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. XVII.

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CONTENTS OF VOL. XVII.

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

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VOL. XVII.—PART I.

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ABRIDGED PROSPECTUS.

Membership.

THE Roll contains the names of over 950 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, no fewer than 397 Medals and Money Prizes having been presented.

School of Forestry.

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 Forest for Scotland which might serve the above-named objects. Copies of this Scheme were laid before the recent Departmental Committee on British Forestry; and in their Report, which has now been issued, they have recommended the establishment of a Demonstration Area and the provision of other educational facilities 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.

Excursions.

During the past twenty-five 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, and last summer a Tour extending over seventeen days was made in Sweden. 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 Norway, France, and Southern Germany. 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, pitwood 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.

The Society's *Transactions*.

The *Transactions* of the Society are published annually, and 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. Copies of the *Transactions*, which now extend to sixteen volumes, are to be found in the principal Libraries of the United Kingdom, as well as in those of the British Colonies and of America.

Honorary Consulting Scientists.

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

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

Consulting Chemist.—ANDREW PEEBLES AITKEN, M.A., Sc.D., Professor of Chemistry, Veterinary College, Clyde Street, Edinburgh.

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

Consulting Entomologist.—ROBERT STEWART MACDOUGALL, M.A., D.Sc., Professor of Entomology, etc., New Veterinary College, Edinburgh.

Consulting Geologist.—JOHN SMITH FLETT, M.A., B.Sc., M.B., C.M., Geological Survey, 28 Jermyn Street, London, S.W.

Consulting Meteorologist.—ROBERT COCKBURN MOSSMAN, F.R.S E., F.R.Met.Soc., 10 Blacket Place, Edinburgh.

Local Secretaries.

The Society is represented throughout Scotland, England, and Ireland by the Local Secretaries whose names will be found on page 18 of the *Proceedings* in 1903 appended to this Part. They are ready to afford any additional information that may be desired regarding the Conditions of Membership and the work of the Society.

Special Notices to Members.

THE READING OF PAPERS.

Members are invited to read short papers on any subject connected with Practical Forestry at the Annual Meeting in January, or at the General Meeting to be held at the time of the Excursion. Members who may desire to do this are requested to intimate the title of their subject, in writing, to the Secretary, not later than 1st June 1903 or 1st January 1904, and to state the time they require for reading the paper.

THE SOCIETY'S CABINET OF LANTERN SLIDES.

The Council has resolved that the Society's Cabinet of 100 Micro-Photographic Slides—illustrative of the Structure of Timber, and suitable for the purpose of Lectures with Lantern Exhibitions—may be lent to any applicant who is willing to comply with the printed Conditions, copies of which can be obtained from the Secretary.

ILLUSTRATIONS FUND.

The Council begs to draw special attention to this Fund, the object of which is to defray the expense of illustrating the Society's *Transactions*.

THE SOCIETY'S ALBUM.

The Council wishes it to be known that the Society has an Album of Photographs of Members, and that the Secretary will be glad to receive contributions.

NEW MEMBERS.

The Council has printed a Memorandum containing particulars regarding the past and present work of the Society, which, it is hoped, may lead to the introduction of New Members. The Secretary will send copies of this document to any Member who may ask for them, and will forward a copy to any person likely to join the Society whose address may be sent to him by a Member.

The Secretary will receive applications for Membership at any time. See Form of Proposal and Conditions of Membership on opposite page.

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, 5 St Andrew Square, 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, and others, subscribing annually	Half-a-Guinea.
3. Foresters, Gardeners, Land-Stewards, 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.**

V. Members in arrear shall not receive the *Transactions*. Any Member whose Annual Subscription remains unpaid for three years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till all his arrears are 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, and others, .	5 5 0
3. Foresters, Gardeners, Land-Stewards, 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 *new* Life Members.

XII. Every Proposal for Membership shall be made on the FORM provided for the purpose, which must be signed by two Members of the Society as Proposer and Seconder, and delivered to the Secretary to be laid before the next meeting of the Council. The Proposal shall lie on the table till the following meeting of the Council, when it shall be accepted or otherwise dealt with, as the Council may deem best in the interests of the Society. The Proposer and Seconder shall be responsible for payment of the new Member's first Subscription.

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THE ROYAL SCOTTISH ARBORICULTURAL SOCIETY AT FINSPÖNG, SWEDEN, 23RD JULY 1902.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

I. *Departmental Committee on British Forestry appointed by the Board of Agriculture.*[1]

REPORT TO THE PRESIDENT OF THE BOARD OF AGRICULTURE.

SIR,

The Committee which you appointed on the 20th February last, to inquire into and report upon the present position and future prospects of forestry, and the planting and management of woodlands in Great Britain, and to consider whether any measures might with advantage be taken, either by the provision of further educational facilities or otherwise, for their promotion and encouragement, have agreed to the following Report.

Witnesses.

1. We have held six sittings for the purpose of taking evidence, and have examined witnesses from among the various classes concerned with our woodlands. These witnesses have comprised the Earl of Selborne, Lord Glanusk, and Sir John W. Ramsden, Bart., representing owners of woodlands; among estate managers and agents, Mr A. Slater, Land Steward to H.M. the King at Osborne, Mr A. Vernon, now President of the Surveyors' Institution, Mr D. W. Drummond, Estate Agent to the Earl of Cawdor and Sir James Drummond in South Wales; and, among foresters, Mr A. C. Forbes, Forester to the Marquess of Bath, Mr W. B. Havelock, Forester to the Earl of Yarborough, and Mr A. Pitcaithley, Forester to the Earl of Mansfield. With the view of ascertaining whether British was at any disadvantage as compared with foreign timber, and to what extent any alleged

[1] Reprinted by permission of the Controller of His Majesty's Stationery Office.

inferiority in the former could be remedied, we have examined Mr S. Margerison and Mr C. Hopton, on behalf of the Timber Trades Federation of the United Kingdom; Mr J. H. Croxford, of Messrs Price, Walker, & Co., timber importers; and Mr M. F. Roberts, who gave evidence as to the tests undertaken by the Postmaster-General to determine the comparative suitability of British and foreign timber for telegraph poles. Institutions interested in forestry were represented by Mr J. Michie, Commissioner to H.M. the King at Balmoral, delegated by the Highland and Agricultural Society of Scotland; Mr D. Robertson, Forester to the Duke of Sutherland, on behalf of the Royal Scottish Arboricultural Society; Mr J. Davidson, Land Agent to the Commissioners of the Admiralty's estates in the North of England, Secretary to the English Arboricultural Society; and Mr A. D. Webster, nominated by the Royal Horticultural Society. The necessity for the provision of further educational facilities has occupied much of our attention; and the scientific witnesses who have given special consideration to this subject comprise three members of the Committee, viz., Dr W. Schlich, Professor of Forestry at the Royal Indian Engineering College, Coopers Hill; Lieut.-Col. F. Bailey, Lecturer in Forestry at the University of Edinburgh, representing the Edinburgh University Court; and Dr W. Somerville, Assistant Secretary to the Board of Agriculture, formerly Lecturer in Forestry at Edinburgh University, and Professor of Agriculture and Forestry at the Durham College of Science and of Agriculture at Cambridge University; while the latter university sent as its official witness Professor H. Marshall Ward, Professor of Botany. Evidence as to the existing administration on various points connected with woodlands has been received—from Major P. G. Craigie, C.B., Assistant Secretary to the Board of Agriculture, with regard to the collection of statistics of woodlands and the granting of loans by the Government; from Mr C. O. Minchin, of the Board of Inland Revenue, regarding the incidence of succession and estate duties; and from Mr J. T. Maxwell, of the Scottish Local Government Board, with regard to the incidence of local rates in Scotland; while the English Local Government Board have also furnished us with a memorandum regarding such rates in England. In addition, evidence as to the availability for afforestation of the catchment areas of municipal water-supplies was tendered by Mr J. Parry, Water Engineer to the Liverpool Corporation.

Select Committee of 1885-87.

2. We have also taken cognisance of the evidence given before the Select Committee of the House of Commons appointed in 1885, and reappointed in 1886 and 1887, to consider whether, by the establishment of a Forest School or otherwise, our woodlands could be rendered more remunerative. We considered that it was unnecessary to recall the witnesses examined in 1885-87; but in drawing up our present Report, due weight has been given to this evidence, a digest of which, for convenience of reference, has been prepared and is printed as an Appendix to the evidence taken by us.

Authorities.

3. We have considered the recent publications of several authorities on the improvement of forestry in this country, and we have been guided by these as well as by the evidence taken. A digest of some of these publications is printed as an Appendix.

Select Committee's Recommendations.

4. The Select Committee of the House of Commons stated in their Report that the possibility of improvement in the management of our woodlands was so great that, even as regards those belonging to the State, "the difference between skilled and unskilled management would itself more than repay the cost of a Forest School. This area is trifling as compared with the extent of private woodlands." They pointed out that almost all civilised states have Forest Schools, that in the United Kingdom there are large areas of waste, and that the woodlands of the Empire, as a whole, are greater than those of any other State.

5. We endorse the conclusions of the Select Committee of 1885-87 as regards the neglected condition of forestry in Great Britain, the possibility of improvement, and the necessity for the provision of better means of education. But as regards that Committee's final recommendation—the appointment of a Board of Forestry—this is not now required, since forestry is one of the subjects committed to the charge of the Board of Agriculture.

Present Condition of Forestry.

6. The present Departmental inquiry starts very much at the same point as did that of the Select Committee in 1885. It is

true that a few scattered efforts have since been made to adopt methodical treatment; and a wider appreciation of the advantages of close canopy, clean timber, and heavy crops is discernible. Yet, on the whole, there has probably been a further reduction of the already inadequate stock of timber in the wooded area. The more intelligent of our foresters have come to recognise the shortcomings of our practice, and, within the limit of their opportunities, have endeavoured to effect an improvement. Attempts have also been made to organise some forestry instruction. The classes at the University and at the Royal Botanic Garden of Edinburgh, and the lectures given at a few Agricultural Colleges, and under the auspices of one or two County Councils, have been well conducted.

Waste Lands.

