISTIE, Charles, Factor, Estate Office, Strathdon.
1910. CHRISTIE, James Sinton, Assistant Gardener, 50 Vicarage Road, Camberwell, London, S.E.
1908. CHRISTIE, Miss Isabella Robertson, of Cowden, Dollar.
1906. CHRISTIE, Thomas, Nurseryman, Rosefield Nurseries, Forres.
*1883. CHRISTIE, William, Nurseryman, Fochabers.
1890. CLARK, Charles, Forester, Cawdor Castle, Nairn.
1902. CLARK, Francis Ion, Estate Office, Haddo House, Aberdeen.
1910. CLARK, George, Assistant Forester, Keiloch, Invercauld, Ballater.
1910. CLARK, George, Assistant Forester, Forester's Bothy, Thirlmere, Grasmere.
1891. CLARK, John, Forester, Kelly, Methlick, Aberdeen.
1906. CLARK, John, Forester, Almond Dell, Old Clapperton Hall, Midcalder.
*1892. CLARK, William, 66 Queen Street, Edinburgh.
1902. CLARK, William, Assistant, Minto Estates Office, Hawick.
1911. CLARKSON, Alexander G., Assistant Forester, Lindertis, Kirriemuir.
*1872. CLERK, Sir George D., Bart. of Penicuik, Midlothian.
1910. CLINTON-BAKER, Henry Wm., J.P. for Herts, Bayfordbury, Hertford.
*1902. CLINTON, The Right Hon. Lord, Fettercairn House, Fettercairn.
1906. CLYNE, James, Engineer, Knappach, Banchory.
*1898. COATS, Sir Thomas Glen, Bart., Ferguslie Park, Paisley.
1904. COBB, Herbert Mansfield, Land Agent, Higham, Rochester, Kent.
1906. COCKER, Alexander Morrison, Nurseryman, Sunnypark Nursery, Aberdeen.
*1904. COKE, Hon. Richard, Weasenham, Swaffham.
1906. COLES, Walter G., Engineer, 122 George Street, Edinburgh.
1900. COLLIE, Alexander, Head Forester, Nettlebed, Henley-on-Thames.

Date of Election.

1907. Collier, James, Assistant Forester, Estate Yard, Woodlawn, Co. Galway.

*1879. *Colquhoun, Andrew, 75 Buchanan Street, Glasgow.*

1908. Colston, William G., Estate Clerk, Castlemilk Estates Office, Norwood, Lockerbie.

1908. Coltman, William Hew, J.P., B.A., Barrister, Blelack, Dinnet, Aberdeenshire.

1907. Comrie, Patrick, Land Agent, Waterside, Dalry, Ayrshire.

1905. Comrie, William Lewis, Factor, Cally Estates Office, Gatehouse.

1895. Connor, George A., Factor, Craigielaw, Longniddry.

*1837. Cook, James, Land Steward, Arniston, Gorebridge, Midlothian.

1906. Cook, Melville Anderson, Assistant Forester, Glamis, Forfarshire.

1904. Coupar, Charles, Assistant Forester, Rose Cottage, Achnacarry, Spean Bridge.

*1897. Coupar, Wm., Overseer, Balgowan, Perthshire.

1910. Coutts, James, Assistant Forester, Douglas Castle, Lanarkshire.

1908. Coutts, Wm., Forester, Gardener, and Ground Officer, Learney, Torphins, Aberdeen.

*1908. Cowan, Alexander, Valleyfield, Penicuik.

*1876. Cowan, Charles W., Dalhousie Castle, Bonnyrigg, Lasswade.

*1892. Cowan, George, 1 Gillsland Road, Edinburgh.

1908. Cowan, Henry Hargrave, Dalzell Estates Office, Motherwell.

*1899. Cowan, Robert, Chisholm Estates Office, Erchless, Strathglass.

*1901. Cowan, Robert Craig, Eskhill, Inveresk.

1910. Cowan, Robert, Head Forester, Hoddom Cross, Ecclefechan.

*1874. Cowper, R. W., Gortanore, Sittingbourne, Kent.

*1904. Cox, Albert E., of Dungarthill, Dunkeld.

*1904. Cox, William Henry, of Snaigow, Murthly.

1900. Crabbe, Alfred, Forester, Glamis.

1875. Crabbe, David, Forester, Byreburnfoot, Canonbie, Dumfriesshire.

1867. Crabbe, James, Glamis.

1904. Craig, Alexander, Assistant Forester, Glamis.

1910. Craig, Andrew, jun., Assistant Surveyor, Ryesholm, Dalry.

*1909. Craig, Sir Archibald Gibson, Bart. of Riccarton, Currie.

*1875. Craig, Wm., M.D., C.M., F.R.S.E., 71 Bruntsfield Place Edinburgh.

1903. Cranstoun, Charles Joseph Edmondstoune, of Corehouse, Lanark.

*1908. Craw, John Taylor, Factor and Farmer, Coldstream.

1899. Crerar, David, Land Steward, Methven Castle, Perth.

1911. Crichton, Edward James, Wood Merchant's Clerk, Silverbank Sawmills, Banchory.

1898. Crichton, William, Manager, Castle Ward, Downpatrick.

1903. Croll, John, of D. & W. Croll, Nurseryman, Dundee.

*1900. Crooks, James, Timber Merchant, Woodlands, Eccleston Park, Prescot.

*1865. Cross, David G., Forester, Kylisk, Nenagh, Ireland.

*1895. Crozier, John D., Forester, Durris, Drumoak, Aberdeen.

1910. Cruden, Lewis G., Forester, East Lodge, Brucklay, Aberdeenshire.

Date of Election.

1908. *Cruickshank, Adam, Forester, Fasque, Fettercairn.*

1907. CRUICKSHANK, James, Farmer and Hotelkeeper, Port Erroll, Aberdeenshire.

1900. CUMMING, John H., Overseer, Royal Dublin Society, Ball's Bridge, Dublin.

1906. CUMMING, William, Nursery Foreman, Burnside Nurseries, Aberdeen.

*1901. CUNNINGHAM, Captain John, Leithen Lodge, Innerleithen.

*1898. CUNNINGHAM, George, Advocate, 30 Queen's Gate Terrace, London, S.W.

1908. CUNNINGHAM, John Gilchrist, of Letham, 2 Gladstone Terrace, Burntisland.

1909. CUNNINGHAM, Robert, Forester, Glenlogan, by Mauchline, Ayrshire.

*1893. CURR, W. S., Factor, Ninewar, Prestonkirk.

1907. CUTHBERTSON, Evan James, W.S., 12 Church Hill, Edinburgh.

1907. DALE, Robert, Forester, The Nursery, Sorn Castle, Ayrshire.

*1867. DALGLEISH, John I., of Westgrange, Brankston Grange, Bogside Station, Alloa.

*1906. DALGLEISH, Sir William Ogilvie, Bart., Errol Park, Errol.

*1900. DALHOUSIE, The Right Hon. the Earl of, Brechin Castle, Forfarshire.

1908. DALKEITH, The Earl of, Eildon Hall, St Boswells.

*1910. DALLIMORE, William, Assistant, Royal Gardens, Kew, 36 Leyborne Park, Kew Gardens, Surrey.

1901. DALRYMPLE, Hon. Hew H., Lochinch, Castle Kennedy, Wigtownshire.

*1906. DALRYMPLE, Lord, M.P., Lochinch, Stranraer.

1904. DALRYMPLE, The Right Hon. Sir Charles, Bart. of Newhailes, Musselburgh.

1901. *Dalziel, Henry, Assistant Forester, Cormiston Towers, Biggar.*

*1911. DANIELL, Cyrus Leaf, of Earlyvale, Eddleston, N.B.

1905. DAVID, Albert E., Assistant Forester, Pilsley, Bakewell, Derbyshire.

1904. DAVIDSON, James, 12 South Charlotte Street, Edinburgh.

1892. DAVIDSON, John, Forester, Dalzell, Motherwell, Lanarkshire.

1908. DAVIDSON, Major Duncan Francis, Dess, Aberdeenshire.

*1892. DAVIDSON, William, Forester, Panmure, Carnoustie.

1901. DAVIE, George, Overseer, Balruddery Gardens, near Dundee.

1904. DAVIE, Thomas, Forester, Glenreardell, Whitehouse, Argyllshire.

1909. DAWSON, Fred, Assistant Forester, Brotto, Dale Head, Grasmere.

*1908. DAWSON, William, M.A., B.Sc.(Agr.), Lecturer on Forestry, Marischal College, Aberdeen.

1910. DEAS, James, Devon Cottage, Bonnyrigg.

1904. DENHOLM, John, Timber Merchant, Bo'ness.

1906. DENTON, Sydney, Assistant Forester, Harewood, Leeds.

1906. DEWAR, Alex., Factor, Fasque Estates Office, Fettercairn.

1902. DEWAR, H. R., Forester, Beaufort Castle, Beauly.

*1901. DEWAR, Sir John A., Bart., M.P., Perth.

1909. DICK, Colonel A. C. D., Pitkerro House, by Dundee.

1904. DICK, William, Timber Merchant, Hamilton.

*1898. DIGBY, The Right Hon. Baron, Minterne, Cerne, Dorsetshire.

Date of Election.

1904. *Dodds, Thomas, Cashier, Pollok Estate Office*, 216 *West George Street, Glasgow.*

*1903. Don, Alex., Namitomba Estate, Zomba, British Central Africa.

1893. Donaldson, James, Timber Merchant, Tayport, Fife.

1908. Doughty, James T. S., Solicitor and Factor, Ayton.

*1896. Douglas, Alex., Estate Bailiff's Office, Dean Road, Scarborough.

1882. Douglas, Captain Palmer, of Cavers, Hawick.

1904. Douglas, James A., Assistant Forester, Ardgowan, Inverkip.

1887. Douglas, Robert, 64 Princes Street, Edinburgh.

1903. Douglas, William G., Forester, Ingleborough Estate, Clapham, Yorks.

1911. Doull, Donald, M.A., A.R.C.Sc., High School, Kelso.

1903. Dow, Alexander, Forester, Bretby Park, Burton-on-Trent.

1898. Dow, Thomas, Forester, Wakefield Lawn, Stony Stratford, Bucks.

1909. Drummond, A. Hay, of Cromlix, Dunblane.

1900. Drummond, Dudley W., Commissioner, Cawdor Estate Office, Carmarthen, South Wales.

1904. Drummond, William, Head Forester, Fairburn Estate, Muir of Ord, Ross-shire.

1862. Drummond & Sons, William, Nurserymen, Stirling.

1909. Drysdale, Thomas, Land Steward, Estate Office, Auchinleck.

1908. Duchesne, M. C., Land Agent, Farnham Common, Slough, Bucks.

*1909. Duff, Alexander M., Land Steward and Farm Manager, Ninewells, Snaigow, Murthly.

1907. Duff, John Wharton Wharton, of Orton and Barmuchity, Morayshire.

1903. Duff, Mrs M. M. Wharton-, of Orton, Morayshire.

1907. Duff, Thomas Gordon, of Drummuir and Park, Banffshire.

1907. Duguid, Charles, Head Forester, Philorth, Fraserburgh.

1910. Dunbar, John Christie Flockhart, Factor, Crathes Castle, Crathes.

1910. Duncan, Robert, Head Forester, Dryfeholm Estate, Lockerbie.

1907. Dunglass, Lord, Springhill, Coldstream.

1905. Dunstan, M. I. R., Principal of South-Eastern Agricultural College, Wye, Kent.

*1902. Durham, Right Hon. the Earl of, K.G., Lambton Castle, Durham.

1873. Durward, Robert, Estate Manager, Blelack, Dinnet, Aberdeenshire.

1900. Duthie, James A., of Benjamin Reid & Co., Nurserymen, Aberdeen.

1898. Eadson, Thomas G., Forester, Whaley, Mansfield.

1911. Easson, Thomas S., W.S., 66 Queen Street, Edinburgh.

1885. Edington, Francis, Overseer, Monk Coniston Park, Lancashire.

1906. Edgar, James, Factor, Poltalloch Estate Office, Lochgilphead.

1904. Edmond, James, Assistant, Wemyss Castle Estate Office, East Wemyss, Fife.

1899. Edwards, Alex. W. B., Forester, Thirlmere Estate, *via* Grasmere.

1893. Elder, William, Forester, Thoresby, Ollerton, Newark, Notts.

Date of Election.