7. As regards the question of the extension of the forest area, it is shown on the highest authority that there is in these islands a very large area of waste, heather, and rough pasture or land out of cultivation, amounting in all to 21 million acres, on a large proportion of which afforestation could be profitably undertaken. Regular forest book-keeping is rare in Great Britain; but we believe the various estimates of profit obtained from the cultivation of timber, which have been laid before both inquiries, to be substantially correct. These show that excellent returns, even with indifferent management, have often been obtained from plantations formed on land of little or no value for any other purpose.

Profits in Germany.

8. Dr Schlich gives corroborating evidence from the Continental forests, where accurate book-keeping has long been practised. As an example, he says, referring to Saxony: "I have selected one of the ranges which is by no means the best. It is a district called the Anthonsthal Range, an area of 4072 acres, managed by a highly trained forester, situated in the Erzgebirge, between an elevation of 1500 and 2700 feet. . . . Distinguishing between four quality classes of soil, and calling 1 the best and 4 the least, the average quality is 2·7; it is therefore between second and third quality. The species grown there are 93 per cent. spruce, 3 per cent. silver fir, Scottish pine and beech, and 4 per cent. blanks for certain reasons. The

growing stock in this forest in 1839 averaged 2128 cubic feet per acre, and in 1893 it was 3276 cubic feet. The receipts per acre were 48·3s., and the expenses 10·3s., the net receipts being 38s. per acre per annum." This statement refers to land not worth more than 4s. per acre per annum for agricultural or pastoral purposes.

Importance of Afforestation.

9. The importance of afforestation in such a district as the Highlands of Scotland will be readily grasped. Rough land is extensive, capital as a rule scarce, and great woodland areas, where well managed, have proved financially successful, while profits on sheep farming have of late years reached a very low point. Land under forests would give healthy employment to a much greater number of persons than the same area under sheep. Many hill pastoral farms have one shepherd to three or four thousand acres, but much of such land, for various reasons, is unsuited to the growth of timber for profit. We believe that we are well within the mark in assuming that land quite capable of producing high-class timber employs only one shepherd per thousand acres if used as a sheep run; while all the evidence on this point goes to show that similar land when under timber, gives employment to at least one man per hundred acres; and this without taking account of the labour requisite to remove and work up the timber. The possibilities, therefore, of forestry as a means of furnishing remunerative labour to an increased rural population are great.

Afforestation of Waste Lands.

10. It will be found in our evidence that experts of high authority have recorded the opinion, already expressed in many reliable publications, that the world is rapidly approaching a shortage, if not actual dearth, in its supply of coniferous timber, which constitutes between 80 and 90 per cent. of the total British timber imports. The great area of waste land in these islands which might be afforested, and with regard to which such valuable evidence has been led, thus becomes a matter of grave national concern. No individual effort is likely to cope with such extensive afforestation, not only because British forestry, as now practised, is inefficient, but because of the capital required, the time during which it remains sunk before producing income,

and the lack of all security on private estates for continuous good management from the time that the forest is formed until matured timber is placed upon the market. We do not feel justified in urging the Government to embark forthwith upon any general scheme of State Forests under present circumstances; but the question of planting suitable waste lands under the control of the Crown, or over which the Crown exercises manorial rights, where it may be proved practicable and desirable, is, for the reasons above mentioned, worth the attention of the Commissioners of Woods and Forests.

11. In order that the country should be enabled to appreciate the extent to which a great rural industry might be created in the national interest, and to clear the way for any effective treatment of the allied questions of the utilisation of waste land and the increase of the woodland areas, we recommend that the Government department charged with the collection of land statistics, should take steps to compile a statement of areas presumably suitable for afforestation in Great Britain.

Existing Woodlands.

12. The present condition of existing woodlands has been repeatedly and clearly reviewed by many eminent authorities. It is the common verdict that timber of the kind and quality imported in such large quantities from the Baltic and similar temperate regions can be grown as well here as anywhere; in fact, it is a matter of common knowledge that European "red wood" and "white wood," so highly esteemed for structural purposes, are yielded by the Scots pine and the spruce, two of the commonest trees of British woodlands. That foreign is so generally preferred to home-grown timber is in no way due to unsuitability of soil or climate, but is entirely due to our neglect of sylvicultural principles. It is hardly too much to say that until within the last ten years or so owners of woodlands, with few exceptions, failed to realise that the shape, size, and quality of trees could be influenced by anything that they could do. They seemed to imagine that the character of the final product was largely a matter of accident, whereas it is mainly determined by management. They failed to recognise that cultural treatment which suits oak or ash is unsuited to pine or spruce; and so it has come to pass that British coniferous timber has been generally excluded by architects from building specifications. As another instance of this, we may refer

to the statements supplied by the Post Office as to the unsuitability of home-grown pine for telegraph poles.

Education.

13. That the yield of our woodlands can be materially improved admits of no doubt, and the evidence before us unanimously favours immediate and effective provision for bringing systematised instruction within the reach of owners, agents, foresters, and woodmen. This has been on all sides emphasised as the first requisite in any project for the improvement of forestry, and consequently stands out as the cardinal point of our recommendations.

University Education.

14. It is clear that the same class of instruction is not suitable for, and will not commend itself to, all the different grades of persons who have to deal, in some capacity or other, with woodlands. The natural centres for the instruction in forestry of the future owners and agents, under present conditions, are the universities and provincial colleges. Here additional facilities for theoretical instruction and practical demonstration are required. Certain witnesses examined before the Select Committee in 1885-87 expressed the opinion that forestry instruction might consist of special lectures bearing on tree-growth, to be given by Professors of Chemistry, Botany, Geology, or Agriculture. Even now, if one may judge by what sometimes passes under the name of forestry instruction, this idea is not altogether extinct. It cannot be too strongly emphasised that such instruction alone is not forestry, but only the necessary foundation on which the pupil grafts the study of forestry proper, that is to say, the profitable production of trees grown in masses. We consider that the scope and character of the instruction given at Edinburgh University, which we visited, is the least that should be aimed at, though it might, with advantage, be carried considerably further, and that better facilities should be provided. Similar courses should be provided at Oxford and Cambridge, as well as in all the agricultural colleges, and colleges with agricultural departments, which are subsidised by the Board of Agriculture or by the Scotch Education Department. Our attention has been directed to recent developments in the United States of America, where forestry instruction, both in the lecture-room and the woods, has been introduced into many of the universities and

colleges. At Yale and Cornell, for instance, students may proceed to a special degree in forestry.

Example Plots.

15. Even where access may be had to private woods, it is exceedingly desirable that collegiate instruction in forestry should be illustrated by means of example plots (the German *Forstgarten*). These are a considerable feature of the teaching in the university of Giessen and elsewhere on the Continent, and they have been reproduced, on a small scale, at Coopers Hill and on the Northumberland Demonstration Farm. If each plot be made of sufficient size, say three acres, it is capable not only of demonstrating principles, and the effect of mixing and management, but also, within limits, of yielding comparative financial results. A total area of 100–200 acres at each centre would be necessary and sufficient for this purpose. In confirmation of this opinion, Professor Schwappach allows us to quote his view that the plots at Giessen (the whole area of which is only $16\frac{1}{2}$ acres) are too small, and that the serious effects of curtailed space are already being felt. We have made an inspection of several areas of land near Cambridge, one of which could doubtless be bought for such a purpose, and similar facilities could probably be secured near Edinburgh and other centres of instruction.

16. The desirability of a great State Forest School on the model of Nancy or of Eberswalde has not escaped our attention, but we do not feel justified, under present conditions, in recommending so great an outlay as would be necessitated by the creation of such an institution. We think, however, that many of the advantages of an institution of this type could be secured at a comparatively small outlay by the transference of the Forestry Department at Coopers Hill to a university centre. This would at once place the highest form of forestry education available in this country within the reach of a large proportion of the prospective landowners and land-agents, while the advantages to the candidates for the Indian Forest Service of three years' residence in a university are obvious. The colonies make increasing demands on this country for qualified forest experts, and we anticipate that an increasing number of lecturers and advisory experts will be required for work in the United Kingdom. Our universities contain many students thoroughly well-grounded in natural science and economics, who, at the end

of their period of study of pure subjects, would readily be attracted to the study of forestry, and would rapidly qualify as forest experts.

State Demonstration Forests.

17. For effective instruction, however, a large area of woodland for purposes of practical demonstration is an absolute necessity. Professional equally with scientific witnesses pressed for instruction or demonstration areas, under State or corporate control, so as to secure that continuity of management without which a sustained annual yield and a maximum return is impossible.

18. There has been a growing feeling of late years amongst those who interest themselves in forestry in this country, that no scheme for the general improvement of present conditions can be satisfactory that does not provide for the establishment of at least two large State forests, which shall demonstrate the most perfect technical and economic developments of the art of forestry. At present there are no large wooded areas in this country—whether public or private—which foresters and others may visit for the purpose of seeing the working and results of systems that they may think of adopting: they are unable to move along the path of progress, because no concrete examples of typical systems are available for inspection. Then, again, there is a feeling of uncertainty in regard to the expenses and profits of forestry, that must always exist where figures are taken from private accounts; and this, even assuming that such accounts are reliable and sufficiently detailed, and are open to inspection. These State forests would also serve as the training-ground for many of our young foresters, whose education will be dealt with later.

19. Such areas, properly organised, would afford as striking an object-lesson as any to be found within the sphere of technical education; every proved and appropriate method for the economical and effective management of woodlands and the utilisation of forest products would be employed under competent direction. But to be of the highest value, such forests must not only exemplify definite sylvicultural systems; they must also be managed as commercial undertakings, so as to produce the best financial results.

20. We have stated that we consider it necessary to have

"example plots" in connection with the universities and other centres of instruction, as well as two large State demonstration areas; and it may be well here to explain why both are required. The example plots should embrace a comparatively small area, and comprise an arboretum or collection of specimen trees, and also an area devoted to the experimental planting and growth of trees in masses up to a certain age. Such an area cannot, from the very nature of the objects aimed at, be expected to yield a profit, or to give conclusive results as to the economic growth of trees in masses. The demonstration forest, on the other hand, would be managed according to a working plan, drawn up so that the area should yield as large a profit as possible. Forest students from the universities and others would spend a week or two at a time, or longer, in the demonstration forest; but they, and the lecturer, also require an area close at hand to which resort can be more frequently made. As showing more exactly the uses of such example plots, we have printed in the Appendix a summary description of the *Forstgarten* attached to Giessen University.

21. We are of opinion that not more than two such demonstration areas—one in England and one in Scotland—are at present required. In order to provide suitable centres for fully demonstrating the principles of forestry, these areas should be large, preferably from 2000 to 10,000 acres, and should include within their boundaries as great a variety of soil, aspect, altitude, etc., as possible, so that they may afford practical illustrations of the proper management of forests under all sorts of conditions.

22. In England, with its Crown Forests, an instruction area could be readily made available with the consent of the State and the co-operation of the Commissioners of Woods and Forests. In Scotland, where the amount of land remaining vested in the Crown is small, an area should be bought, and it would not be unreasonable to ask the State to re-invest in land to the extent of, say, £50,000. We think that, inasmuch as the benefit to landowners to be derived from the instruction and example provided by such a demonstration forest will be very considerable, it would not be too much to expect that they should co-operate by giving a guarantee to the Government for the interest on the purchase money.

23. With a view to the selection of suitable districts for demonstration areas within reasonable reach of the centres of

instruction, and, as above indicated, confining our attention for financial reasons to Crown forests so far as regards England, we have inspected the Forest of Dean in Gloucestershire, and the Alice Holt Woods and Bere Forest in Hampshire, as well as woods in the counties of Fife, Peebles, Perth, Inverness, and Moray. Although covering an area somewhat smaller than that indicated above as the minimum desirable, we consider that the Alice Holt Woods could be more readily brought into good working order, and could be made to serve as a useful object-lesson at an earlier date, than any of the other woods belonging to the Crown; and we accordingly recommend that they should be made available as soon as possible, to serve as a demonstration area. As regards a locality in Scotland, we are not at present in a position to make any specific recommendation.

Agricultural Colleges.

24. With regard to the training of young men who propose to take up land agency as a profession, and who cannot afford to spend three years at a university, we consider that facilities for imparting sound knowledge of the elements of forestry should be provided at the various colleges supplying instruction in agriculture in Great Britain. Inasmuch as land-agents are entrusted with the management of large estates, which usually comprise a certain area under wood, it is clearly requisite that they should know how to turn that area, as well as the land under other crops, to the best account. We have it in evidence, however, that comparatively few land-agents possess a competent knowledge of forestry. Instruction in the elements of forestry should therefore form part of the regular curriculum at all such colleges; and we suggest that this subject should receive greater prominence at such institutions, in order that students may qualify themselves to undertake the efficient supervision of what is an important, and should be a profitable, part of many estates.

Training of Foresters and Woodmen.

25. For working foresters or woodmen, whose prospective salaries do not at present justify their attending for any length of time at the universities or colleges, a practical training in the woods naturally forms the best basis of instruction, and for this the State demonstration areas already recommended offer the

most suitable medium. But even here, if the foresters are to spend sufficient time in them to acquire a competent practical knowledge of their subject, the question of means presents itself; and, moreover, manual work must be supplemented by theoretical study. We accordingly recommend that student-foresters be taken on as employees in receipt of regular wages, and that classes be held, which they should be required to attend.

26. In order to provide for the instruction to be given in these demonstration forests, we suggest that the State should equip each of them with buildings, which would offer accommodation for a director and his assistant, and, if necessary, for ten to twenty student-foresters. We do not anticipate that the cost of the buildings would exceed £5000 to £7500 in each forest. The director should be placed in suitable relationship with the lecturers at the various colleges, and would be responsible for the management of the forest and for the general conduct of the school, and would, at the same time, give instruction in sylviculture and forest management, mensuration and valuation. His assistant would teach the subjects of the growth, structure, and diseases of timber, the formation and properties of soil, and forest entomology. We anticipate that the annual expense of maintenance of each of these schools would be about £750, in which the chief items would be the salaries of the director and his assistant. The classes should be open to young foresters and woodmen selected by County Council Technical Education Committees or otherwise, the normal term of residence being two years. These students would thus work in the woods, and receive systematic instruction. Experience of farm schools shows that young men can be boarded and lodged for 10s. to 15s. per week. We are convinced that at a very early date, if not immediately, the advantages to foresters of the instruction to be gained in these areas would be so fully recognised that there would be keen competition to obtain an entry into the lower grades of the service, and that the whole of the manual labour required in the demonstration area would be performed by foresters who come to learn. As an example of what may be expected, we may point to the system at the Royal Botanic Gardens, Kew, where the labourers and gardeners are now recruited entirely from among qualified gardeners who are anxious to improve their knowledge by working there for a certain period, and receiving instruction.

27. For such foresters and woodmen as are unable to leave their posts to go through the training in the demonstration forests, or for whom there are no vacancies, we recommend that the various agricultural colleges should institute short courses in forestry, similar to the short courses in agriculture and dairying which have been so marked a feature of technical education in recent years. The classes held in the demonstration areas should also, upon payment of a small fee, be open to students from outside, and not confined to the student-foresters. We suggest also that County Councils should offer small scholarships or bursaries to enable students to attend classes in forestry, while many owners of woods would probably find it advantageous to pay the expenses of their foresters, so as to enable them to attend short courses. Lectures, under the auspices of the County Council, might also be given with advantage in neighbourhoods where woods are numerous, as has already been done in Northumberland and Aberdeenshire. Supplementary to the class-room instruction, and sometimes independent of it, the instructor should visit woods where the owner or forester expresses a desire for advice, and should give practical demonstrations in planting, thinning, and the other operations of forestry. It may be pointed out that in the United States of America there is in the Department of Agriculture a Bureau of Forestry, equipped with a staff of field assistants, whose services in the preparation of working plans, and in the matter of practical advice on the ground, are at the disposal of private owners.

Minor Considerations.

Local Rates.

28. Evidence has been laid before the Committee to the effect that in England the incidence of rates on plantations, and the valuation of woodlands made by Assessment Committees, are subjects of complaint. It has been suggested that, as in some other countries, young plantations should not be rated so long as they yield no return; also that the relief given to agricultural land by the State should be extended to woodland. There are fewer similar complaints from Scotland, although it is interesting to notice that in Scotland a plantation when grazed by stock is rated on its grass rent, the timber bearing no rates; but were the same wood properly managed and stock excluded, the timber

alone would bear the rates. We are not, however, prepared to make any recommendation on the subject; though attention may be directed to the incidence of taxation in certain foreign countries.

29. We have had considerable evidence that claims are made upon timber merchants and others by local authorities on account of "extraordinary traffic," it being alleged that the heavy weight of timber damages the roadway; and it has been represented to us that such claims hamper the industry. We are of opinion that these claims are unreasonable, more especially in view of the fact that woodlands, by paying rates during the many years when they are yielding nothing, and when no timber is therefore moved along the roads, have contributed to the maintenance of these roads, from which they derive no benefit until the crop is brought to market.

Estate Duties.

30. Three systems of levying the Estate Duty on woodlands have already been tried since the introduction of the Finance Act, 1894; and that now in force is peculiarly unfair to the poorer districts. The ordinary rate of duty on agricultural estates rests on a maximum basis of twenty-five times the annual value of the land, the consequence being that in richer districts, where land is valued up to this amount, the timber itself bears no duty. In the poorer districts of Britain, however, and in Ireland, where, under the Finance Act, estates are valued down to sixteen years' purchase, the Death Duty can, where there is a crop of timber to be valued, be levied upon the latter until the maximum is reached; the maximum of twenty-five years' purchase thereby becoming, in those cases where an estate is sufficiently wooded, the minimum basis. It is therefore conceivable that duty calculated on nine years' purchase of an estate could be levied on its timber, which, were the estate more agriculturally prosperous, would be totally exempt. An estate in the comparatively rich lands of Devonshire, for example, might escape a Death Duty upon timber which one in Argyllshire might have to bear to the extent of a fourth of the whole duty raised. Moreover, the pressure of such a Death Duty on timber must both act as a bar to afforestation in districts most needing it, and compel the realisation of immature timber, thus preventing the practice of sound forestry. We feel that this irregularity in the incidence of the duties needs immediate revision.

Damage by Sparks.

31. Some adequate security against the raising of fires by sparks from railway engines seems equally feasible and desirable. Inasmuch as a Bill dealing with this question, introduced during the last session, has already received your support, it is not necessary to dwell further upon this subject, than to urge the desirability of some such Bill becoming law at the earliest opportunity.

Ground Game.

32. The presence of ground game is ruinous to systematic forestry and to sylviculture by natural regeneration. We think that, in the public interest, the owner of plantations who himself keeps down ground game should have the right to recover compensation for damage caused by hares and rabbits from adjoining property.

State Loans.

33. It has been suggested that the State should advance loans to encourage afforestation; and interesting evidence has been led as to whether timber grown under adequate inspection on a regular plan, protected by shelter-belts, and insured against fire, could not itself be made security for loans, apart altogether from the land upon which it is grown. Whilst agreeing that any such scheme would most effectively tend towards the extension and better management of woodlands, we advise that the State should concentrate any efforts it may make upon the provision of adequate facilities for instruction. Once adequate provision for training is made, and the consequent improvement of our present woodlands becomes manifest, it will then be opportune to raise the subject either of loans, or of State forests, in favour of which there is such a large consensus of expert opinion. At the same time, attention may be called to the existing facilities provided by Governments abroad for obtaining loans.

Statistics of Woodlands.

34. A clearer definition of the term "Woodlands" is required for the preparation of Agricultural Returns and for the Ordnance Survey. We recommend that returns be collected of the acreage under wood, in continuation of the Board of Agriculture's Return of 1895. In view of the evidence we have received as to the

uncertainty concerning what is to be understood by the term "Woodlands," we suggest that the term be defined to mean "land altogether or mainly used for the growth of wood." We also suggest that the Return distinguish between (1) recent plantations, *i.e.*, land planted or replanted within the last ten years; (2) pure coppice; (3) coppice with standards; and (4) other woods. For the purpose of the Agricultural Returns, coppice may be taken to include woods that are cut over periodically, and reproduce themselves naturally by stool shoots.