1903. ELGAR, Walter Robinson, Land Agent, Hill House, Sittingbourne.
1902. ELLICE, Captain Edward Charles, Invergarry.
1911. ELLIOT, George F. Scott, Secretary, Landowners' Co-operative Forestry Society, 122 George Street, Edinburgh.
*1899. ELLISON, Francis B., Bragleenbeg, Kilninver, Oban.
*1904. ELPHINSTONE, The Lord, Carberry Tower, Musselburgh.
1901. ELWES, Henry John, F.R.S., of Colesborne, Cheltenham.
1901. ERSKINE, Richard Brittain, Oaklands, Trinity, Edinburgh.
1898. EWAN, Peter, Forester, Wood Cottage, Newland Park, Chalfont St Giles, Bucks.
1873. EWING, David, Forester, Strichen House, Aberdeen.
1904. EWING, Guy, F.S.I., 80 Chancery Lane, London, W.C.
1906. FAICHNEY, John, Forester, Blythswood, Renfrew.
1906. FAIRBAIRN, John, Assistant Forester, Softlaw, Kelso.
1909. FALCONER, James, Farmer, Hill, Errol.
1910. FARQUHARSON, Major James, of Corrachree, Tarland, Aberdeenshire.
*1894. FARQUHARSON, James, Forester, Ardgowan, Inverkip.
1911. FARQUHARSON, Right Hon. Robert, M.D., Finzean, Aboyne.
1900. FEAKS, Matthew, Forester, Benmore, Kilmun.
1904. FENWICK, Andrew, Assistant Forester, Lime Walk Cottage, Rosehaugh, Avoch, Ross-shire.
1903. FENWICK, William, Factor, Darnaway Castle Estates Office, Earlsmill, Forres.
1908. FERGUSON, Donald, Joiner and Timber Merchant, Quarry Lane, Lennoxtown.
*1900. FERGUSON, James Alex., Ardnith, Partickhill, Glasgow.
1910. FERGUSON, John, Forester, Gregynog Lodge, Tregynon, Newtown, Montgomeryshire.
*1888. FERGUSON, The Right Hon. R. C. Munro, M.P., of Raith and Novar, Raith, Fife.
1880. FERGUSSON, Sir James Ranken, Bart., Spitalhaugh, West Linton.
1908. FERNIE, Alexander, Head Forester, Hopetoun, South Queensferry.
*1911. FERNIE, William Duncan, Forester, Balcarres, Fife.
*1907. FERRIE, Thomas Young, Timber Merchant, 69 Buchanan St., Glasgow.
*1901. FINDLAY, John Ritchie, of Aberlour, Aberlour House, Aberlour.
1893. FINLAYSON, Malcolm, Solicitor, Crieff, Perthshire.
1908. FINNIE, Alexander, Clerk of Works, Woodlands Cottage, Durris.
1907. FISH, Andrew, Forester, Boghead, Kirkmuirhill, Lanarkshire.
1909. FISHER, Malcolm, Assistant Forester, North Stables, Helbron Estate, Fairley.
1869. FISHER, William, Estate Agent, Wentworth Castle, Barnsley, Yorkshire.
*1902. FITZWILLIAM, Right Hon. the Earl of, Wentworth, Rotherham.
1910. FLEMING, Archibald, Overseer, Culcreuch, Fintry, Stirlingshire.
1899. FLEMING, Sir John, Timber Merchant, Albert Saw-mills, Aberdeen.
*1906. FLETCHER, J. Douglas, of Rosehaugh, Avoch, Ross-shire.
1909. FLETCHER, John Sydney, Under Forester, Thirlmere, Grasmere.
1910. FORBES, Alistair Hugh, Factor, The Foley, Rothesay.

Date of Election.

1890. FORBES, Arthur C., Department of Agriculture, Dublin.
1898. FORBES, James, Factor, Edlabus, Bridgend, Islay.
*1896. FORBES, James, The Gardens, Overtoun, Dumbartonshire.
*1878. FORBES, Robert, Estate Office, Kennet, Alloa.
*1873. FORBES, William, Estate Office, West Bilney Lodge, King's Lynn, Norfolk.
*1869. FORGAN, James, Forester, 5 Belhelvie Terrace, Perth.
1892. FORGAN, James, Sunnybraes, Largo, Fife.
1889. FORSTER, William A., Forester, Belgrave Lodge, Pulford, Wrexham.
1908. FORTESCUE, William Irvine, M.B.C.M., 7 Bon Accord Square, Aberdeen.
*1908. FORTUNE, George R., Factor, Colinsburgh, Fife.
*1897. FOTHRINGHAM, W. Steuart, of Murthly, Perthshire.
*1909. FOULIS, Arch. Keith, Factor's Assistant, Roselea, Orchard Street, Motherwell.
1908. FOWLER, Sir John Edward, Bart., Braemore, Garve.
*1866. FRANCE, Charles S., 13 Cairnfield Place, Aberdeen.
*1901. FRASER, Alexander, Solicitor and Factor, *Hon. Secretary and Treasurer, Northern Branch*, 63 Church Street, Inverness.
1908. FRASER, Charles James Roy, of Lochavich, Argyllshire.
1909. FRASER, George, Assistant Forester, Kingswood, Murthly.
*1892. FRASER, George, Factor, Dalzell, Motherwell, Lanarkshire.
*1902. FRASER, George M., 13 Drumsheugh Gardens, Edinburgh.
1898. FRASER, James, Assistant Forester, 10 Woodside Walk, Hamilton.
*1899. FRASER, James, Home Steward, Factor's Office, North Harris, Portree.
1911. FRASER, James, Student of Forestry, c/o Campbell, 12 Sylvan Place, Edinburgh.
1895. FRASER, J. C., Nurseryman, Comely Bank, Edinburgh.
1905. FRASER, John, Forester, The Little Hill, Leighton, Ironbridge R.S.O., Salop.
1901. FRASER, John M'Laren, of Invermay, Forgandenny, Perthshire.
1904. FRASER, Peter, Land Steward, Dalguise, Dunkeld.
1904. FRASER, Robert A., Cab Proprietor, 3 Sunbury Street, Edinburgh.
1907. FRASER, Robert S., Bunchrew House, Bunchrew, Inverness; Ivy House, Comshall, Surrey.
*1892. FRASER, Simon, Land Agent, Hutton in the Forest, Penrith.
*1907. FRASER, Sweton, Forester, Gallovie, Kingussie.
1908. FRASER-TYTLER, James Francis, of Woodhouselee, Rosslyn.
1896. FRATER, John, Foreman Forester, Ardross Mains, Alness, Ross-shire.
1902. FRATER, John, Head Forester, Ardross Castle, Alness, Ross-shire.
1907. FYFE, Harry Lessels, Assistant Forester, Elko, B.C., Canada.
1909. *Fyfe, William, Assistant Forester, North Lodge, Blair Drummond, Doune.*
1910. FYFFE, Robert, Botanical, Forestry, and Scientific Department, Entibbe, Uganda.

Date of Election.

1904. GALLOWAY, George, Quarrymaster, Roseangle, Wellbank, by Dundee.
*1893. GALLOWAY, Robert, S.S.C., *Secretary*, 19 Castle Street, Edinburgh.
*1909. GAMBLE, J. Sykes, C.I.E., etc., Highfield, East Liss, Hants (Hon. Member of the Society).
1896. GAMMELL, Sydney James, of Drumtochty, Countesswells House, Bieldside, Aberdeen.
1910. GARDINAR, James, Assistant Forester, Forester's Bothy, Thirlmere, Grasmere.
1909. *Gardiner, Francis Forsyth, Assistant Forester, Home Farm, Newmains, Douglas, Lanarkshire.*
1908. GARDINER, R., Assistant Forester, Inverliever Estate, Cruachan, Kilchrenan, Taynuilt.
1908. GARDYNE, Lieutenant-Colonel Greenhill, of Finavon, Forfar.
*1899. GARRIOCH, John E., Factor, Lovat Estates, Beauly.
*1907. GARSON, James, W.S., Albyn Place, Edinburgh.
*1903. GASCOIGNE, Lieut.-Col. Richard French, D.S.O., Craignish Castle, Ardfern, Argyllshire.
1898. GAULD, William, Forester, Coombe Abbey, Binley, Coventry.
1902. GAVIN, George, Factor, Falkland Estate, Falkland.
1897. GELLATLY, Thomas, Forester, Hallyburton, Coupar Angus.
1903. GIBSON, William, Forester, Carnell, Hurlford, Ayrshire.
1905. GILBERT, Alexander, Assistant Forester, Midhope Castle, Hopetoun, South Queensferry.
*1881. GILCHRIST, Wm., Forester, Nursery Cottage, Mount Melville, St Andrews.
1897. GILLANDERS, A. T., F.E.S., Forester, Park Cottage, Alnwick, Northumberland.
1894. GILLESPIE, James, Overseer, Garden, Arnprior, Port of Monteith.
1894. GILMOUR, Colonel Robert Gordon, of Craigmillar, The Inch, Midlothian.
1908. GLADSTONE, Hugh Steuart, F.Z.S., M.A., etc., Lannhall, Thornhill.
*1900. GLADSTONE, Sir John R., Bart. of Fasque, Laurencekirk.
1906. GLASS, James, Forester, Back Road Cottage, Larbert House, Larbert.
*1891. GLENCONNAR, Right Hon. Lord, 31 Lennox Gardens, London, S.W.
*1901. *Godman, Hubert, Land Agent, Ginsborough, Yorkshire.*
1909. GOODFELLOW, John, Forester, Faskally, Pitlochry.
1910. GORDON, G. P., B.Sc., Student of Forestry, Goldie Lea, Eskbank.
1907. GORMAN, Alfred W., Timber Merchant's Clerk, 14 Smith Street, Hillend, Glasgow.
*1868. GOSSIP, James A., of Howden & Co., The Nurseries, Inverness.
*1897. GOUGH, Reginald, Forester, Wykeham, York.
1909. GOW, Alexander, Home Farm, Hatfield Park, Hatfield, Herts.
1897. GOW, Peter Douglas, Farmer, Bonaly, Colinton, Midlothian.
1897. GOW, Peter, Land Steward, Laggan, Ballantrae, Ayrshire.
1905. GOW, Robert, Head Forester, Appin House, Argyllshire.
*1904 GRAHAM, Anthony George Maxtone, of Cultoquhey, Crieff.
1906. GRAHAM, David A., Teacher, 19 St Fillan's Terrace, Edinburgh.
1907. GRAHAM, Hugh Meldrum, Solicitor, Inverness.

Date of Election.

1908. GRAHAM, James, Marquis of, Brodick Castle, Arran (per Mr Douglas, Strabane, Brodick).
1910. GRAHAM, Robert Francis, M.A., of Skipness, Argyll.
*1884. GRAHAM, Wm., 6 Royal Crescent, W., Glasgow.
*1905. GRAHAM, William, Foreman Forester, St Ann's Cottage, Rae Hill, Lockerbie.
1909. GRAINGER, Henry Herbert Liddell, Ayton Castle, Ayton.
1887. GRANT, Alexander, Forester, Rinagaip, Dallas, by Forres.
*1911. GRANT, Captain Arthur, D.S.O., House of Monymusk, Aberdeen.
1867. GRANT, Donald, Forester, Drumin, Ballindalloch, Banffshire.
1908. GRANT, Donald, Forester, Fersit, Tulloch, Inverness-shire.
1904. GRANT, Ewan S., Head Forester, c/o Mrs Goater, Lower Tilgate, near Crawley, Sussex.
1908. GRANT, Iain Robert James Murray, of Glenmoriston, Inverness-shire.
1909. GRANT, James, Forester, Raith, Kirkcaldy.
1893. GRANT, John B., Forester, Drumin Cottage, Glenlivet.
*1874. GRANT, John, Overseer, Daldowie, Tollcross, Glasgow.
1907. GRANT, Robert, Fernleigh, Birchington, Kent.
1908. GRANT, Sir John Macpherson, Bart., Ballindalloch Castle, Ballindalloch.
1906. GRASSICK, William Henderson, Land Steward, Daviot Branch Asylum, Pitcaple, Aberdeenshire.
1906. GRAY, David, Wheelwright, 270 Great Western Road, Aberdeen.
1907. GRAY, George, Forester, The Lodge, Eliock, Sanquhar, Dumfriesshire.
*1908. GRAY, James Lowrie, Tenant Farmer, Elginhaugh, Dalkeith.
1909. GRAY, James Ritchie, Wheelwright, 270 Great Western Road, Aberdeen.
1902. GRAY, Walter Oliver, Forester, Pallinsburn, Cornhill, Northumberland.
1901. GRAY, Major William Anstruther-, of Kilmany, Cupar, Fife.
1908. GRAY, William, Forester, Lundie, Lochee.
1898. GREY, The Right Hon. Sir Edward, Bart., M.P., of Falloden, Chathill, Northumberland.
1908. GRIEVE, J. W. A., Indian Forest Service, The Club, Darjeeling, Bengal.
1903. GRIFFITHS, Sir Richard Waldie, of Hendersyde Park, Kelso.
*1905. GURNEY, Eustace, Sprowston Hall, Norwich.

1911. HACKING, Thomas, B.Sc., etc., Agricultural College, Uckfield, Sussex.
1879. HADDINGTON, The Right Hon. the Earl of, K.T., Tyninghame, Prestonkirk.
1910. HALDANE, David, Forester, Craighlaw Lodge, Kirkcowan, Wigtownshire.
*1900. HALDANE, William S., of Foswell, W.S., 55 Melville Street, Edinburgh.
1905. HALL, Thomas, Forester, Moore Abbey, Monasterevan, Co. Kildare.
1906. HALL, William, Head Forester, Church Cottages, Bilton, near York.
1904. HALLEY, John Y. (of Garvie & Syme), Ironmonger, etc., Perth.
*1897. HALLIDAY, Geo., Timber Merchant, Rothesay.

Date of Election.

*1901. HALLIDAY, John, Timber Merchant, Rothesay.
1911. HAMILTON, Alexander, Assistant Forester, Pilsley, Bakewell, Derbyshire.
1907. HAMILTON, Andrew, Naval Architect, 124 Shiel Road, Liverpool.
1908. HAMILTON, David R., Catcune Mills, Gorebridge.
*1882. HAMILTON, Donald C., Forester, Knowsley, Prescot.
1909. HAMILTON, John, C.A., 34 York Place, Edinburgh.
*1899. HAMILTON, The Right Hon. Baron, of Dalzell, Dalzell House, Motherwell.
1892. HANNAH, George, Overseer, Estate Office, Boynton, Bridlington.
1905. HANSON, Clarence Oldham, Deputy Conservator, Indian Forest Department, Latimer Lodge, Cinderford, Gloucestershire.
1907. HARBOTTLE, William, Assistant Forester, Woodhouse, Loughborough, Leicestershire.
*1903. HARDIE, David, Factor, Errol Park, Errol.
*1880. HARE, Colonel, Blairlogie, Stirling.
*1896. HARLEY, Andrew M., Forester, 5 Thayer Street, Manchester Square, London.
1908. HARLOND, Henry, Park Forester, Sutton Coldfield, Warwickshire.
1911. HARRIER, James B., Forester, Innes House, Elgin.
*1910. HARRISON, Alexander, Apprentice C.A., 3 Napier Road, Edinburgh.
1905. HARROW, R. L., Head Gardener, Royal Botanic Garden, Edinburgh.
1897. HART, John, Factor, Mains of Cowie, Stonehaven, Kincardineshire.
*1880. HAVELOCK, W. B., The Nurseries, Brocklesby Park, Lincolnshire.
1911. HAWES, A. F., A.B., M.F., Experimental Station, Burlington, Vermont, U.S.A.
1911. HAWLEY, Ralph Chipman, A.B., M.F., Assistant Professor of Forestry, Yale Forest School, 360 Prospect Street, New Haven, Conn., U.S.A.
*1908. HAY, Athole Stanhope, of Marlefield, Roxburgh.
1905. HAY, Henry Ferguson, Forester, Cholmondeley Estate Yard, near Malpas, Cheshire.
*1892. HAY, John, Overseer, Dollars Estate Office, 8 Rennie Street, Kilmarnock.
1904. HAY, Sir Duncan Edwyn, Bart. of Haystoun, 42 Egerton Gardens, London, S.W.
1905. HAY, William Black, Assistant Forester, Bondgate, Harewood, Leeds.
1896. HAY, Wm. P., Merchant, Rosebank, Loanhead, Midlothian.
1869. HAYMAN, John, Glentarff, Ringford, Kirkcudbrightshire.
1902. HAYNES, Edwin, Editor *Timber Trades Journal*, 164 Aldersgate Street, London.
1909. HECTOR, Thomas Gordon, Estate Clerk, Philorth Estate Office, Fraserburgh.
1907. HENDERSON, John, Assistant Forester, Gateside, Balbirnie, Markinch.
*1908. HENDERSON, John G. B., W.S., Nether Parkley, Linlithgow.
1908. HENDERSON, R., Assistant Forester, c/o Mrs Charlwood, Bury Creath, Banstead, Surrey.

Date of Election.

1893. Henderson, R., 4 High Street, Penicuik, Midlothian.
1893. Henderson, William, Forester, Clonad Cottage, Tullamore, King's County.
*1906. Hendrick, James, B.Sc., F.I.C., Marischal College, Aberdeen.
1898. Hendry, James, 5 Thistle Street, Edinburgh.
1910. Henkel, John Spurgeon, Assistant Conservator of Forests, Midland Conservancy, Knysna, Cape Colony.
1908. Henry, Augustine, M.A., etc., Reader in Forestry, 23 Chesterton Road, Cambridge.
1911. Henry, George J., 66 Queen Street, Edinburgh.
*1901. Hepburn, Sir Archibald Buchan-, Bart. of Smeaton-Hepburn, Prestonkirk.
*1874. Herbert, H. A., of Muckross, Killarney, Co. Kerry, Ireland.
*1884. Heywood, Arthur, Glevering Hall, Wickham Market, Suffolk.
1904. Hill, George, Assistant Forester, Fothringham, Forfar.
*1904. Hill, J. Smith, The Agricultural College, Aspatria.
*1903. Hill, Robert Wylie, of Balthayock, Perthshire.
*1905. Hillier, Edwin L., F.R.H.S., Nurseryman and Landscape Gardener, Culross, Winchester.
*1902. Hincks, Ralph Tichborne, J.P., D.L., Foxley, Hereford.
1907. Hinds, John, Forester, Stockeld Park, Wetherby, Yorks.
1906. Hislop, Robert, Assistant Forester, 11 Bawdsey Street, Bawdsey Manor Estate, near Woodbridge, Suffolk.
1895. Hoare, Sir Henry Hugh Arthur, Bart. of Stourhead, Bath.
1909. Hobart-Hampden, A. G., Indian Forest Service, Ferns, Great Hampden, Great Missenden.
1909. Hodgson, Joseph, Assistant Forester, Fisher Place, Thirlmere, Grasmere.
*1908. Hog, Steuart Bayley, B.A., Newliston, Kirkliston.
1866. Hogarth, James, Forester, Culhorn, Stranraer, Wigtownshire.
1908. Hogg, Alexander, Assistant Forester, Nibbetstane, Durris, Drumoak.
*1905. Holms, John A., Formaken, Erskine, Renfrewshire.
1910. Holzapfel, John William, B.Sc. and N.D.A., Student in Forestry, Kenton Farm, Kijabe, British East Africa.
1909. Honeyman, John, Overseer, Kemback Estate, Cupar, Fife.
*1902. Hood, Thomas, jun., Land Agent, Ras-el-Khalig, Egypt.
*1908. Hope, Captain Thomas, of Bridge Castle, Westfield, Linlithgowshire.
*1871. Hope, H. W., of Luffness, Drem, Haddingtonshire.
1907. Hopkinson, James Garland, Factor, Drumtochty Estates Office, 11a Dee Street, Aberdeen.
*1876. Horsburgh, John, 21 Dick Place, Edinburgh.
1908. Houston, Samuel, 118 Allison Street, Crosshill, Glasgow.
*1911. Howard de Walden, Baron, The Dean, Kilmarnock.
1909. Howe, James, Assistant Forester, Midhope, Hopetoun, South Queensferry.
1902. Howe, John Arnold, Overseer, Home Farm, Mount Stuart, Rothesay.
1905. Hudson, W. F. A., M.A., Lecturer on Forestry, Agricultural College, Glasgow.

Date of Election.

1905. HUTTON, George Kerse, Assistant Forester, Castle Kennedy, Wigtownshire.

1906. HUTTON, James, Head Forester, Glendye, Banchory.

1905. IMRIE, Charles, Assistant Forester, Balgove, Rossie, Montrose.

1910. IMRIE, George James, Forest Officer Transvaal Forest Service, P.O. Box 44, Belfast, Transvaal.

1901. IMRIE, James, Forester, Aberpergrom Estate, Glen-neath, Glamorganshire.

*1884. *Inglis, Alex., Greenlaw Dean, Greenlaw, Berwickshire.*

*1908. INGLIS, Alexander Wood, of Glencorse, Loganbank, Milton Bridge.

*1904. INGLIS, David, National Bank House, Pathhead, Kirkcaldy.

1911. INGLIS, Frederick, Assistant Forester, Dalzell, Motherwell.

1910. INGLIS, Robert, Factor, Old Blair, Blair Atholl.

1909. INGLIS, Walter, Assistant Forester, Dalzell Farm, Motherwell.

1891. INGLIS, William, Forester, Brodick, Isle of Arran.

1904. INNES, Alexander Berowald, of Raemoir and Dunnottar, Raemoir House, Banchory.

1895. INNES, Alexander, Forester, Drummuir, Keith.

1911. INNES, Robert, Assistant Forester, Dean Road, Kilmarnock.

1909. IRONSIDE, William, Solicitor, Royal Bank Buildings, Oban.

*1906. IRVINE, Alexander Forbes, J.P., B.A.(Oxon.), Drum Castle, Aberdeen.

1901. IRVINE, John, Assistant Forester, Colesborne, Cheltenham, Gloucestershire.

1906. IRVING, James Rae Anderson, Foreman Forester, Langholm Estate, Canonbie, Dumfriesshire.

*1908. IZAT, Alexander, C.I.E., Mem. Inst. C.E., Balliliesk, Muckhart, Perthshire.

1907. JACK, David, Assistant Forester, Houston House, Houston, Johnstone.

*1906. JACKSON, George Erskine, B.A.(Oxon.), W.S., Kirkbuddo, Forfar.

1898. JAMIESON, James, Forester, Ynyslas, Llanarthney R.S.O., Carmarthenshire.

1896. JARDINE, Sir R. W. B., Bart. of Castlemilk, Lockerbie, Dumfriesshire.

1907. JERVOISE, Francis Henry Tristram, J.P., Herriard Park Basingstoke.

1904. JOANNIDES, Pericles, Willesden, Sporting Club Station, Ramleh, Egypt.

1909. JOHNSTON, David T., Gardener, Dalmeny House Gardens, Edinburgh.

1910. JOHNSTON, Frank James, Nurseryman and Forester, Claycroft, Dalbeattie.

1911. JOHNSTON, George, Assistant Forester, Dean Road, Kilmarnock.

*1901. JOHNSTON, James, F.S.I., Factor, Alloway Cottage, Ayr.

*1883. JOHNSTON, Robert, Forester, Bon Ryl Estate, Duns, Berwickshire.

1907. JOHNSTON, Robert, Forester, Dalkeith Park, Dalkeith.

1900. JOHNSTONE, William, Head Forester, Beil, Prestonkirk.

Date of Election.

*1907. JOHNSTONE, Richard, Forester, The Glen, Innerleithen.
1911. JOLY DE LOTBINIERE, Major H. G., R.E., Survey Department, Cairo, Egypt.
*1882. JONAS, Henry, Land Agent and Surveyor, 23 Pall Mall, London, S.W.
*1902. JONAS, Robert Collier, Land Surveyor, 23 Pall Mall, London.
1903. JONES, Ireton Arthur, of Kennick & Co., Delgany Nurseries, Co. Wicklow.
1888. JONES, James, Wood Merchant, Larbert, Stirlingshire.
1893. JONES, Thomas Bruce, Wood Merchant, Larbert.

*1907. KAY, James, Nursery Station, Indian Head, Sask, Canada.
1867. KAY, James, Retired Wood Manager, Barone, Rothesay.
1909. KAY, John, Assistant Gardener, Grangemuir Lodge, Prestwick.
1911. KEAY, Robert Burton, Estate Overseer, Findon Cottage, Conon Bridge.
1896. KEIR, David, Forester, Ladywell, Dunkeld.
1906. KEIR, James S., Estate Manager, Borrodale, Arisaig.
*1909. KEITH, Marshall John, Factor, Brucklay Estates Office, Aberdour House, Fraserburgh.
1910. KEMP, Tainsh, Saw Mill Manager, Lochend Road, Leith.
*1901. KENNEDY, Frederick D. C.-Shaw-, Dyroch, Maybole.
*1890. KENNEDY, James, Doonholm, Ayr.
1899. KENNEDY, Thomas, Assistant Forester, Lambton Park, Fence Houses, Durham.
1904. KENNEDY, Colonel Watson, Wiveton Hall, Cley, Norfolk.
*1892. KERR, John, Farmer, Barney Mains, Haddington.
*1908. KERR, J. Ernest, of Harviestoun, Harviestoun, Dollar.
1896. KETTLES, Robert, Assistant Forester, Craigend, Perth.
1910. KHAN, Allah Dád, District Forester, Fazilká, Ferozepur, Panjap, India.
1907. KIDD, John, Forester, Hackwood Park, W., Basingstoke.
1894. KIDD, Wm., Forester, Harewood, Leeds.
*1908. KIMMETT, John, Forester, The Lodge, Glenstriven, Toward, Argyllshire.
1900. KING, David, Nurseryman, Osborne Nurseries, Murrayfield.
1910. KING, William, Gardener, Airy Bank, Cousland, Dalkeith.
1910. KININMONTH, Robert, Assistant Forester, Raith, Kirkcaldy.
*1906. KINLOCH, Charles Y., of Gourdie, by Murthly.
*1903. KINNAIRD, The Hon. Douglas A., Master of Kinnaird, 10 St James Square, London.
1906. *Kinnear, Alexander T., Wood Manager and Forester, Jeaniebank House, Old Scone, Perth.*
1905. KINROSS, D. A., Farmer, Hillend, Clackmannan.
*1898. KINROSS, John, Architect, 2 Abercromby Place, Edinburgh.
1908. KIPPEN, John, Assistant Forester, Doune Lodge, Doune.
*1902. KIPPEN, William James, Advocate, B.A., LL.B., Westerton, Balloch, Dumbartonshire.
1910. KIRKPATRICK, James, Forester, Balhary, Meigle.
1898. KYLLACHY, The Hon. Lord, of Kyllachy, 6 Randolph Crescent, Edinburgh.

Date of Election.