Municipal Waterworks Areas.

35. We have received valuable evidence as to the work undertaken by the Corporation of Liverpool to afforest the catchment area, around Lake Vyrnwy, of the water-supply of that city, and some other municipalities have also had similar schemes placed before them. We are of opinion that this is a direction in which a considerable amount of afforestation may usefully be done. To prevent all risk of contamination of the water-supply, it is at the present day the policy to remove, as far as possible, all human habitations and farm buildings, as well as live stock, from such areas. These areas, therefore, however well suited they may otherwise be for the production of crops or the maintenance of live stock, are practically derelict, and yield no return, beyond that obtained from the sale of the water, upon what is usually a very heavy capital expenditure on the part of the Corporation. We desire therefore to draw the attention of Corporations to the advantages and profits to be derived from planting their catchment areas with trees, which ultimately will not only contribute materially to the retention of the rain that falls over the area, and thus assist in regulating the water-supply and in preventing floods and water-famines, but will tend to the purification of the water, and should also, properly managed, yield a fair and regular income on the capital expended. Such catchment areas, if they are to be thus utilised, should be placed under the control of a competent forester. And inasmuch as they will be under corporate control, and less subject to changes of management than land owned by private individuals, there is no reason why they should not also ultimately serve as demonstration forests, and be available for the instruction of students. For example, the catchment areas of the Liverpool and Birmingham Corporation Waterworks, situated

in Wales, within reach of university colleges possessing agricultural departments, could, with the consent of the Corporations concerned, be used for these purposes.

Conclusions.

36. Our conclusions may be summarised as follows:—

We recommend—

(*a*) That two areas for practical demonstration be acquired, the one in England and the other in Scotland, of not less than 2000 acres, if possible, nor over 10,000 acres in each case. We suggest that the Alice Holt Woods in Hampshire be made available as soon as possible to serve as a Demonstration Area in England; and that a suitable estate be purchased in Scotland, as convenient as possible to Edinburgh, for the same purpose. These recommendations would have to be carried out by arrangement between the Commissioners of Woods and Forests and the Board of Agriculture; and assistance should be looked for from local authorities, societies, and individuals interested in forestry and technical education.

(*b*) That additional facilities for instruction be afforded, by the appointment of a lecturer on forestry in connection with each of the universities of Cambridge and Oxford, and that example plots, as defined in paragraph 15, be provided in connection with each of these centres and with Edinburgh.

(*c*) That a good grounding in forestry form an integral part of the curriculum of the colleges providing instruction in Agriculture in Great Britain; and that short courses of instruction, suitable for the requirements of young foresters, be also provided there. Instructors should also be available for giving practical advice in connection with the management of woods, the owners of which desire an expert's opinion.

(*d*) That provision be made for the education of foresters and woodmen, by employing students to work in both the demonstration forests; and that suitable buildings be erected on the ground for the instruction and, where necessary, for the accommodation of these student-foresters.

(*e*) That lectures be given, under the auspices of the County Councils, in neighbourhoods where there is a considerable area under wood; and that scholarships be offered in such counties to enable working foresters to attend courses of lectures.

(*f*) That the inequality shown to exist in the levy of the Estate Duty on timber be redressed.

(*g*) That the Government be urged to secure the early enactment of a Bill to protect owners of woods against loss by fire caused by sparks from locomotives.

(*h*) That the inquiry conducted in 1895, concerning the area of woodlands, be repeated by the Board of Agriculture, and that details concerning the character of the timber crop grown upon them be ascertained.

(*i*) That the attention of Corporations and Municipalities be drawn to the desirability of planting with trees the catchment areas of their water-supply.

We have much pleasure in expressing our great appreciation of the zeal and ability of Mr R. H. Hooker, who has performed the duties of Secretary to our entire satisfaction.

We have the honour to be,

SIR,

Your most obedient Servants,

R. C. MUNRO FERGUSON.
J. F. L. ROLLESTON.
E. STAFFORD HOWARD.
W. SCHLICH.
FRED. BAILEY.
J. R. CAMPBELL.
J. HERBERT LEWIS.
GEORGE MARSHALL.
WM. SOMERVILLE.

R. H. HOOKER, *Secretary*,
29th November 1902.

II. *Robert Hartig on the Larch Disease.*[1]

Peziza (Helotium) Willkommii.

The fungus which induces the larch-blister is the cause of one of the most destructive and widely distributed diseases of the larch. It was first described by Willkomm, who, however, made a mistake in its identification, and called it *Corticum amorphum.*

Corticum, in fact, bears only a superficial resemblance to *Peziza*, and belongs to the *Basidiomycetes.* On the strength of a macroscopic similarity, also, it was next said to be *Peziza calycina*, till I recognised that in this fungus we had to do with a new and still unknown species. The ascophore is at once distinguishable from that of *P. calycina* by its very short cup-stalk. So much by way of explaining the regrettable confusion of names.

The larch is a forest tree which thrives splendidly throughout the whole of Germany, suffering but little from frost, at least not more so than other indigenous trees. Originally, however, its distribution was confined to high Alpine regions, because only there could it offer successful resistance to its enemies. Amongst these enemies are to be classed a number of insects, notably the Larch moth, *Coleophora laricella.* This insect is also found in Alpine regions to a considerable height (over 4000 feet), and so widely is it distributed, and so numerously represented, that it is at first surprising why it does hardly any damage there. This is easily explained from the fact that at high elevations the transition from winter to spring is very rapid, and the development of the leaf-fascicles occupies but a short time. On the plains the larch begins to display green buds even towards the end of March, but their further development is often retarded for a long time, until, in the beginning of May, the growth of the leaves progresses more rapidly. This is the dangerous period for the larch, because when the caterpillars awake from hibernation they begin to devour the green buds, and when growth proceeds slowly these are largely consumed, and the trees are, for the most part, defoliated. On the other hand, when the leaf-fascicles develop rapidly, a small proportion of the foliage suffices to feed the caterpillars. In Alpine regions the short

[1] Reprinted by permission from *Text-Book of the Diseases of Trees*, by Professor R. Hartig, of the University of Munich. Translated by William Somerville, D.Œc., B.Sc., F.R.S.E., F.L.S.; Revised and Edited, with a Preface, by H. Marshall Ward, D.Sc., F.R.S., F.L.S., F.R.H.S. (London: Macmillan & Co. 1894.) This is universally recognised as the standard work on the subject of tree diseases.—Hon. Ed.

spring saves the larches from complete or excessive defoliation, which, especially when often repeated, results in the crippling and death of the trees. The Larch Aphis also, *Chermes laricis*, damages the foliage of the larch to no small extent, though not nearly so much as the moth. The disease which is induced by *P. Willkommii* differs entirely from the crippling which larches experience as a result of the attack of the moth, aphis, etc. This parasite is indigenous to high Alpine regions, where it produces the same disease that has resulted in the destruction of innumerable woods in Germany, Denmark, and Scotland. In its native habitat, however, it is only under special conditions of environment that it destroys whole woods. In order correctly to appreciate this point, we must first review the course of development of the parasite.

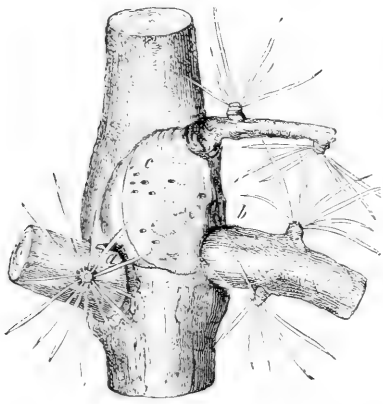


FIG. 1. — A canker-spot that has been recently formed in the upper portion of the stem of an eight-year-old larch from the Tyrol. Infection has occurred above the branch, *b*, where a crack has been formed in the tissues, owing to the branch having been depressed under a load of snow. Numerous immature ascophores, *c*, have already formed on the dead cortex.

The spores—which originate in cup-shaped fructifications to be afterwards described—soon germinate in the presence of sufficient moisture, with effect not on an uninjured tree, however, but only on a wound. Such wounds are very often due to hailstones, or to the dwarf-shoots being devoured in spring —as was mentioned above—or they are formed in the upper angle of the base of a branch (Fig. 1, *b*) owing to its depression under accumulations of snow or hoar-frost. From such wounds the vigorous, copiously ramifying, septate mycelium spreads in the soft bast, partly between and partly in the cells advancing in the sieve-tubes, and killing and browning the tissues. The mycelium also grows into the wood, and even penetrates as far as the medulla.

That portion of the corticle tissues which has been killed

during the first year dries up and appears as a depression, especially after growth in thickness has been resumed by the healthy part of the tree (Fig. 1).

In summer the growth of the mycelium ceases, and an unusually broad layer of cork is formed for the protection of the tree along the boundary between the sound and diseased tissues. These layers of cork (Fig. 2, *b b*) which form between the dead and living tissues induce external rupturing of the cortex at points along the boundary of the canker-spot (Fig. 3), the result being that turpentine flows from the interior of the tree. Year by year the canker-spot enlarges along its whole periphery, rather more rapidly, however, longitudinally than horizontally, and it is probably the vital activity of the cortical tissues which in summer causes a temporary interruption to the progress of the parasite. In autumn the mycelium again succeeds in entering the living bast, either through the cambium region or by way of the wood, so that, as a matter of fact, the layer of cork is only of slight service. In proportion as the passage of the plastic substances is confined to one side of the tree, growth of the wood and bast is stimulated at that part (Fig. 2). Thus the conflict between parasite and host-plant may remain long undecided, and in the Tyrol I found larches still alive with blisters of a hundred years' standing.

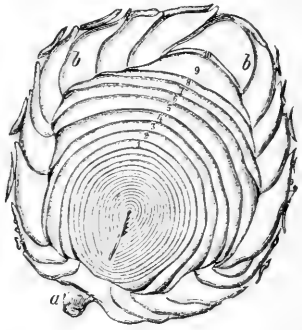


FIG. 2. — Cross section of a well-grown larch which has been attacked by *P. Willkommii*. Infection had occurred ten years previously at the dwarf shoot, *a*. Each year the mycelium advances in opposite directions, in spite of the fact that a layer of cork, *b b*, is formed at the beginning of each growing season along the boundary of the living tissue. In the immediately preceding year a very small quantity of wood had been formed.