1907. Laird, Charles, Forester, c/o Mrs Telford, Erskine, Bishopton.
1911. Laird, Eric P., of James Dickson & Sons, Nurserymen, 46 Hanover Street, Edinburgh.
*1896. Laird, Robert, Nurseryman, 17a South Frederick Street, Edinburgh.
1911. Laird, William Pringle, Nurseryman, 20 High Street, Dundee.
*1901. Lamb, Alexander, Overseer, Freeland, Forgandenny.
1910. Lamb, Everard Joseph, of Scotby House, Carlisle.
*1894. Lamington, The Hon. Lord, G.C.M.G., Lamington, Lanarkshire.
1899. Lamond, Alexander, Forester, Freeland, Forgandenny.
*1905. Lamont, Norman, M.P., of Knockdow, Toward, Argyllshire.
1911. Lange, Leopold Peter Harding, Superintendent of Plantations, c/o Conservator of Forests, Pretoria, Transvaal.
*1906. Langlands, James H., Cunmont House, by Dundee.
*1896. Lansdowne, The Most Hon. the Marquess of, K.G., 54 Berkeley Square, London, S.W.
1906. Lauder, Alexander, D.Sc., Edinburgh and East of Scotland College of Agriculture, 13 George Square, Edinburgh.
1901. Lauder, William, Steward, Summerhill House, Enfield, Co. Meath.
1911. Lauderdale, Earl of, Thirlestane Castle, Lauder.
1897. Lauriston, John, Assistant Forester, c/o Mrs James Blair, Wynd, Cumbernauld.
1906. Lawson, William, Assistant Factor, Cromartie Estates, Kildary, Ross-shire.
1902. Learmont, John, Nurseryman, Larchfield Nurseries, Dumfries.
*1911. Leather, Major Gerard F. T., Middleton Hall, Belford, Northumberland.
1904. Lees, D., of Pitscottie, Cupar, Fife.
1905. Lees, Ernest A. G., Factor, Durris Estate, by Aberdeen.
1909. Le Fann, Victor Charles, B.A., F.S.I., Estate Office, Bray, Co. Wicklow.
1909. Legat, Charles Edward, B.Sc.(Agric.), Chief of Forestry Division, Department of Agriculture, Transvaal, Pretoria.
1880. Leishman, John, Manager, Cavers Estate, Hawick, Roxburghshire.
1908. Leslie, Archibald Stewart, W.S., Factor to Colonel A. G. Leslie of Kininvie, etc., 33 Queen Street, Edinburgh.
1909. Leith, Lord, of Fyvie, Fyvie Castle, Aberdeenshire.
*1868. Leslie, Charles P., of Castle-Leslie, Glaslough, Ireland.
*1893. Leven, George, Forester, Bowmont Forest, Roxburgh.
*1881. Leyland, Christopher, Haggerston Castle, Beal, Northumberland.
1907. Lindsay, Hugh, Head Forester, Torwoodlee Estate, Galashiels.
*1909. Lindsay, John, Under Forester, Station Lodge, Brodie.
1879. Lindsay, Robert, Kaimes Lodge, Murrayfield, Midlothian.
1907. Lindsay, William, of Messrs J. & H. Lindsay, Ltd., Tourist Agents, 18 St Andrew Street, Edinburgh.
1909. Little, Thomas, Assistant Forester, Burnside Cottage, Canonbie.
1905. Logan, David, Factor, Saltoun, Pencaitland.
*1908. Logan, Douglas Campbell, Assistant Factor, Porthane, Kenmore, Aberfeldy.

Date of Election.

1908. Logue, Hugh, Forester, Knockdow, Toward, Argyllshire.
*1883. Loney, Peter, Estate Agent, 6 Carlton Street, Edinburgh.
1909. Longmuir, James, Assistant Forester, Monreith, Port-William.
1911. Longmuir, James, jun., Assistant Forester, Rose Cottage, Achnacarry, Spean Bridge.
1907. Loutit, Rev. John Smeaton, Minister of Foveran, Manse of Foveran, Aberdeen.
*1898. Lovat, The Right Hon. Lord, C.B., D.S.O., Beaufort Castle, Beauly, Inverness.
*1880. *Love, J. W., c/o Mrs Boyce, Byron Street, St Kilda, Victoria, South Australia.*
*1875. Lovelace, The Right Hon. the Earl of, East Horsley Towers, Woking, Surrey.
1909. Low, David, Assistant Forester, Bowmont Forest, Roxburgh.
1898. Low, James, Forester, Ballindalloch, Strathspey.
*1900. Low, William, B.Sc., of Balmakewan, Marykirk, Kincardineshire.
1908. Lowden, Thomas, Assistant Forester, Canmore, Alberta, Canada.
1910. Lowe, Alex., Forester, Lockerbie House, Lockerbie.
*1908. Lumsden, George James, Aithernie, Lundin Links, Fife.
*1891. Lumsden, Hugh Gordon, of Clova, Lumsden, Aberdeenshire.
1900. Lumsden, Robert, jun., 11 Morningside Terrace, Edinburgh.
1908. Lunn, George, Forester, Invercauld, Ballater.
*1875. Luttrell, George F., of Dunster Castle, Taunton, Somersetshire.
*1900. Lyell, Sir Leonard, Bart. of Kinnordy, Kirriemuir.
1910. Lyford-Pike, James, Forestry Student, 131 Warrender Park Road, Edinburgh.
*1909. Lyle, Alexander Park, of Glendelvine, Murthly.

*1907. M'Ainsh, Duncan, Wood Merchant, Crieff.
1908. M'Ainsh, R., Assistant Forester, Bowmont Forest, Roxburgh.
1906. Macalpine-Leny, Major R. L., of Dalswinton, Dumfriesshire.
1909. MacArthur, Alaster, Bank Agent, etc., Inveraray.
1909. M'Bain, John, M.A., Headmaster, High School for Girls, 35 Hamilton Place, Aberdeen.
1907. M'Bain, William, Forester, Estates Office, Drumnadrochit.
*1892. Macbean, Simon, Land Steward, Erskine, Bishopton.
1896. M'Beath, David, Forester, Brinscall, Chorley, Lancashire.
1908. M'Callum, Alexander, Assistant Forester, Dunira Cottages, Comrie, Perthshire.
1908. M'Callum, D., Assistant Forester, Innerbuist Cottage, Stormontfield, Perth.
1894. M'Callum, Edward, Overseer, Kerse Estate, Falkirk.
1898. M'Callum, James, Forester, Canford, Wimborne, Dorset.
*1901. M'Callum, Thomas W., Retired Ground Officer, Dailly, Ayrshire.
1904. M'Clellan, Frank C., Zanzibar Government Service, Pemba, *via* Zanzibar, East Africa.
*1870. M'Corquodale, D. A., Bank of Scotland, Carnoustie, Forfarshire.
1893. M'Coubrie, M. S., Land Steward, Tullamore, King's County, Ireland.

Date of Election.

1904. MACDONALD, Alexander, Factor, Meggernie, Aberfeldy.
1907. MACDONALD, Alexander, Farmer, Rhives, Delny.
1908. *M'Donald, Donald, Assistant Forester*, 166 *Darnley Street, Pollokshields, Glasgow.*
1901. MACDONALD, Mrs Eleanor E., The Manse, Swinton.
1893. MACDONALD, George U., Overseer, Haystoun Estate, Woodbine Cottage, Peebles.
1908. MACDONALD, The Hon. Godfrey Evan Hugh, Factor, Macdonald Estates Office, Portree.
*1900. MACDONALD, Harry L., of Dunach, Oban.
*1894. MACDONALD, James, Forester, Kinnaird Castle, Brechin.
1897. M'DONALD, James N. B., Forest Nursery Station, Indian Head, Sask, Canada.
*1903. MACDONALD, James Farquharson, S.S.C. and N.P., Kilmuir, Linlithgow.
1895. MACDONALD, John, Forester, Skibo, Dornoch.
1908. M'DONALD, John, Foreman Forester, Culzean Estate, Maybole.
1908. MACDONALD, John Ronald M., of Largie, M.A., D.L., J.P., Largie Castle, Tayinloan, Kintyre.
1910. MACDONALD, John, Assistant Forester, Rose Cottage, Achnacarry, Spean Bridge.
1907. MACDONALD, T. Martin, of Barguillean, Taynuilt.
1906. MACDONALD, William Kid, Windmill House, Arbroath.
1904. M'DONALD, William Yeats, of Auquharney, Hatton, Aberdeenshire.
1894. M'DOUGALL, Alex., Forester, Tuncombe Park, Helmsley R.S.O., Yorks.
1907. MACDOUGALL, James, Assistant Forester, 20 Victoria Street, Perth.
*1895. MACDOUGALL, Professor Robert Stewart, M.A., D.Sc., 9 Dryden Place, Edinburgh.
*1884. MACDUFF, Alex., of Bonhard, Perth.
1906. M'EWAN, James, Assistant Forester, Glamis.
1909. M'EWAN, John, Assistant Forester, c/o Dow, 170 Darnley Street, Pollokshields, Glasgow.
1908. M'EWAN, W., Assistant Forester, Drummond Cottage, Logiealmond, by Perth.
1909. MACEWAN, William, Assistant Forester, Garscube Estate, by Glasgow.
1904. M'EWAN, Wm., Forester, Allangrange, Munlochy, Ross-shire.
1901. M'EWEN, Alexander, Overseer, Castle Lachlan, Stralachlan, Greenock.
1898. MACFADYEN, Donald, Assistant Forester, Drumlanrig, Thornhill.
1907. MACFARLANE, Archibald, Timber Merchant, Harbour Saw-mills, Paisley.
1909. M'FARLANE, Peter Graham, Assistant Forester, East End, Gartmore.
1910. MACFARQUHAR, Donald, Forester, Port Glas, Kenmore, Aberfeldy.
*1904. MACFIE, John William, of Dreghorn, Rowton Hall, Chester.
*1901. M'GARVA, Gilbert Ramsay, Factor, Estate Office, Innes, Elgin.
1901. M'GHIE, John, Overseer, Kelburne Estate, Fairlie.
*1901. M'GIBBON, Donald, Forester, Rossie Estate, Inchture.

Date of Election.

1904. M'Gibbon, R., Forester, Wentworth, Rotherham.
1908. M'Glashan, James, Forester, Belladrum, by Beauly.
*1902 MacGregor, Alasdair Ronald, Edinchip, Lochearnhead.
1902. M'Gregor, Alexander, Forester, Abbeyleix, Queen's Co.
*1908. MacGregor, Alexander, Iron Merchant, Ravenswood, Dalmuir, Dumbartonshire.
1896. M'Gregor, Angus, Forester, Craigton, Butterstone, Dunkeld.
1899. M'Gregor, Archibald, Forest Office, Forestry Department, Nairobi, B.E.A.
*1906. MacGregor, Evan Malcolm, Factor, Ard Choille, Perth.
1909. MacGregor, James, Head Forester, Broomhill, Airthrey Castle, Bridge of Allan.
1910. M'Gregor, John, Assistant Forester, Brucefield, Clackmannan.
1910. M'Gregor, John, Wood Merchant, Tam's Brig Sawmills, Ayr.
1905. M'Hardy, James, Forester, Forglen, Turiff, Aberdeenshire.
1904. M'Hardy, William, Forester, Chancefield, Falkland, Fife.
1901. M'Hattie, John W., City Gardener, City Chambers, Edinburgh.
1894. M'Ilwraith, Wm., Forester, Hall Barn Estate, Beaconsfield, Bucks.
1907. M'Innes, William, Assistant Forester, Advie, Strathspey.
1905. M'Intosh, Alexander, Foreman Forester, Townsend Street, Birr, King's Co., Ireland.
1911. M Intosh, Donald J., Assistant Forester, Lynedoch, Almondbank, Perth.
*1895. *Macintosh, D. L., The Gardens, Stronvar, Lochearnhead.*
*1879. M'Intosh, Dr W. C., Professor of Natural History, University of St Andrews, 2 Abbotsford Crescent, St Andrews.
1904. M'Intosh, Robert, Forester, Cullentragh Cottage, Rathdrum, Co. Wicklow.
*1885. MacIntosh, William, Fife Estates Office, Banff.
1901. Macintosh, William, Forester, New Chapel, Boncath R.S.O., South Wales.
1907. M'Intyre, Charles, Forester, Inver, Dunkeld.
1910. Macintyre, John Finlayson, Assistant Forester, The Gardens, Glencoe, Ballachulish (East).
1908. Macintyre, Peter Brown, Findon Mains, Conon Bridge.
1911. M'Intyre, Thomas Walker, Sorn Castle, Ayrshire.
1892. M'Kay, Allan, c/o Park & Co., Ltd., Timber Merchants, Fraserburgh.
1910. Mackay, James Waite, Forest Apprentice, 60 Park Street, Hull.
1865. Mackay, John, Lauderdale Estate Office, Wyndhead, Lauder.
1908. M'Kay, Murdo, Forester, Castlecomer, Co. Kilkenny.
1887. Mackay, Peter, Forester and Overseer, Bargany Mains, Dailly, Ayrshire.
1907. Mackay, William, Factor, Chisholm Estates, 19 Union Street, Inverness.
1900. M'Kechnie, Angus, Assistant Forester, Walkergate, Alnwick.
1891. Mackendrick, James, Forester, Estate Office, Pallas, Loughrea, Co. Galway.

Date of Election.