Should the parasite advance relatively quickly, and, at the same time, should the growth of the tree at the affected part be slow, then the canker-spot soon embraces the whole stem or branch (Fig. 2), and the tree dies above this spot.

By artificial mycelial infection one may, almost without fail, produce a blister on any part of a sound larch.

Soon after the death of the cortical tissues, the cushion-like stromata of the parasite originate in the form of small yellowish-white pustules of the size of a pin-head (Fig. 1 *c*, Fig. 3 *a*). In the interior of these stromata, and partly on their surface as well, vermiform passages or roundish cavities are formed, the walls of which are covered with innumerable club-shaped sterigmata, at whose apex extremely minute cells originate. Whether these organs, which appear to be incapable of germination, are abortive gonidia, or are to be classed with spermatia, remains, in the meantime, undetermined. In this place it is specially important to emphasise the fact that they are incapable of assisting in the distribution of the parasite.

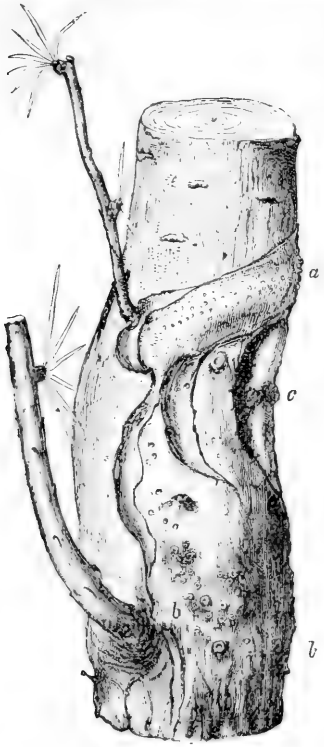


FIG. 3.—A canker-spot of two years' standing, close to the collar, and hidden by the grass. On the upper portion, which is exposed to air-currents, the stromata are abortive; but in the lower portion, which has been kept moist, they have developed to form vigorous ascocarps.

The small stromata are very readily affected by a dry atmosphere and by air-currents, in which they quickly wither and die. They develop only when constantly surrounded by moist air. Under such circumstances they produce the well-known cup-shaped ascocarps (Fig. 3, *b b*). These possess a hymenium of a fine red colour. The hymenium consists of innumerable asci surrounded by filamentous paraphyses. Eight colourless spores are formed in the interior of each ascus. The fact that the mycelium penetrates even into the wood, and kills it, explains why one or a few small blisters may greatly interfere with the growth of the whole stem. Numerous cup-shaped ascocarps ultimately make their appearance on the dead cortex, and these are met with even when blisters are absent.

In muggy situations the larches soon become diseased, and die in a few years without any large blisters making their appearance. The cup-shaped ascocarps of the parasite appear upon the cortex. It looks as though the large quantity of water present in larches whose transpiration is interfered with greatly favours the development and spread of the fungus in the wood, and that the disease consequently spreads throughout the whole plant.

The foregoing descriptive sketch of the results of my investigations may suffice to explain the recognised facts connected with the occurrence and distribution of the disease.

The larch-blister has been indigenous to high Alpine regions from time immemorial. It occurs, however, with marked intensity only in damp muggy valleys in immediate proximity to lakes (*e.g.*, the Achensee in the Tyrol, etc.), though on plateaus it may also destroy a small tree here and there. Owing to the prevalence of air-currents, freely exposed ascocarps never ripen on plateaus and valley-slopes. The ascocarps ripen only on those blisters which are situated at the foot of the stem close to the ground, or on blistered branches that are in contact with the earth. This is owing to the surrounding high grass sheltering the young ascocarps against air-currents, and so keeping them moist.

In the early decades of this century, when the larch was planted in various parts of Germany, the enemy was left behind in its native habitat, and the trees flourished to perfection. Probably every old forester knows some groups of larches of the most stately growth which date back to that period. In consequence of these satisfactory results, the larch was generally planted throughout the whole of Germany. Most excellent results were obtained, even where the inferior quality of the soil held out but a poor prospect of success.

But after woods of all sizes had been established from the foot of the Alps to the coasts of the North Sea and Baltic, the fungus spread downwards from the Alps, to find everywhere the most favourable conditions for its development. These consisted of dense young pure woods, groups that had been formed in replanting up old beech woods, moist stagnant air, wounds caused by the moth, etc. Commerce also assisted to intensify the evil, diseased larches being sent out from the nurseries and transported from district to district.

Under these conditions the fructifications of the fungus attained

to luxuriant development and ripened their spores on the blisters, while the spores found ample opportunity of germinating, and of infecting the trees in the close pure woods. To-day but few of the many promising young woods remain. The larches have maintained their ground best in those woods where a few were introduced as advance-growth. The air circulating in the freely developed crowns has not only kept the disease in check, but has also prevented the spores from ripening on diseased specimens.

Supposing that we have to do with a diseased larch wood, it is first necessary to determine whether the damage is entirely due to the moth, or whether it is a case of fungoid blister.

Often enough both will appear in company. If it is simply a case of stunting in consequence of the attack of the moth, pruning away the branches till only the vigorous upper part of the crown remains may be permanently beneficial. The upper branches will grow vigorously, and may form a good, permanently healthy crown, especially as the moth is most destructive on the lower branches.

If it is a case of fungoid injury, pruning may assist somewhat only if the bole as a whole, and especially the part in the crown, is sound. If a tree is in vigorous growth, the smaller blisters low down on the stem, although they increase in size, will induce death only at an advanced age.

Blisters on the branches are, in themselves, of less importance. They merely contribute to the danger of the further spread of the disease by means of spores.

As regards the future cultivation on plains and at moderate elevations of this so essentially valuable tree, the following points may be noted in the light of what has been said. It should only be grown singly—that is to say, it should form but a small part of a mixture, and it ought, if possible, to be planted somewhat in advance of the other trees. It should never be planted in pure woods, and should always occupy an open situation. Where diseased woods are present in the immediate neighbourhood, it is better to abandon the idea of cultivating this tree. The greatest caution is to be exercised in procuring young trees from outside sources, and plants showing any signs of disease in the seed or plant beds must at once be removed and burned.

III. *Larch and Spruce Fir Canker.*[1] By George Massee, F.L.S.

The following remarks bearing on these destructive diseases are the outcome of observations and experiments extending over a period of sixteen years, and conducted in various parts of England extending from Yorkshire to Hampshire.

Only those experiments considered necessary to support the reasons advanced as to the primary causes for the widespread devastation, and the proof that such injury is due to certain fungi, are given; fuller details as to methods, etc., will be recorded elsewhere.

Larch Canker.

Dasyscypha calycina, Fuckel, Symb. Myc., p. 305 (1869).
Syn. *Peziza calycina*, Schum., Enum. Pl. Saell., ii. p. 424 (1803); *Peziza Willkomii*, Hartig, Unters. Forstbot. Inst. Münch, i. p. 63, Taf. IV. pp. 10-20; *Corticium amorphum*, Willkomm; Die mikros. Feinde des Waldes, Heft II. p. 167, 4 pl. (1867).

This destructive parasite is present in greater or less quantity, depending on local conditions, wherever the larch (*Larix europæa*, D.C.) grows. In this country it also occurs on the Scots pine (*Pinus sylvestris*, L.) and on the silver fir (*Abies pectinata*, D.C.). It has been met with on young branches of the mountain pine (*Pinus pumilio*, Haenke) in Southern Europe. Finally, it occurs on the balsam fir (*Abies balsamea*, Miller) in the United States.

D. calycina is a wound-parasite, as proved by the researches of Hartig (1); in other words, it cannot gain an entrance into the tissues of a living tree except through a wound. Respecting the origin and nature of these wounds, more will be said later.

Carruthers (2) has recently stated that *D. calycina* is not a wound-parasite, but that its spores can penetrate the young uninjured bark of the larch. This idea is not supported by any account of actual experiments, and is quite contrary to my own experience. One hundred and four inoculations on young unwounded branches of larch, in some instances seedlings, in others old trees, extending over several years, made at different seasons and under varied conditions, by using fresh ascospores which

[1] Reprinted from the *Journal of the Board of Agriculture*, by permission of the Controller of His Majesty's Stationery Office.

germinated readily in water, invariably resulted in failure to infect the branch experimented upon. The same failure attended eleven experiments of inoculation with the conidia of *D. calycina*.

On the other hand, inoculation by means of placing ascospores, or mycelium contained in either wood or resin, on a wounded surface, almost invariably resulted in establishing the disease, the only accepted evidence being the production of conidia or ascophores. Branches two or three years old are most susceptible, and out of numerous experiments I have never succeeded in inoculating a branch when more than five years old.

Quite young trees—under ten years—are much more readily inoculated than older trees, although I have sometimes succeeded in inoculating young branches of very old trees.

I have never succeeded in producing canker by using the conidia (=spermatia of some authors) of the fungus for inoculation purposes, even when deposited in quantity in a protected wound; nevertheless, the conidia germinate freely when placed in contact with a very thin section of larch bark in a hanging drop (Fig. 6). The ascospores also germinate and push out strong germ-tubes under similar conditions (Fig. 7).

Hartig (1), who, like Willkomm (3), figures the conidia as elliptical, whereas I find them to be perfectly globose, did not succeed in causing these bodies to germinate, and states distinctly that the conidia are incapable of infecting the larch; this statement is repeated by Marshall Ward (4). Although, as already stated, I have never succeeded in producing canker by inoculation with conidia, yet the fact that these bodies do germinate, and their constant presence along with the cups or ascophore form of fruit on canker wounds, seem to suggest that possibly they may, under certain undiscovered conditions, be the cause of the disease. The conidia-bearing pustules are very minute and of a dull yellow colour, and although by no means rare, are apt to be overlooked unless specially searched for (Figs. 2, 3, Pl. I.).