1908. MacKenzie, A., Assistant Forester, Innerbuist Cottage, Stormontfield, Perth.
1908. Mackenzie, Major A. F., of Ord, Ord House, Muir of Ord.
1867. Mackenzie, Alex., Warriston Nursery, Inverleith Row, Edinburgh.
1909. Mackenzie, Alex. James, Factor, 62 Academy Street, Inverness.
1907. Mackenzie, Sir Arthur, Bart. of Coul, Strathpeffer.
1901. Mackenzie, Charles, Factor, Clunes, Achnacarry, Spean Bridge.
1909. Mackenzie, Charles J. S., Assistant Forester, Caberfeidh, Carr Bridge.
1908. M'Kenzie, Colin, Assistant Forester, Potters Heron, Ampfield, nr. Ramsey, Hants.
1901. M'Kenzie, Daniel, Forester, Wynyard Estate, Stockton-on-Tees.
1904. Mackenzie, Major E. Walter Blunt, Castle Leod, Strathpeffer.
1908. Mackenzie, Evan North Barton, Kilcoy Castle, Killearnan.
1908. Mackenzie-Gillanders, Captain E. B., of Highfield, Muir of Ord.
*1893. Mackenzie, James, Forester, Cullen House, Cullen.
1899. M'Kenzie, James, Wood Merchant, Carr Bridge, Inverness-shire.
1897. Mackenzie, John, Forester, Holmhead, Daljarrock, Ayrshire.
1907. Mackenzie, John, jun., Factor, Dunvegan, Skye.
*1900. Mackenzie, Sir Kenneth John, Bart. of Gairloch, 10 Moray Place, Edinburgh.
1908. Mackenzie, Nigel Banks, Factor, Fort William.
1908. Mackenzie, Nigel Blair, Assistant Factor, Fort William.
1907. Mackenzie, Colonel Stewart, of Seaforth, Brahan Castle, Dingwall.
1911. Mackenzie, Thomas, Factor, Craigard, Invergarry.
1907. Mackenzie, W. Dalziel, of Farr, Inverness.
1896. Mackenzie, Wm., Forester, Novar, Evanton, Ross-shire.
1905. M'Kerchar, John, Commercial Traveller and Seedsman, 35 Giesbach Road, Upper Holloway, London, N.
*1897. *M'Kerrow, Robert, Manager, Carton, Maynooth, Co. Kildare.*
1907. MacKezzack, George Ross, of Ardgye, Elgin.
1909. M'Kie, Henry B., Factor, Freeland, Erskine, Bishopton.
*1898. MacKinnon, A., The Gardens, Scone Palace, Perth
1883. MacKinnon, George, The Gardens, Melville Castle, Lasswade.
1907. Mackinnon, Robert, Forester, Smithton, Culloden.
1878. Mackintosh, The, of Mackintosh, Moy Hall, Inverness.
*1905. Mackintosh, W. E., Yr. of Kyllachy, 28 Royal Circus, Edinburgh.
*1895. Maclachlan, John, of Maclachlan, Castle Lachlan, Argyll.
1904. Maclaggan, George C. R., Forester, Munday Cottages, Aberdalgie.
1908. M'Laren, James, Sub-Agent, Jervaulx Abbey, Middleham, Yorks.
*1879. M'Laren, John, 12 Findhorn Place, Edinburgh.
1909. MacLarty, Alexander Sinclair, Forester, Tullichewan Cottage, Alexandria.
*1898. Maclean, Archibald Douglas, J.P., Harmony, Balerno.
1908. M'Lean, Donald, Factor, Sutherland Estate Offices, Golspie.
1906. M'Lean, James Smith, Forester, Douglas Castle, Lanarkshire.
1902. Maclean, Peter, Forester, Invergarry.
1898. M'Lennan, John, The Gardens, Killaugh House, Rocky Valley, Bray.

Date of Election.

1909. MacLennan, Murdo, Assistant Forester, c/o Mrs Riddles, 12 Rodney Street, Edinburgh.
1901. M'Leod, Peter, Nurseryman, Perth.
1908. M'Millan, Duncan, Estate Overseer, Hafton S.O., Sandbank.
1895. Macmillan, John D., Steward, Margam Park, Port Talbot, Wales.
1910. M'Morran, Peter, Assistant Forester, Dalzell, Motherwell.
*1904. M'Nab, David Borrie, Solicitor, Clydesdale Bank, Bothwell.
1909. M'Nair, Gregor, Overseer, Conaglen, Ardgour.
1903. M'Naughton, George, Assistant Forester, Turleum Cottage, Drummond Castle, Crieff.
1903. M'Naughton, John, Forester, Auchterarder House, Perth.
1910. M'Pherson, Alexander, Tayness, Kilmartin, Lochgilphead.
1909. Macpherson, Duncan, Foreman Forester, Consall Hall, Stoke-on-Trent, Staffordshire.
1900. M'Rae, Alexander, Forester, Dundrum, Co. Tipperary.
*1899. Macrae-Gilstrap, Major John, of Ballimore, Otter Ferry, Argyllshire.
1900. M'Rae, Henry, Assistant Forester, Ufton, Southam, Rugby.
1908. M'Rae, John, Assistant Forester, Lintonill, Cullen, Banffshire.
1908. Macrae, Sir Colin G., W.S., 45 Moray Place, Edinburgh.
1906. Macrae, John, Forester, Highfield, Muir of Ord, Ross-shire.
1907. M'Raw, Donald, Manager, Strathgarve, Garve R.S.O.
*1879. MacRitchie, David, C.A., 4 Archibald Place, Edinburgh.
1895. M'Tavish, John, Assistant Forester, The Glen, Skelbo, Sutherland.
1905. M'Vinnie, Samuel, Forester, Skeagarvie, Rossmore Park, Monaghan.
*1905 Maitland, A. D. Steel, of Sauchie, etc., Sauchieburn, Stirling.
1908. Malcolm, George, Factor, Fernie House, Fort William.
*1880. Malcolm, Lieut.-Col. E. D., R.E., Achnamara, Lochgilphead.
1907. Malkin, Herbert C., J.P., 46 Phillimore Gardens, Kensington, W.
*1895. Mann, Charles, Merchant, Lumsden, Aberdeenshire.
*1909. Mann, James, of Castlecraig, Dolphinton.
*1898. Mansfield, The Right Hon. the Earl of, Scone Palace, Perth.
1896. Mar and Kellie, The Right Hon. the Earl of, Alloa House, Alloa.
*1895. Margerison, Samuel, English Timber Merchant, Calverley, near Leeds.
1909. Marsden, Reginald Edward, Indian Forest Service, 13 Leinster Gardens, London, W.
*1901. Marshall, Archd. M'Lean, Chitcombe, Breda, Sussex.
*1905. Marshall, Henry Brown, of Rachan, Broughton.
1899. Marshall, John, Timber Merchant, etc., Maybole.
1893. Marshall, J. Z., Timber Merchant, 2 Dean Terrace, Bo'ness.
1907. Marshall, William, Assistant Forester, Castle Grant, Grantown-on-Spey, Glenllivon Park, Carmarthen, N. Wales.
1910. Martin, Lieut-Col. Martin, Upper Ostaig, by Broadford, Isle of Skye.
*1876. Martin, James, Forester, Knipton, Grantham, Lincolnshire.
*1909. Massie, George Duncan, Solicitor (Hon. Secretary, Aberdeen Branch), 147 Union Street, Aberdeen.
*1884. Massie, W. H., of Dicksons & Co., 1 Waterloo Place, Edinburgh.

Date of Election.

1907. MASSON, William, Forester, Meikleour, Perth.
1910. MASTERTON, James, Hedger and Assistant Forester, Kennet Cottages, Alloa.
1893. MATHER, R. V., of Laing & Mather, Nurserymen, Kelso.
1901. MATTHEWS, Robert, Land Steward, Duncrub Park, Dunning.
1909. MAUDE, James, Timber Merchant, Hebden Bridge, Yorks.
*1894. MAUGHAN, John, Estate Agent, Jervaulx Abbey, Middleham R.S.O., Yorks.
1907. MAW, Percival Trentham, Holmsdale, Nutfield, Surrey.
1907. MAXTONE, James, Overseer, Strathallan, Machany, Perthshire.
1896. MAXTONE, John, Forester, Duff House, Banff.
*1904. MAXWELL, Aymer, Yr. of Monreith, Wigtownshire, Lieutenant, Grenadier Guards.
1891. MAXWELL, James, Forester and Overseer, Ruglen, Maybole.
*1893. MAXWELL, Sir John Stirling-, Bart. of Pollok, Pollokshaws.
1886. MAXWELL, The Right Hon. Sir Herbert E., Bart. of Monreith, Port William, Wigtownshire.
1908. MAXWELL, Wellwood, of Kirkennan, Dalbeattie.
1908. MAXWELL, William James, Factor, Terregles Banks, Dumfries.
1905. MAXWELL, William Jardine Herries, of Munches, Dalbeattie.
1907. MEACHER, Sydney George, Land Agent, Marlee, Blairgowrie.
1896. MEIKLEJOHN, John J. R., Factor, Novar, Evanton, Ross-shire.
1906. MELDRUM, Thomas C., Nurseryman, Forfar.
1899. MELVILLE, David, The Gardens, Dunrobin Castle, Golspie.
1911. MELVIN, David, Assistant Forester, Blair Drummond, Perthshire.
1901. MENZIES, James, Forester, Caledon Estate, Co. Tyrone.
*1908. MENZIES, William Dudgeon Graham, J.P., Hallyburton, Coupar-Angus.
*1880. MESHAM, Captain, Pontryffydd, Bodvari, Rhyl, Denbighshire.
1906. MESTON, William, Assistant Forester, Tower Cottage, Durris, Aberdeen.
1877. METHVEN, Henry, of Thomas Methven & Sons, 15 Princes Street, Edinburgh.
1869. METHVEN, John, of Thomas Methven & Sons, Leith Walk Nurseries, Edinburgh.
1892. METHVEN, John, Viewforth, Kennoway, Fife.
1911. MICHIE, Henry M., Assistant, Raith Estate Office, Kirkcaldy.
*1881. MICHIE, John, M.V.O., Factor, Balmoral, Ballater, Aberdeenshire.
1893. MICHIE, William, Forester, Welbeck, Worksop, Notts.
*1893. MIDDLEMASS, Archibald, Forester, Tulliallan, Kincardine-on-Forth.
1905. MIDDLETON, James, Factor, Braehead House, Kilmarnock.
1910. MIDDLETON, James, Assistant Forester, Blythswood, Renfrew.
*1905. MILLAR, John, Timber Merchant, Greenhaugh Saw-mills, Govan.
1908. MILLAR, John W., Manager, Eldin Chemical Co., Loanhead.
*1908. MILLER, Robert E., Bonnycraig, Peebles.
1910. MILLIGAN, Alexander, Assistant Forester, Cromartie Estates, Kildary, Ross-shire.
1910. MILLIGAN, J. A., Assistant Forester, Ivy House, Baslow, Derbyshire.

Date of Election.

1899. MILNE, Alexander, Factor, Urie Estate Office, Stonehaven.
1902. MILNE, Alexander, Forester, Charboro' Park, Wareham, Dorset.
1903. MILNE, Colonel George, of Logie, Aberdeenshire.
1904. MILNE, Frederick, Assistant Forester, Nursery Cottage, Tarbrax, by Forfar.
1908. MILNE, G., Assistant Forester, Innerbuist Cottage, Stormontfield, Perth.
1895. MILNE, James, Land Steward, Carstairs House, Carstairs.
1906. MILNE, John, Assistant Forester, West Cottage, Balfour, Durris, Drumoak.
1899. MILNE, Ritchie, Assistant, Annandale Estate Office, Hillside, Lockerbie.
*1898. MILNE, Robert P., Spittal Mains, Berwick-on-Tweed.
1890. MILNE, William, Farmer, Foulden, Berwick-on-Tweed.
1902. MILNE, William, Forester, Huntly Hill, Stracathro, Brechin.
1906. MILNE, William, Nurseryman (Wm. Fell & Co., Ltd.), Hexham.
1901. MILNE-HOME, David William, of Wedderburn, Caldra, Duns.
*1897. MILNE-HOME, J. Hepburn, Irvine House, Canonbie.
1894. MILSOM, Isaac, Gardener and Steward, Claydon Park, Winslow, Bucks.
*1909. MIRRIELEES, Frederick Donald, B.A. Oxon., of Pasture Wood, Dorking, Surrey.
1904. MITCHELL, Alexander, Forester, Rosebery, Gorebridge.
1898. MITCHELL, David, Forester, Drumtochty, Fordoun.
*1882. MITCHELL, Francis, Forester, Woburn, Beds.
1904. MITCHELL, James, Organising Secretary for Technical Education to Fife County Council, County Buildings, Cupar, Fife.
*1902. MITCHELL, John, jun., Timber Merchant, Leith Walk Saw-mills, Leith.
1904. MITCHELL, John Irvine, M.A., Teacher, 3 Craighouse Terrace, Edinburgh.
1901. MITCHELL, William Geddes, Estate Agent, Doneraile, Co. Cork.
1909. MITCHELL, William, Foreman Forester, Torresdale Castle, Carradale, Argyllshire.
1903. MOERAN, Archibald E., Land Agent, etc., Lissadell, Stillorgan Park, Co. Dublin.
1902. MOFFAT, John, Head Forester, Boiden, Arden, N.B.
1909. MOFFAT, William, Forester, Castle Wemyss, Wemyss Bay.
1909. MOFFATT, Thomas, Clyde View, Fairlie, Ayrshire.
*1908. MOISER, Cyril, P.A.S.I., Heworth Grange, York.
*1895. MONCREIFFE, Sir Robert D., Bart. of Moncreiffe, Perth.
*1906. MOON, John Laurence, Forest Ranger, Forestry Department, Nairobi, British East Africa.
1903. MORAY, The Right Hon. the Earl of, Darnaway Castle, Forres.
*1897. MORGAN, Alex., Timber Merchant, Crieff, Perthshire.
*1899. MORGAN, Andrew, Assistant Factor, Glamis.
*1895. MORGAN, Malcolm, Timber Merchant, Crieff, Perthshire.
1911. MORGAN, W. Dunlop, Forestry Student, 83 Brunswick Street, Edinburgh.