Wounds for artificial infection were usually made by inserting the point of a lancet quite through the bark to the cambium zone, exercising at the same time a little lateral pressure, so that a small crack about two lines long was made. Into this wound either ascospores or mycelium were introduced. When the weather was very warm and dry, the inoculated wounds were protected for a week by a covering of oiled paper to prevent too

rapid drying. The first indication of the success of an inoculation was usually manifested during the sixth to eighth week after the experiment, when the outer dead bark became cracked and raised, due to accelerated growth of the living cortex underneath; and at the expiration of about ten weeks a few pustules of conidia, accompanied by a small number of usually imperfectly developed ascophores, appeared if the weather continued moist; but, as a rule, it was not until the following year, in April or May, that well-formed cups were produced.

In addition to the kind of wound described above, I have proved by repeated experiments that a pin-prick makes a wound sufficiently large for the purpose of a successful inoculation, if spores are placed in the drop of liquid oozing out of the wound.

May is the month during which artificial infection takes most readily, and I imagine that the same holds good in a state of nature, for the following reasons. Well-developed ascophores are most abundant during this month, and there is a superabundance of sap which readily oozes to the surface through the smallest puncture it is possible to make with a fine needle. In this extruded sap the ascospores readily germinate and enter the living tissues of the tree.

The large percentage of instances where the canker appeared only at the point of artificial inoculation proved that the disease was in reality the outcome of such inoculation; nevertheless, in two instances where four-year-old larches, growing in pots, and obtained from a locality where the disease was supposed to be entirely absent, were inoculated, I was surprised to find that in one tree the canker appeared simultaneously at three different points, two of which had not been artificially inoculated; and that in the second tree, artificial inoculation produced no result, but the canker appeared on another part.

The only explanation that can be suggested is that, in this instance, the disease must have existed in the locality where the trees were raised, and that infection had taken place from floating spores before the trees came into my possession.

That the ascospores when expelled from the asci in the cup do actually float in the atmosphere, was definitely proved by the following experiment, which was repeated on several occasions. Ordinary glass slips used for microscopic purposes, having about a square inch of their surface on one side smeared with dilute glycerine, which does not dry up when exposed to the air, were

suspended by means of thread, at distances varying from 6 to 18 inches from cankered spots bearing well-developed ascophores. Examined after twelve hours' exposure, numerous spores were found entrapped in the glycerine, which, on being placed in suitable medium, germinated readily. Similarly prepared slips of glass suspended haphazard in a plantation where canker abounded also caught floating spores. No conidia were observed on any of the slides.

The wounds occurring in nature through which inoculations take place, may be grouped under four headings: (*a*) wounds caused by wind, or by snow resting on the branches; (*b*) extrusion of sap caused by late frosts; (*c*) nibbling of the cortex by insects, and more especially the punctures made by the larch aphis (*Chermes laricis*, Hartig); (*d*) wounds made near the base of the stem when planting young trees.

As a broad rule, it may be stated that when trees under ten years of age are attacked by canker, they are either killed outright, or are so deformed that if they continue to grow, they are of very inferior value from an economic standpoint. The reason for this is that in the case of seedlings or very young trees, the main stem is the part usually attacked, whereas in older trees the bark of the trunk becomes so rigid that it is impervious to the punctures of aphides, and it is not so readily influenced by frost; and the only chance of admission to the cambium of the trunk is when branches are either broken off or more or less cracked at the point where they leave the trunk.

I have constantly observed that in the month of May—when practically all infection occurs—the proportion of sap is much greater in seedlings and quite young trees than in old ones. What I mean exactly is this, that if branches of equal age of a young and an old tree are wounded by inserting a needle or a lancet, sap oozes to the surface in the case of the young tree, but not in the old one.

It is this sap that retains floating spores, and also serves as a nutrient solution in which they readily germinate.

Commencing with the causes which lead to the development of canker in seedlings and young trees, the larch aphis (*Chermes laricis*, Hartig) is most responsible; in fact, I consider it to be no exaggeration to state that if the aphis could be obliterated, larch canker, as a destructive epidemic, would cease to exist in this country. As to whether the interdependence between aphis

and canker holds good in other countries, I am not in a position to state.

During the early part of May, it is not at all unusual to find the axils of many dwarf branches on the stems of seedling and young larches each occupied by an aphis "foundress" and her stalked eggs. Now, as to whether the foundress actually punctures the bark at this point or not, I have not been able to determine, but there is always a certain amount of moisture on the bark where a foundress is located, and I have repeatedly produced canker by placing ascospores underneath the foundress.

Situated on the bark quite near to each foundress is a small patch of white flocculent matter, the centre of which is occupied by a fairly large drop of sap. As evaporation proceeds after two or three days, the resinous portion of the sap alone remains and becomes solid (Fig. 5, Pl. I.). If spores are placed in this drop when first extruded, and in a liquid condition, canker follows.

The significance of this white fleck with its central drop of plant sap I have not been able to determine. Its constant presence is alluded to by Buckton (5), who also figures it, without comment or explanation. The one important feature in this connection is to remember that it is a channel through which inoculation can take place.

Professor Marshall Ward (4) considers that late frosts are to a great extent responsible for the prevalence of canker in larch. I have once observed in the middle of May, a time when seedlings and young larches are replete with sap, that after a sharp frost, followed by bright sunshine, the branches were studded with minute drops of sap, which eventually hardened into resin.

Ripe ascospores were not forthcoming at the time when this observation was made, but I can readily conceive that canker would have resulted if spores had been deposited on the freshly extruded beads of sap.

Owing to the comparative paucity of sap in the branches of old trees, a May frost would not be so likely to result in injury.

In the case of young trees, infection often takes place just above the ground line, and is thus explained by Dr Somerville (8):—"Not only is infection specially liable to occur low down on a stem on account of the abundance of moisture, but the chances of an outbreak of disease at such a place are also favoured by the frequent presence of wounds near the surface of the ground. These wounds may be caused by lifting the plants

from the nursery beds, or they may be formed by the feet or the tools of the workmen during planting. Where trees are planted by 'notching,' the turf is firmed round the base by the repeated application of the heel of the planter, and in doing so it not infrequently happens that the boot comes in contact with the stem and abrades the bark. And should the plant escape injury during planting, it is still very likely to be injured near the ground by rabbits, hares, voles, and other animals."

For the reasons already stated, the trunks of trees over ten years of age are practically safe against attack from canker, except near the apex, and there the drier air does not favour the earliest stage of inoculation so much as the damper conditions that prevail near the ground. If the trunk escapes the disease, canker attacking the branches at a later stage does not, as a rule, interfere with the continued growth and development of the tree.

The cup or ascophore varies considerably in size, ranging from two to five millimetres, externally snow-white, and minutely hairy under a pocket-lens; the disc varies from deep orange to red. The cup is not distinctly stalked, but is somewhat narrowed at the point of attachment The spores are variable in size, ranging from 18-25 × 6-8 μ; paraphyses longer than the asci (Fig. 2, Pl. II.).

The characteristic appearance of canker caused by the fungus is sufficiently familiar to most of those interested in the subject as to require no detailed description. Fig. 1, Pl. I., shows a typical canker of small dimensions, with the fungus—ascophores and conidia pustules—natural size.

The mycelium of the fungus is most abundant in the cortex and cambium region, but it also enters the wood (Fig. 26, Pl. III.).

In the great majority of instances, canker commences on a very young stem or branch, in the axil of a dwarf shoot, which was presumably occupied by an aphis "foundress," as already described. Again, when canker is present on a thick trunk or branch, there are almost invariably the remains of a dead branch in the centre of the canker depression. In the axil of the dead branch, which had been partly cracked away from its origin by snow or wind, the spores of the fungus first found an entrance into the then living tissues.

In addition to the larch and Scots pine, I have also succeeded in producing canker by artificial inoculation on branches of the

Siberian larch (*Larix sibirica*, Ledeb.), and the Japanese (*Larix leptolepis*, Endl.).

In the last named, inoculation was only effected after much perseverance, and on a seedling placed under conditions very favourable for the inception of the disease. It is quite possible that the Japanese larch would prove immune when growing in the open in this country.

Spruce Canker.

Dasyscypha resinaria, Rehm, Ascom. Lojk., No. 38 (1882).
Syn. *Peziza resinaria*, Cooke and Phil., Grevillea, iii. 185 (1875).

This parasite appears to be local in its distribution in Britain, but owing to the fact that to the naked eye, and even when examined with a pocket-lens, it is practically indistinguishable from the fungus causing larch canker, and as it has been generally considered that the last-named disease was always due to the presence of *Dasyscypha calycina*, it is quite probable that *Dasyscypha resinaria* is frequently passed over as *D. calycina*.

In this country *D. resinaria* is most frequently met with on the spruce (*Picea excelsa*, Link), and has occurred in Shropshire, Yorkshire, Surrey, and Hants. It is also not uncommon on the larch (*Larix europæa*, D.C.), where it occurs either alone or in company with *D. calycina*. Quite recently *D. resinaria* has proved very destructive to the Bhotan pine (*Pinus excelsa*, Wall.) in Wiltshire.

On the Continent *D. resinaria* has been recorded from Germany and Hungary, a parasite on the spruce fir; whereas in the United States this fungus causes great injury to *Abies balsamea*, Mill.

Like *D. calycina*, *D. resinaria* is a wound-parasite, and is frequently enabled to enter the tissues of a living tree through wounds made by another minute parasitic fungus, a species of *Exosporium* (Figs. 20-25).

I have proved by carefully-conducted inoculation experiments on seedling spruce, that the *Exosporium* is a true parasite; its spores, when placed on the open bark of seedlings or the young branches of old trees, can germinate and pierce the bark and pass into the inner actively-living tissues, provided the atmosphere remains damp, until the spores have germinated and the germ-tube passed into the interior of the branch.