Date of Election.

1907. MORRISON, Andrew, Estate Manager, Brodie Mains, Forres.
1895. MORRISON, Hew, LL.D., Librarian, Edinburgh Public Library.
*1908. MORRISON, Hugh, Little Ridge, Tisbury, Wilts.
1908. MORRISON, John, Factor, House of Tongue, Sutherland.
1903. MORRISON, William, Manufacturer, 61 Grant Street, St George Road, Glasgow.
1905. MORTON, Andrew, Forester, Stockstruther, Roxburgh.
*1905. MOTHERWELL, A. B., Writer, Airdrie.
*1908. MOUBRAY, John J., Naemoor, Rumbling Bridge.
1907. MOULTRIE, James. Assistant Forester, Star, Balbirnie, Markinch.
1908. MOWAT, George, Forester, Carmichael, Thankerton, Lanarkshire.
1906. MOWAT, John, Overseer, Hazelhead Estate, Aberdeen.
1906. MUIR, William, Estate Clerk, Broomlands, Kelso.
1890. MUIRHEAD, George, F.R.S.E., Commissioner, Speybank, Fochabers.
1901. MULLIN, John, Forester, Eglinton Castle, Irvine.
1904. MUNRO, Alexander, Overseer, Invereshie, Kincraig.
1903. MUNRO, Alexander J., 48 Castle Street, Edinburgh.
1895. MUNRO, Donald, Forester, Holkham Hall, Norfolk.
1906. MUNRO, Donald, Wood Merchant, Ravenswood, Banchory.
1902. MUNRO, George A., S.S.C., 6 Rutland Square, Edinburgh.
1908. MUNRO, George, M.B.C.M., 51 Albany Street, Leith; and Kergord, Shetland.
1905. MUNRO, Sir Hector, Bart. of Foulis Castle, Evanton, Ross-shire.
1909. MUNRO, Hugh R., Assistant Forester, Dalzell Home Farm, Motherwell.
*1902. MUNRO, Hugh Thomas, Linderbis, Kirriemuir.
1910. MUNRO, James Watson, Student for B.Sc. in Agriculture and Forestry, Jeaniebank, Old Scone Road, Perth.
1907. MUNRO, John, Foreman Forester, Kingswood, Murthly.
1907. MUNRO, John, Land Steward and Forester, The Lodge, Tarland, Aberdeenshire.
1911. MUNRO, William, Assistant Forester, Brick House, Parkend, Lydney, Glos.
1909. MUNRO, William, Factor, Glenferness, Dunphail.
*1909. MURRAY, Major Alastair Bruce, of Polmaise, Stirling.
*1892. MURRAY, Alexander, Forester, Murthly, Perthshire.
1910. MURRAY, Arthur, Assistant Forester, Cruachan, Kilchrenan, Argyll.
1900. MURRAY, George J. B., Forester, Holylee, Walkerburn.
1904. MURRAY, John M., Assistant Forester, Kingswood, Murthly.
1900. MURRAY, William, of Murraythwaite, Ecclefechan, Dumfriesshire.
*1896. MURRAY, William Hugh, W.S., 48 Castle Street, Edinburgh.

*1899. NAIRN, Sir Michael B., Bart. of Rankeillour, Manufacturer, Kirkcaldy.
1904. NAIRN, Robert, Forester, Rowallan, Kilmarnock.
1907. NASH, William, Assistant Forester, Airdsmill, Muirkirk, Ayrshire.
*1905. NASMYTH, Norman, of Glenfarg, Glenfarg Lodge, Abernethy.
*1909. NAYLOR, John Murray, Laighton Hall, Welshpool.
1910. NEILSON, Walter Montgomerie, of Barcuple, Ringford.
*1909. NEISH, Edward William, Advocate, etc., Woodville, Greenock.

Date of Election.

1893. NELSON, Robert, Assistant Forester, Hannahgate Cottage, Kinmount Estate, Cummertrees, Dumfriesshire.
*1908. NELSON, Thomas Arthur, of Achnacloich, Connel, Argyllshire.
1910. NEWTON, James Whittet, Student for B.Sc. in Agriculture and Forestry, c/o Lindsay, 15 Spottiswoode Street, Edinburgh.
1893. NICOL, James, Forester, Aird's Mill, Muirkirk, Ayrshire.
1895. NICOL, James, Forester, Croxteth, Liverpool.
1906. NICOL, William, Forester, Cluny Castle, Ordhead, Aberdeenshire.
*1903. NICOL, William Edward, D.L., J.P., of Ballogie, Aboyne.
1909. NICOLL, William, Foreman Forester, Minto Estate, Hawick.
1901. NICOLL, William Peter, Assistant Forester, Kippo, Kingsbarns, Fife.
*1901. NICOLSON, Edward Badenach, Advocate, 12 Atholl Crescent, Edinburgh.
*1893. NISBET, J., D.Œc., Royal Societies' Club, 63 St James Street, London, S.W.
*1902. *Nisbet, Robert C., Farmer, Kingsknowe, Slateford.*
*1899. NOBBS, Eric Arthur, B.S., Ph.D., Department of Agriculture, Salisbury, Rhodesia.
1899. NOBLE, Charles, Forester, Donibristle, Aberdour.
1904. NOBLE, Hugh, Assistant Forester, Bunachton, Inverness.

*1909. OGILVIE, George Hamilton, Westlands, Broughty Ferry.
1911. OGILVIE, John, M.A., Solicitor, 13 Albert Square, Dundee.
1906. OGILVIE, Thomas, D.L., J.P., Kepplestone, Aberdeen.
1910. OGILVY, Mrs Mary Georgiana Constance N. Hamilton, of Biel, Prestonkirk.
1908. OGSTON, Alexander Milne, of Ardoe, near Aberdeen.
*1908. OGSTON, James, of Kildrummy, Kildrummy, Aberdeenshire.
1900. OLIPHANT, Joseph, Assistant Forester, Quarterbank, Abercairney, Crieff.
1909. OLIVER, Colonel William J., of Lochside, Kelso (18 Victoria Place, Stirling).
*1894. ORKNEY, William C., Surveyor's Office, Montrose Royal Asylum.
*1899. ORR-EWING, Sir Archibald Ernest, Bart., Ballikinrain Castle, Balfron.
*1906. ORR, George W., Cowdenhall, Neilston.
1906. ORR, Harry D., Timber Merchant, 21 Fairfield Road, Chesterfield.
1907. OSWALD, Major Julian, Kindar Lodge, New Abbey, Dumfries.
1902. OSWALD, Richard Alexander, of Auchincruive, Ayr.

1875. PAGE, Andrew Duncan, Land Steward, Culzean Home Farm, Ayr.
1911. PARK, James, Assistant Forester, Tower Cottage, Durris, Drumoak.
1908. PARK, Robert, Contractor, Hamilton Street, Motherwell.
1908. PATERSON, Alexander, Foreman Forester, Linton, Morebattle, Kelso.
1900. PATERSON, George, Timber Merchant, Cliff House, Cults, Aberdeen.
*1879. PATON, Hugh, Nurseryman, Kilmarnock, Ayrshire.
*1898. PATON, Robert Johnston, Nurseryman, Kilmarnock.
*1902. PATON, Tom W., Nurseryman, Kilmarnock.
1898. PATTERSON, Thomas L., Nisbet, Pentcaitland, East Lothian.

Date of Election.

1903. PEARSON, Andrew, Commissioner, Dalkeith House, Dalkeith.
1897. PEARSON, James, Forester, Sessay, Thirsk, Yorks.
1899. PEARSON, James, Factor, The Cottage, Airdrie.
1909. PEATTIE, William, Assistant Forester, The Nursery, Thirlmere, Grasmere.
*1908. PENTLAND, Lord, The Right Hon., Secretary for Scotland, Dover House, Whitehall, London.
*1900. PERRINS, C. W. Dyson, of Ardross, Ardross Castle, Alness.
1904. PETERS, William, Assistant Forester, Gateside, Markinch, Fifeshire.
*1897. PHILIP, Alexander, Solicitor, Brechin, Forfarshire.
*1895. PHILIP, William Watt, Factor, Estate Office, Gigha, Argyllshire.
1908. PHILLIPS, John, Nurseryman, Granton Road, Edinburgh.
*1896. PHILP, Henry, jun., Timber Merchant, Campbell Street, Dunfermline.
*1896. PHILP, John, Timber Merchant, Campbell Street, Dunfermline.
*1896. PITMAN, Archibald Robert Craufurd, W.S., 48 Castle Street, Edinburgh.
1910. PLENDERLEITH, Mungo Sinclair, Fire Insurance Superintendent, 40 Morningside Park, Edinburgh.
1902. PLUMMER, C. H. Scott, of Sunderland Hall, Selkirk.
1901. POLLOCK, Alexander, Rustic Builder, Tarbolton, Ayrshire.
1897. POOLE, Wm., Corn Exchange Buildings, Edinburgh.
1902. POPERT, E. P., Assistant Surveyor, Forest of Dean, Coleford, Gloucestershire.
1908. PORTEOUS, James, Solicitor and Factor, Coldstream.
1899. PORTEOUS, Colonel James, of Turfhills, Kinross.
1910. PRENTICE, Andrew, Forester, Bank House, Worsley, nr. Manchester.
1896. PRENTICE, George, Strathore, Kirkcaldy, Fife.
*1898. PRICE, W. M., Factor, Minto, Hawick.
1908. PRINGLE, James Lewis, of Torwoodlee, J.P., D.L., B.A., Torwoodlee, Galashiels.
1908. PRITCHARD, Henry A., Professor of Estate Management and Forestry, Royal Agricultural College, Cirencester.
1908. PROCTOR, John, Assistant Forester, Castle Stead, Dalkeith Park, Dalkeith.
*1908. PURVIS, Colonel Alexander, St Andrews.
1907. PURVIS, George, Forester, Cowden Estate, Dollar.

1907. RAE, Frederick S., Assistant Forester, Pollok, Pollokshaws.
1907. RAE, Louis, Assistant Forester, Heckfield, Winchfield, Hants.
*1876. RAE, William A., Factor, Murthly Castle, Perthshire.
*1901. RAFFAN, Alexander, Forester, Bonskeid, Pitlochry.
1898. RAFFAN, James, Estate Steward, Fota Farm, Carrigtwohill, Co. Cork.
1899. RAFN, Johannes, Tree-Seed Merchant, Skovfrökontoret, Copenhagen, F.
1902. RALPH, William, I.S.O., Forrester Road, Corstorphine.
1897. RALSTON, A. Agnew, Factor, Philipstoun House, West Lothian.
1907. RALSTON, Charles W., Chamberlain on Dukedom of Queensberry, Dabton, Thornhill, Dumfriesshire.

Date of Election.

*1908. Ralston, Claude, Factor, Estates Office, Glamis.
*1908. Ralston, Gavin, Factor, Glamis.
*1910. Ramsay, Professor George Gilbert, LL.D., Drumire, Blairgowrie.
1907. Ramsay, William, J.P., Longmorn House, Longmorn R.S.O.
*1855. Ramsden, Sir John, Bart., Byram Hall, Ferrybridge, Normanton.
1870. Rattray, Thos., Forester, Westonbirt House, Tetbury, Gloucestershire.
1909. Rattray, William, Wood Merchant, Tullylumb Terrace, Perth.
1908. Redpath, John, Forester, Paxton, Berwick-on-Tweed.
1905. Reid, Alexander T., Assistant, Foret de Bouredine, Medjez-Spa, Bone, Algeria.
1905. Reid, Andrew, The Gardens, Durris, Drumoak, Aberdeenshire.
1901. Reid, Hugh, Forester, Ashton Court, Long Ashton, near Bristol.
1909. Reid, James, jun., Assistant Forester, Balbirnie, Milldeans, Markinch,
1894. Reid, James S., Forester, Balbirnie, Markinch, Fife.
1910. Reid, Peter, Assistant Forester, Cruachan, Kilchrenan, Argyll.
1905. Reid, Robert, Overseer, Kincairney, Dunkeld.
1903. Reid, Robert Matelé, Thomanean, Milnathort.
1908. *Reid, Wm., Estate Overseer, Kildrummy Castle, Mossat, Aberdeenshire.*
1910. Reis, Gordon Stanley, B.Sc., The Laurels, Bright's Crescent, Edinburgh.
1901. Rennie, Joseph, Overseer, Hillend, Possil, Maryhill.
*1908. Renshaw, Charles Stephen Bine, B.A., Barochan, Houston.
1910. Richard, James, Forester, Balnamoon, Brechin.
*1873. Richardson, Adam D., 6 Dalkeith Street, Joppa.
1910. Rigg, Patrick Home, of Tarvit, Cupar.
1907. Rillie, Joseph, Assistant Forester, Dailly, Ayrshire.
1892. Ritchie, Alexander, Overseer, Brucehill, Cardross Estate, Port of Menteith.
*1908. Ritchie, Charles Ronald, Law Apprentice, 37 Royal Terrace, Edinburgh.
*1876. Ritchie, William, Hope Lodge, Moffat.
1898. Ritchie, Wm., Assistant Forester, Moss-side Cottage, Lynedoch, Perth.
1906. Ritchie, Wm. H., of Dunnottar House, Stonehaven.
1911. Ritchie, William, Timber Merchant, 1 Commerce Street, Fraserburgh.
1900. Robb, John, Road Surveyor, County Buildings, Edinburgh.
*1909. Roberts, Alex. Fowler, of Fairnilee, Clovenfords, Galashiels.
1909. Robertson, Alexander, Factor, Polmaise, Stirling.
*1897. Robertson, A. Barnett, Forester, The Dean, Kilmarnock, Ayrshire.
1897. Robertson, Andrew N., Forester, Glenferness, Dunphail.
1911. Robertson, Andrew, Assistant Forester, Dean Road, Kilmarnock.
1911. Robertson, Andrew Clark, Assistant Factor, Blair Drummond, Perthshire.
1899. Robertson, Charles, Forester, Colstoun Old Mill, Gifford.
*1879. Robertson, Donald, Forester, Dunrobin, Golspie.
*1907. Robertson, Edward Hercules, B.A., Advocate, Burnside, Forfar.

Date of Election.

1896. ROBERTSON, George, Forester, Monreith Estate Office, Port William.
1908. ROBERTSON, George, Assistant Forester, The Cottage, Stormontfield, Perth.
*1910. ROBERTSON, Henry Tod, Coalmaster, Meadowbank, Airdrie.
1900. ROBERTSON, James, Assistant Forester, Lime Walk Cottage, Rosehaugh, Avoch, Ross-shire.
1904. ROBERTSON, James, Assistant Forester, Pollok Estate, Pollokshaws.
*1905. ROBERTSON, James Morton, of Portmore, Portmore House, Eddleston.
1905. ROBERTSON, James W., Head Gardener, Letham Grange and Fern, Arbroath.
1907. ROBERTSON, J. P., Forester, Edensor, Bakewell.
*1905. ROBERTSON, John, Factor, Panmure Estates Office, Carnoustie.
1896. ROBERTSON, John, Forester, Altyre, Forres.
1909. ROBERTSON, John Alexander, c/o Donald Robertson, Dunrobin, Golspie.
1895. ROBERTSON, Thomas, Forester and Bailiff, Woodlawn, Co. Galway.
1910. ROBERTSONWHITE, John Peregine, M.A., LL.B., Advocate in Aberdeen, 80 Union Street, Aberdeen.
1909. ROBINSON, Alfred Whitmore, Forester, Bamford, near Sheffield.
1910. ROBINSON, R. G., Department of Lands, State Forests Branch, Tapanui, Otago, N.Z.
*1890. ROBINSON, William, Gravetye Manor, East Grinstead, Sussex.
1899. ROBSON, Alex., of Smith & Son, 18 Market Street, Aberdeen.
1901. ROBSON, Alexander, Head Gamekeeper, The Kennels, Culzean, Maybole.
*1897. ROBSON, Charles Durie, 66 Queen Street, Edinburgh.
1900. ROBSON, John, Forester, Sawmill Cottage, Baronscourt, Newtown Stewart, Ireland.
1893. RODGER, James, Forester, Leinster Street, Athy, Co. Kildare.
1908. ROGERS, E. Percy, Estate Office, Stanage Park, Brampton Byran, Herefordshire.
*1883. ROLLO, The Hon. Wm. Chas. Wordsworth, Master of Rollo, Duncrub Park, Dunning, Perthshire.
*1872. ROSEBERY, The Right Hon. the Earl of, K.G., K.T., Dalmeny Park, Edinburgh.
1898. ROSS, Charles D. M., Factor, Abercairney, Crieff.
1905. ROSS, John S., Factor's Clerk, Monreith Estate Office, Wigtownshire.
*1906. ROXBURGHE, His Grace the Duke of, K.T., Floors Castle, Kelso.
1903. RULE, John, Forester, Huntly.
*1908. RUSSELL, David, Silverburn, Leven.
1893. RUTHERFORD, James A., Land Agent, Highclere Park, Newbury, Berks.
1910. RUTHERFORD, James, Assistant Forester, 65 Bradder Street, Mansfield, Notts.
1909. RUTHERFORD, J. D., Apprentice W.S., 198 Grange Loan, Edinburgh.
1870. RUTHERFORD, John, Forester, Linthaugh, Jedburgh, Roxburghshire.
1904. RUTHERFURD, Henry, Barrister-at-Law, Fairnington, Roxburgh.

Date of Election.

*1894. Samson, David T., Factor, Seafield Estates Office, Elgin.
1875. Sang, Edmund, of E. Sang & Sons, Nurserymen, Kirkcaldy.
*1906. Sang, J. H., LL.B., W.S., Westbrook, Balerno.
1903. Schott, Dr Peter Carl, Nursery and Seed Establishments, Knittelsheim, Palatinate, Germany.
1911. Scott, Alexander, Assistant Forester, Broomhill, New Scone.
*1867. Scott, Daniel, Wood Manager, Darnaway, Forres.
1892. Scott, David, Overseer, Dumfries House, Cumnock, Ayrshire.
1901. Scott, Frank, Forester, Jeaniebank, Old Scone, Perth.
1911. Scott, George Ritchie, Farmer, Oxgang, Colinton.
1881. Scott, James, Forester, Wollaton Hall, Nottingham.
*1907. Scott, James Cospatrick, P.A.S.I., Yarrow Cottage, Poynder Place, Kelso.
1908. Scott, James Henry, of Eredine, Port Sonachan, Argyllshire.
1903. Scott, John, Forester, Annfield, Hartrigge, Jedburgh.
1908. Scott, John A., Forester, The Gardens, Knockbrex, Kirkcudbright.
1890. Scott, John D., Land Steward, Estate Office, Brushford, Dulverton, Somerset.
*1906. Scott, John Henry Francis Kinnaird, of Gala, Gala House, Galashiels.
*1902. Scrimgeour, James, Gardener, Manor House, Donaghadee.
*1890. Scrimgeour, John, Overseer, Doune Lodge, Doune.
1909. Seed, Frederick Hutton, Plant Import Inspector, Mombasa, East Africa Protectorate.
1897. Sharpe, Thomas, Head Forester, Gordon Castle, Fochabers.
1904. Shaw, John, Factor, Kilmahew Estate Office, Cardross.
*1896. Shaw-Stewart, Sir Hugh, Bart., M.P., of Ardgowan, Greenock.
*1904. Shelley, Sir John Courtown Edward, Bart., Avington, Alresford, Hants.
*1898. Sheppard, Rev. H. A. Graham-, of Rednock, Port of Menteith, Stirling.
*1907. Shiach, Gordon Reid, L.D.S., etc., Ardgilzean, Elgin.
*1903. Shiel, James, Overseer, Abbey St Bathans, Grant's House.
1907. Shiels, George Henry, Forester, Low Entercommon, Great Smeaton, Northallerton.
1911. Sim, Ernest James, Factor, Airthrey Estate Office, Bridge of Allan.
1911. Sim, James, District Forest Officer, King Williamstown, Cape Colony.
1905. Sim, John, Forester, Fernybrae, Cornhill, Banffshire.
1903. *Simon, Thomas, jun., Assistant Forester, c/o Mrs Luckins, Wardley Marsh, Liphook, Hants.*
1910. Simpson, Robert, Under Forester, Drumtochty, Auchinblae.
1909. Sinclair, Magnus H., Seedsman, 156a Union Street, Aberdeen.
1906. Sinclair, Robert, Factor, Tarbet, Loch Lomond.
1909. Singer, George, Forester, Rothienorman.
1900. Singer, John G., Forester, Whitestone Cottage, Maybole.
1908. Skimming, Robert, Timber Merchant, Kirkinner.
1907. Skirving, Robert, D.L., J.P., of Cobairdy, Huntly, Aberdeenshire.

Date of Election.

1868. SLATER, Andrew, War Department Estates Office, Durrington, Salisbury, Wilts.
1902. SMART, John, Merchant, 18 Leith Street, Edinburgh.
*1893. SMITH, Charles G., Factor, Haddo House, Aberdeen.
1906. SMITH, Douglas, P.A.S.I., Land Agent, Estate Office, Thwaite, Erpingham, Norwich.
1908. SMITH, Edwin Hedley, B.L., Factor, Whittinghame, Prestonkirk.
1909. SMITH, Harold, Assistant Forester, Heckfield, Winchfield, Hants.
1911. SMITH, Herbert, Assistant Forester, Kirkmuirhill, Lanarkshire.
1901. SMITH, James, Forester, 1 Oxmantown Mall, Birr, King's County.
1908. SMITH, James, Nurseryman, Darley Dale Nurseries, near Matlock.
1908. SMITH, James, Assistant, Town Clerk's Office, Arbroath.
1906. SMITH, James Fraser, F.R.H.S., late Gardener, Barons Hotel, Auchnagatt.
1907. SMITH, Right Hon. James Parker, P.C., 20 Draycott Place, London, S.W.
1895. SMITH, John, Cabinetmaker, 1 Eastgate, Peebles.
*1907. SMITH, J. Grant, Factor, Seafield Estates Office, Grantown-on-Spey.
1901. SMITH, Matthew, Manager for Dyer & Co., Peebles.
1908. SMITH, Robert, Factor, Cranstoun Riddell, Dalkeith.
1901. SMITH, Sydney, Factor, Drummuir Estates Office, Keith.
1909. SMITH, Thomas, Nurseryman, Stranraer.
*1895. SMITH, Thomas, Overseer, The Nursery, Tring Park, Wiggington, Tring, Herts.
1896. SMITH, William, Forester, Camperdown, Dundee.
1899. SMITH, William, Overseer, Rothes Estate Office, Leslie, Fife.
*1896. SMITH, William G., B.Sc., Ph.D., Lecturer on Biology, Edinburgh and East of Scotland College of Agriculture, George Square, Edinburgh.
*1907. SMITHSON, Harry S. C., of Inverernie, Daviot, Highland R.S.O.
1910. SMYLY, John George, B.A., Consulting Forester and Land Agent, 22 Earlsfort Terrace, Dublin.
*1882. SMYTHE, David M., of Methven Castle, Perth.
1907. SOMERSET, His Grace the Duke of, Maiden Bradley, Bath; 35 Grosvenor Square, W.
1906. SOMERVILLE, Hugh Christopher, 2 Fairhaven, Dalkeith.
1906. SOMERVILLE, Robert Anderson, Eastwoodbrae, Dalkeith.
*1889. SOMERVILLE, Dr William, M.A., D.Sc., D.Œc., F.R.S.E., Professor of Rural Economy, Oxford.
1904. SOUTAR, William, Forester, The Farm, Titsey Place, Limpsfield, Surrey.
1910. SPENCE, James George, Forester, Stephenstown, Dundalk, Co. Louth, Ireland.
1898. SPENCE, William, Forester, Strathenery, Leslie.
*1899. SPIERS, Adam, Timber Merchant, Warriston Saw-mills, Edinburgh.
*1883. SPROT, Major Alexander, of Garnkirk, Chryston, Glasgow.
*1909. STAIR, The Earl of, Lochinch, Castle Kennedy.
1899. STALKER, Wm. J., Nurseryman, Nairn.

Date of Election.

1910. Stebbing, Edward Percy, Indian Forest Service, Lecturer in Forestry, Edinburgh University.

1908. St Clair, The Right Hon. Charles William, Lord Sinclair, 55 Onslow Square, London, S.W.

1908. St Quintin, Geoffrey Apsley, Estate Commissioner, Kincurdy, Fortrose.

1903. Stephen, Alfred, Assistant Forester, Drumtochty, Fordoun.

1911. Stephen, George, Forester, Castle Grant, Grantown.

1907. Stephen, John, Forester, Dell Nursery, Nethy Bridge.

1901. Stewart, Alistair D., Kinfauns Estates Office, Rockdale, Perth.

1897. Stewart, Charles, Forester, Castle Menzies, Aberfeldy.

*1908. Stewart, Charles, Achara, Duror of Appin, Argyll.

1907. Stewart, David, Forester, Baunreigh Forestry Station, Mountrath, Queen's Co.

1909. Stewart, Sir David, of Banchory-Devenick, Banchory House, Banchory, Devenick.

1910. Stewart, Donald, Forester, The Lodge, Inverlochy Castle, Fort William.

*1899. Stewart, Duncan D., Factor, Rossie Estate, Inchture.

1901. Stewart, James, Forester, Letham and Fern Estates, Fern, near Brechin.

1903. Stewart, John, Forester, Cavens, Kirkbean, Dumfries.

1909. Stewart, John M'Gregor, Assistant Forester, Sawmill Cottage, Strathord, by Stanley.

*1892. Stewart, Sir Mark J. M'Taggart, Bart. of Southwick, Kirkcudbrightshire.

1908. Stewart, Colonel R. K., of Murdostoun, Murdostoun Castle, Lanarkshire.

1876. Stewart, Robert, Forester, Stonefield, Tarbert, Lochfyne.

1906. Stewart, William Maitland, Factor, 5 Inverleith Terrace, Edinburgh.

1910. Stewart, William, of Shambellie, Kirkcudbrightshire.

*1904. Stirling, Archibald, of Keir, Dunblane.