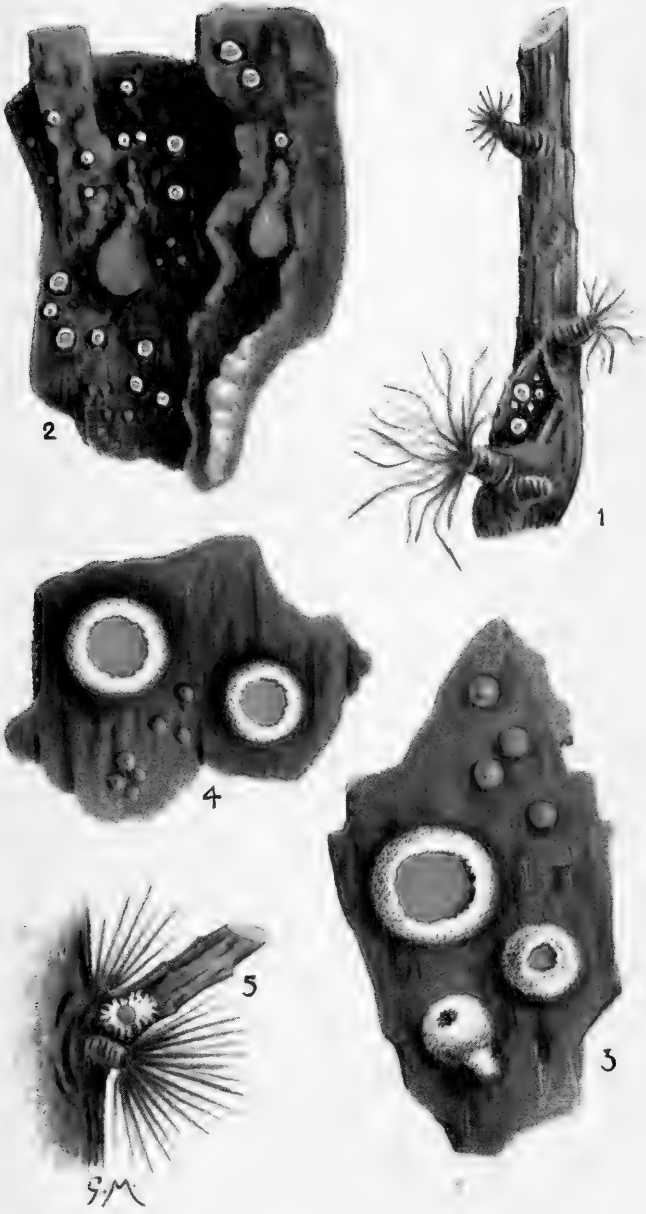
About three months after inoculation the fruit of the *Exosporium* appears on the surface of the bark under the form of numerous minute black dots, as seen by the naked eye. About this time the bark of the branch in the neighbourhood of the fungus becomes cracked, and the cracks, which always remain narrow, are filled with resin. It is through these resin-filled cracks that the germinating spores of *Dasyscypha resinaria* find their way into the interior of the living tree.

In addition to the cracks made by *Exosporium*, the *Dasyscypha* spores germinate on resin oozing to the surface through wounds caused by *Chermes abietis*, L., or by various mechanical injuries, similar to those mentioned under larch canker.

The general appearance of spruce canker is similar to that of larch canker; nevertheless, with practice it is possible to distinguish between the two, by naked eye characters.

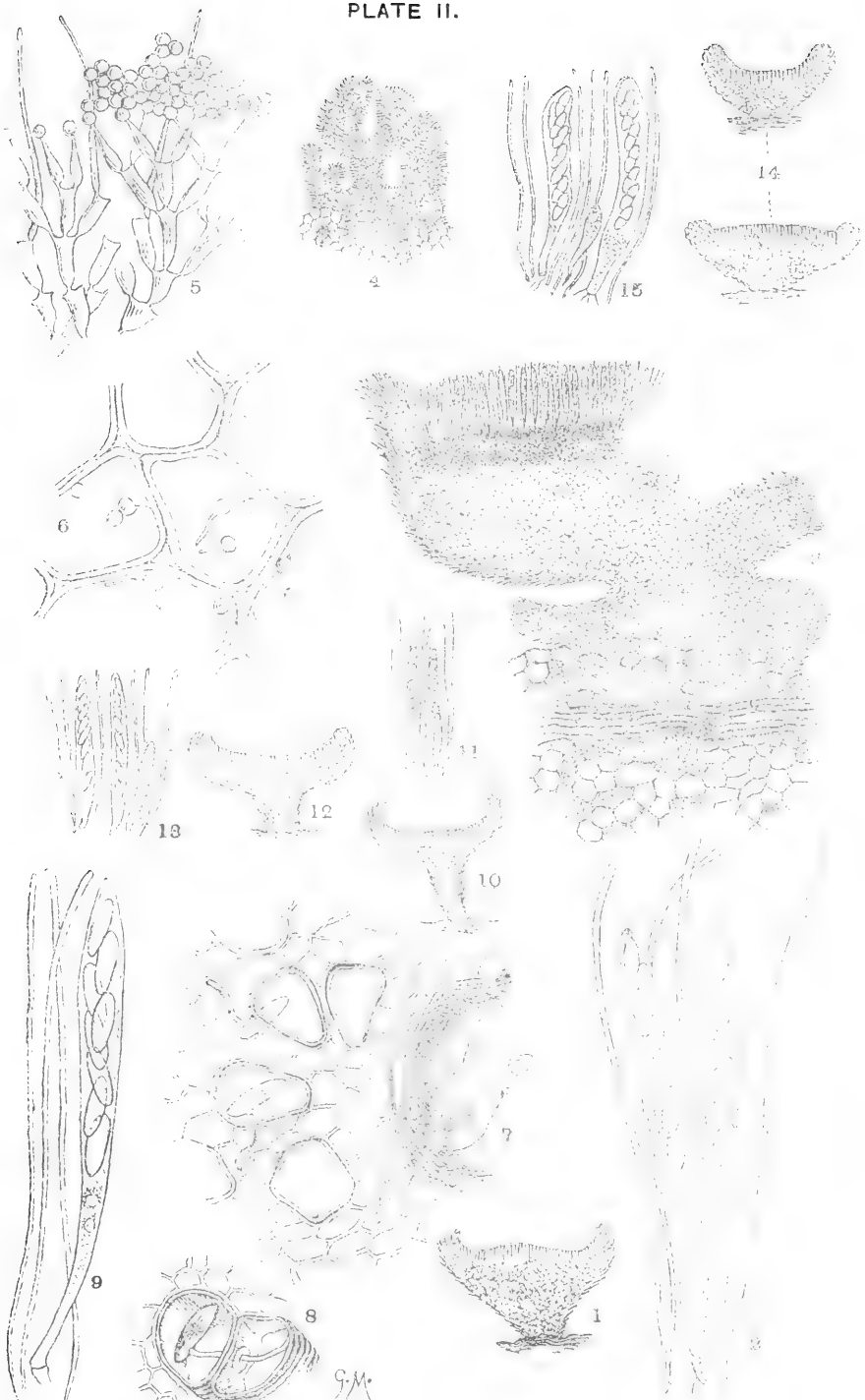
Soon after infection the outer bark is broken up into fragments which fall away, owing to the pressure exerted by the rapidly growing inner bark, which becomes hypertrophied. With age the original depression in the bark caused by the fungus increases in size, but there is more swelling round the edges of the wound than is the case in larch canker, and the wound is more inclined to completely girdle the branch attacked. The flow of resin is much more copious than in larch canker, and large gum-pockets are formed in the wood, filled with hardened resin, which on examination is found to be permeated with the mycelium of the parasite. Resin canals are formed in considerable numbers in the wood near the wound, and the resin also often fills the cells lining the resin canals.

In the United States the injury done by *Dasyscypha resinaria* appears to be much more serious than it is with us at present. It is thus described by Anderson (6):—"On some trees (*Abies balsamea*) almost every knot and dead branch was surrounded by one or more of these canker swellings, the canker not infrequently extending all around the tree trunk or branch. When younger stems or branches were affected in this way, the portion above the canker, and often the whole stem, had been killed by the girdling. . . . Infection takes place, as a rule, around the base of the imperfectly self-pruned branches of the lower part of the trunk. At these places the spores gain access to the inner living bark and to the cambium, where they germinate and cause the increased growth of the wood and



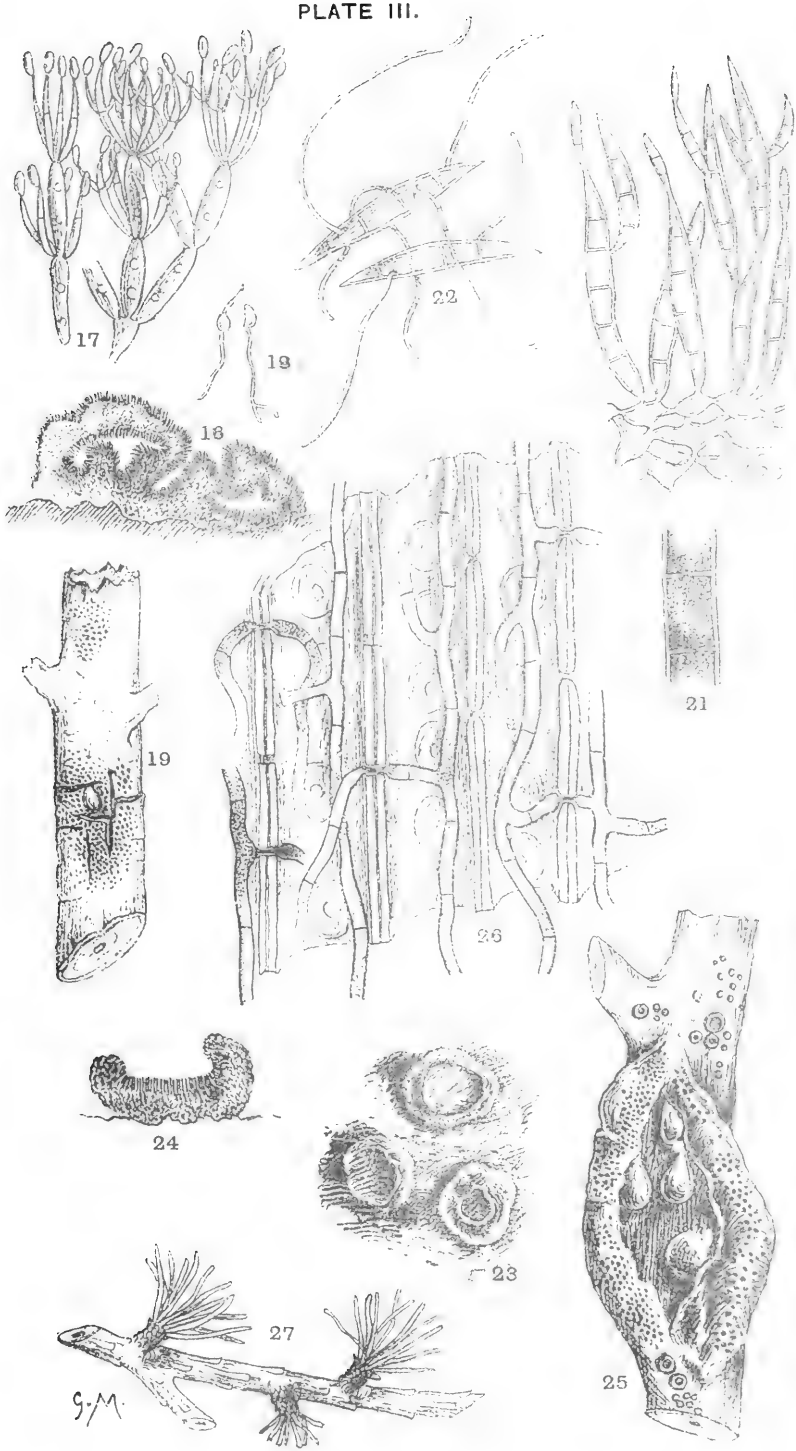
LARCH AND SPRUCE CANKER.