1907. Stirling, John Alexander, of Kippendavie, Dunblane.

*1911. Stirling, Thomas Willing, of Muiravonside, Linlithgow.

*1908. Stirling, William, D.L., J.P., of Fairburn, Muir of Ord.

1909. Stobart, Lionel Forrester, 9 Westminster Mansions, London, S.W.

*1909. Stodart, Charles, Farmer, Wintonhill, Pencaitland.

1897. Stoddart, James, Builder, Bonnyrigg, Midlothian.

1906. Stoddart, James, jun., Joiner, Norwood, Bonnyrigg.

1893. Storie, W., Whitway House, Newbury, Berks.

1908. Stratheden and Campbell, The Right Hon. Lord, Hartrigge, Jedburgh.

*1908. Strathmore and Kinghorne, The Earl of, Glamis Castle, Glamis.

1908. Stuart, Alexander, Estate Clerk, Benmore, Kilmun.

1910. Stuart, George Morrison, Gardener, The Gardens, Forglen, Turriff.

1908. Stuart, Lord Ninian Edward Crichton, M.P., House of Falkland, Fife.

Date of Election.

1906. STUART, Peter, Brewer, Glen Grant, Rothes.
1902. STUNT, Walter Charles, Lorenden, Ospringe, Kent.
*1880. SUTHERLAND, Evan C., Highland Club, Inverness.
1907. SUTHERLAND, George, Assistant Forester and Saw-miller, Park Cottage, Cardross, by Port of Menteith.
*1883. SUTHERLAND, His Grace the Duke of, K.G., Dunrobin Castle, Golspie.
*1892. SUTHERLAND, John D., Ardconnel Lodge, Oban, Argyll.
1909. SUTHERLAND, John S., Assistant Forester, Pilsley, Bakewell, Derbyshire.

1869. TAIT, David, Overseer, Owston Park, Doncaster, Yorkshire.
*1892. TAIT, James, Builder, Penicuik, Midlothian.
*1900. TAIT, James, jun., Westshiel, Penicuik.
1898. TAIT, William, Seedsman, 75 Shandwick Place, Edinburgh.
1902. TAYLOR, John, Forester, Orchill Estate, by Braco, Perthshire.
1904. TAYLOR, Robert, Assistant Forester, Chapelhill, Logiealmond, Methven.
1905. TAYLOR, Robert, Forester, West Saline, Saline, Oakley.
1897. TAYLOR, William, Forester, Sandside, Kirkcudbright.
1905. TELFER, John, Forester, Hardwick House, Whitchurch, Oxon.
1911. TENNANT, H. J., M.P., 33 Bruton Street, London, W.
*1877. TERRIS, James, Factor, Dullomuir, Blairadam, Kinross-shire.
1911. THOMAS, David Gwilym, Forestry Student, 44 Lauriston Place, Edinburgh.
1908. THOMPSON, Archibald, Overseer, Auchindarroch, Lochgilphead.
*1909. THOMPSON, David Peat, Tea Planter and Engineer (Retired), 6 Queen Street, Inverkeithing.
1904. THOMPSON, Dugald, Forester, Drimsynie, Lochgoilhead.
1909. *Thompson, John, Assistant Forester, Abercairney, Crieff.*
1893. THOMSON, David W., Nurseryman, 113 George Street, Edinburgh.
1903. THOMSON, John Burnside, Estate Manager, Calderwood Castle, High Blantyre.
*1855. THOMSON, John Grant, Retired Wood Manager, Mount Barker, Grantown-on-Spey.
*1902. THOMSON, Peter Murray, S.S.C., Cockbridge, Mealsgate, Cumberland.
1903. THOMSON, Robert, Foreman Forester, Park Hill, Ampthill, Bedfordshire.
*1901. THOMSON, Spencer Campbell, of Eilean Shona, 10 Eglinton Crescent, Edinburgh.
*1908. THORBURN, Michael Grieve, D.L., etc., of Glenormiston, Innerleithen.
1911. THOW, William Keir, Assistant Forester, Pitcairngreen, Almondbank, Perth.
1904. THREIPLAND, Captain W. Murray, Dryburgh Abbey, St Boswells.
1906. TINDAL, Robert, Forester, Bellspool Cottages, Stobo.
1901. TIVENDALE, William D., Head Forester to Duke of Portland, Burnhouse, Galston.
*1871. TOMLINSON, Wilson, Forester, Clumber Park, Worksop, Notts.
*1906. TRAIL, James William Helenus, A.M., M.D., F.R.S., Professor of Botany in University of Aberdeen, 71 High Street, Old Aberdeen.

Date of Election.

*1902. TROTTER, A. E. C., of Bush, Milton Bridge, Midlothian.
*1903. TULLIBARDINE, The Most Hon. the Marquis of, D.S.O., Blair Castle, Blair Atholl.
1903. TURNBULL, John, Forester, Forester's Lodge, Arbigland, Dumfries.
1910. TWEEDIE, Alexander, Forester, etc., Garth, Fortingal, Aberfeldy.

1883. UNDERWOOD, Henry E., Fornham, St Martin, Bury St Edmunds, Suffolk.
*1903. UNWIN, Arthur Harold, D.Œc., Town House, Haslemere, Surrey.
*1908. URQUHART, Angus, Assistant Nursery and Seedsman, Inverness.
1907. URQUHART, Colonel Robert, Town Clerk, Forres.
*1908. USHER, Sir Robert, Bart. of Norton and Wells, Norton, Ratho Station, Midlothian.
1903. USHER, Thomas, Factor, Courthill, Hawick.

1908. VEITCH, Andrew, Seedsman and Nurseryman, Melrose.

1911. WADDINGHAM, James Hart, Indian Forest Service, Elsham, Grimsby.
1908. WALDRON, Major Patrick John, East Haugh, Pitlochry.
1903. WALKER, Captain George Lawrie, of Crawfordton, Thornhill.
1894. WALKER, Henry H., Factor, Monreith, Port William, Wigtownshire.
*1878. WALKER, Colonel I. Campbell, Newlands, Camberley, Surrey.
*1907. WALKER, James, Wood Merchant, Inverness.
*1906. WALKER, John Steven, Yard Foreman, Saw-mills, Hurlford, Ayrshire.
*1906. WALKER, Robert Williamson, C.E., Factor and Land Surveyor, 3 Golden Square, Aberdeen.
1903. WALLACE, Andrew, Saw-miller, 5 North Street, Freuchie.
1893. WALLACE, David P., Forester, The Saw-mills, Filleigh, Molton, S. Devon.
*1897. WALLACE, John A. A., of Lochryan, Cairnryan, Stranraer.
*1905. WALLACE, Thomas Douglas, F.S.I., Callendar Estate Office, Callendar Park, Falkirk.
1909. WALLACE, William, Foreman Forester, Hollows, Canonbie.
1899. WANDESFORDE, R. H., Prior of Castlecomer, Co. Kilkenny.
1909. WARDLAW, Andrew Main, Solicitor, Bridge of Allan.
1909. WARING, Captain Walter, M.P., of Lennel, Coldstream.
*1900. WARWICK, Charles, Foresty Department, Caledon, Co. Tyrone.
1901. WASON, Right Hon. Eugene, M.P., of Blair, Dailly, Ayrshire; 8 Sussex Gardens, Hyde Park, London.
1901. WATSON, James, Manager, Moy Hall, Inverness-shire.
1893. WATSON, John, Timber Merchant, Annandale Street, Edinburgh.
*1893. WATSON, John T., 6 Bruntsfield Gardens, Edinburgh.
1910. WATSON, William Johnstone, Student of Forestry, 35 Blythswood Drive, Glasgow.
1872. WATT, James, J.P., of Little & Ballantyne, Nurserymen, Carlisle.
1893. WATT, James W., Knowefield Nurseries, Carlisle.
1911. WATT, Sidney, Assistant Forester, Blue Tower, Douglas, Lanarkshire.

Date of Election.

1908. WAUGH, J., Assistant Forester, c/o Mrs Mercer, Harts Lane, Burghclere, Newbury, Berks.
1906. WEBSTER, Charles, Gardener and Forester, The Gardens, Gordon Castle, Fochabers.
*1911. WEBSTER, Sir Francis, Ashbrook, Arbroath.
*1908. WEDDERBURN, Ernest Maclagan, LL.B., W.S., F.R.S.E., Factor, 2 Glenfinlas Street, Edinburgh.
*1908. WEIR, William, of Kindonan, Adamton, Monkton, Ayrshire.
*1891. WELSH, James, of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1904. WENTWORTH-FITZWILLIAM, George Charles, of Milton, Peterborough.
1902. WHELLENS, W. Henry, Forester, Comlongon Nurseries, Ruthwell.
1905. WHITE, Andrew, Forester, Portmore, Eddleston.
*1898. WHITE, J. Martin, Balruddery, near Dundee.
1895. WHITE, William, Farmer, Gortonlee, Lasswade.
1909. *Whitehead, David, Assistant Forester, Kingswood, Murthly.*
*1884. WHITTON, James, Superintendent of Parks, 249 George Street, Glasgow.
*1899. WHYTE, John D. B., Factor, Estate Office, Elveden, Suffolk.
1895. WIGHT, Alexander, Overseer, Thurston, Temple Mains, Innerwick.
*1869. WILD, Albert Edward (Conservator of Forests, Darjeeling, India), c/o Henry S. King & Co., 65 Cornhill, London, E.C.
1910. WILDES, Walter R., A.B. and M.F., Consulting Forester, Little Falls, New Jersey, U.S.A.
1883. WILKIE, Charles, Forester, Lennoxlove, Haddington.
1891. WILKIE, G., Architect, Hayfield, Peebles.
1902. WILKINSON, John, Factor, The Grange, Kirkcudbright.
1903. WILL, George, Manager, Crichton Royal Institution Farm, Dumfries.
1908. WILLIAMSON, James A., A.R.I.B.A., Public Works Office, City Chambers, Edinburgh.
1895. WILLIAMSON, John, Bank Agent, Loanhead, Midlothian.
*1907. WILLIAMSON, John, Joiner and Builder, Grangemouth.
1907. WILSON, Adam Frank, C.D.A.(Edin.), 164 Braid Road, Edinburgh.
1907. WILSON, Andrew Robertson, M.A., M.D., Hopewell, Tarland, Aboyne; and Trafford House, Liscard, Cheshire.
*1898. WILSON, David, Timber Merchant, Troon, Ayrshire.
*1889 WILSON, David, jun., of Carbeth, Killearn, Glasgow.
1908. WILSON, Edward Arthur, Rockingham, Edgbaston Park Road, Birmingham.
1907. WILSON, Ian Hall, Saw-mill Manager, Brodie Cottage, Brodie.
1896. WILSON, James, M.A., B.Sc., Royal College of Science, Stephens Green East, Dublin.
1900. WILSON, James, jun., Nurseryman, St Andrews.
1907. WILSON, James G., Assistant, 24 St Andrew Square, Edinburgh.
1910. WILSON, John, Estate Steward, Brand's Mill, Dunbar.
1902. WILSON, Sir John, Bart. of Airdrie.
1901. WILSON, John Currie, Factor, Tulliallan Estate Office, Kincardine-on-Forth.

Date of Election.

1903. Wilson, Thomas, Head Gardener, Glamis Castle, Glamis.
1899. Wilson, William, Timber Merchant, Auchenleck, Ayrshire.
1893. Wiseman, Edward, Nurseryman, Elgin.
1895. Wiseman, William, Nurseryman, Forres.
1911. Wishart, John, Ellangowan, Peebles.
1906. Wolfe, George, sen., J.P., Shovel Manufacturer, Millburn, Bathgate.
1909. Wood, James, of Wallhouse, Torphichen.
1907. Wood, Thomas, Forester, West Lodge, Durie, Leven, Fife.
1907. Woolford, Albert, Assistant Forester, Goldsboro', Knaresborough, Yorks.
1904. Worsfold, Edward Mowll, Land Agent, Christ Church Villas, Priory Road, Dover.
1904. Wotherspoon, George, Factor, Cromartie Estate Office, Kildary, Ross-shire.
1909. Wright, John Moncrieff, of Kinmonth, Bridge of Earn.
1904. Wright, Sir Robert Patrick, F.H.A.S., F.R.S.E., Maraval, Uddingston.
1909. Wright, William Girvan, M.R.A.C., Maraval, Uddingston.
1868. Wyllie, George, Ballogie, Aboyne, Aberdeenshire.
1906. Wyllie, William, Seedsman, 18 Market Street, Aberdeen.

*1908. Yeaman, Alexander, W.S., 32 Charlotte Square, Edinburgh.
1904. Yool, Thomas, Factor, Menzies Estates Office, Aberfeldy.
1905. Young, John, Hedger, West Lodge, Corehouse, Lanark.
1908. Young, John, Hedger and Assistant Forester, Muirhouse, Falkirk.
1907. Young, John U., Cart Craigs, Pollokshaws.
1909. Young, Peter, Assistant Forester, Loch Cottage, Taymount, Stanley.
1910. Young, R. M., Nursery Manager, Cathcart Nurseries, Newlands, Glasgow.
1910. Young, William George, Estate Clerk, Craigielaw, Longniddry.
1910. Younger, Harry George, 21 Grosvenor Crescent, Edinburgh.
*1898. Younger, Henry J., of Benmore and Kilmun, Greenock.
*1899. Yule, Miss Amy Frances, L.A., Tarradale House, Muir of Ord.