PLATE II.



LARCH AND SPRUCE CANKER.

PLATE III.



LARCH AND SPRUCE CANKER.

secondary cortex. Wounds caused by insects and by hail, and by the breaking of the branches by snow and ice, also expose the cambium to the fungus spores."

The ascophore or cup of the fungus in *D. resinaria* is somewhat smaller than in *D. calycina*, more distinctly stalked, and with a yellow or pale orange, nor orange-red disc; externally white or tinged grey, minutely velvety under a pocket-lens. Conidial form minute, dull orange. (Fig. 4, Pl. I.) The essential specific characters of the present species are the very minute, subglobose spores, averaging 3×2–$2{\cdot}5$ μ; conidia elliptic-oblong, 2×1 μ.

Both ascophores and conidia germinate freely when placed in contact with a thin section of cortex or wood of the host-plant in a hanging drop.

Successful inoculations, resulting in the production of ascophores, have resulted from introducing a fragment of mycelium enclosed in resin into punctures in larch and spruce. Ascophores also followed the placing of ascospores in the minute cavity occupied by *Chermes laricis* on *Larix sibirica*, Ledeb.

In addition to *Dasyscypha calycina* and *D. resinaria*, certain other species belonging to the same genus, and bearing a close superficial resemblance to *D. calycina*, occur on various conifers; and judging from the appearance of the wound produced, may be considered as wound-parasites.

Dasyscypha subtilissima, Cooke, has been observed on *Abies pectinata*, D.C., and *Larix europæa*, D.C., in Britain, France, Germany, and the United States.

Dasyscypha calyciformis, Rehm, has been shown by Wagner (7) to be parasitic on *Pinus sylvestris*, L., *Abies pectinata*, D.C., and *Picea excelsa*, Link, in Germany.

Probably the North American *Dasyscypha Agassizii*, Sacc. growing on *Abies* sp. should be included here.

Summary.

The larch is most susceptible to canker when quite young, and as the fungus spores in the majority of instances gain an entrance to the living tissues through injuries caused by the larch aphis, *Chermes laricis*, Hedwig, it follows that seedlings and young trees should be protected against this pest. This can be accomplished by spraying in the spring with paraffin emulsion, prepared as follows:—Dissolve half a pound of soft soap in two

gallons of hot water, then add two gallons of paraffin and mix thoroughly until the ingredients do not separate on standing. One gallon of the emulsion thus prepared should be diluted with fourteen gallons of water, when it is ready for use.

Recent investigations tend to show that the spruce-gall aphis (*Chermes abietis*, L.), and the larch aphis (*Chermes laricis*, Hartig), are alternating stages of one species. The sexual generation occurs only on the spruce, the agamic generations, consisting entirely of females, then migrating to the larch. Under the circumstances a mixture of spruce and larch is not to be recommended, as it furnishes the aphis with its two necessary host-plants.

As a safeguard against inoculation taking place through bark fissures caused by late frosts, it is advisable not to form seed-beds nor to plant larch in low-lying damp localities, where not only are the plants most exposed to frost, but such situations also favour the presence of the aphis.

In the case of larger trees there is no cure. If the trunk is not seriously injured the tree may continue to grow and make wood for many years after being cankered. However, it is very important to remember that the toleration of canker-bearing ascophores is a serious menace to surrounding trees. As the spore is the only known means of transmitting the disease from one tree to another in a state of nature, therefore, whenever practicable, all canker wounds should be cut away, and the removed portions burned. Protect the cut surface with a coating of gas-tar.

In this country ascophores of the fungus are formed everywhere in abundance, independent of altitude.

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Description of the Figures.

Plate I.

Fig. 1. Portion of stem of a young larch, showing a small canker wound with ascophores or cups of *Dasyscypha calycina;* natural size. (The result of artificial inoculation.)

Fig. 2. A small but characteristic canker, with ascophores and conidia-pustules of *D. calycina;* natural size.

Fig. 3. Ascophores and conidia-pustules of *D. calycina;* × 35.

Fig. 4. Ascophores and conidia-pustules of *Dasyscypha resinaria;* × 35.

Fig. 5. Portion of a larch branch showing the white flocculent tuft with a central drop of sap, which is constantly located near to a "foundress" aphis when with her eggs; × 5.

Plate II.

Fig. 1. Section through an ascophore of *Dasyscypha calycina;* × 40.

Fig. 2. Asci containing spores, also paraphyses, of *D. calycina;* × 400.

Fig. 3. Section through an ascophore of *D. calycina*, showing the mycelium of the fungus permeating and rupturing the bark and cortex; × 400.

Fig. 4. Section through a conidial-pustule of *D. calycina;* × 50.

Fig. 5. Conidiophores and conidia of *D. calycina;* × 1200.

Fig. 6. Conidia of *D. calycina* germinating in contact with a thin section of larch bark in a hanging drop; × 1200.

Fig. 7. Ascophores of *D. calycina* germinating in contact with a thin section of larch bark in a hanging drop; × 400.

Fig. 8. A single spore of *D. calycina* germinating—the germ-tube has penetrated the wall of the cell through a bordered pit; × 400.

Fig. 9. Ascus containing spores, also paraphyses, of *D. calycina*, var. *Trevelyani*, Cooke,—a variety distinguished by the spores being larger than in the type form; × 400.

Fig. 10. Section through ascophore of *Dasyscypha resinaria;* × 40.

Fig. 11. Asci, spores, and paraphyses of *D. resinaria;* × 400.

Fig. 12. Section through ascophore of *Dasyscypha subtilissima;* × 40.

Fig. 13. Asci, spores, and paraphyses of *D. subtilissima;* × 400.

Fig. 14. Sections through ascophore of a minute white *Dasyscypha*—sometimes occurring along with *D. calycina;* × 80.

Fig. 15. Asci, spores, and paraphyses of ascophore described under Fig. 14; × 400.

Plate III.

Fig. 16. Section through conidial-pustule of *D. resinaria:* × 100.

Fig. 17. Conidiophores and conidia of *D. resinaria;* × 1200.

Fig. 18. Conidia of *D. resinaria* germinating; × 1200.

Fig. 19. *Exosporium* sp. on a larch branch, showing the cracks in the bark, caused by the parasite; natural size.

Fig. 20. Conidia of the *Exosporium;* × 1200.

Fig. 21. Portion of a conidium of *Exosporium*, showing continuity of protoplasm between adjoining cells; × 2000.

Fig. 22. *Exosporium* cells germinating; × 1200.

Fig. 23. Entire plants of *Exosporium;* × 50.

Fig. 24. Section of plant of *Exosporium;* × 80.

Fig. 25. Larch branch showing canker caused by *Dasyscypha resinaria*—the *Exosporium* is still present round the edge of the wound; natural size.

Fig. 26. Section through larch wood showing hyphæ of *Dasyscypha calycina* in the cells; × 1200.

Fig. 27. Part of a larch branch showing an aphis "foundress" nestling in the axil of each dwarf shoot; natural size.

IV. *Note on the Larch Disease.* By A. W. Borthwick, B.Sc., Hon. Consulting Cryptogamist to the Society.

The larch canker disease is caused by a fungus, *Dasyscypha* (*Peziza*) *Willkommii*, Hartig, a wound-parasite, *i.e.*, a fungus which can only effect an entrance into the tissues of the living host through a wound of some description. The disease occurs in the native habitat of the larch in the Alps; but, unfortunately, is to be found also all over Europe wherever the tree is cultivated. In its native home (the higher reaches of the Alps) the larch suffers much less from this disease than in places where it has been artificially introduced. The reason for this will be shown later on.

The fungus belongs to one of the two great divisions of the higher fungi, the *Ascomycetes*. The main character which distinguishes the *Ascomycetes* is the *Ascus*, a name given to a sporangium of definite size and shape, and containing a definite number of spores.

The shape of the *Ascus* is generally club-like, the number of spores usually eight. The cup-like structure which bears the Asci is termed the Ascophore.

In the body of the fungus two distinct portions may be recognised—a reproductive and a vegetative. The vegetative part is composed of fine thread-like strands called *hyphæ*, which ramify through the living tissues of the host, and cannot be seen from the outside, nor even when the stem is cut through, without the aid of a microscope. The reproductive bodies, Ascophores, are seen as little cups round the margin of the blister, the Asci of which liberate their spores when ripe. The spores will germinate readily in a sufficiently moist atmosphere, but the germ-tube is unable to pierce the unwounded "bark" or "skin" of the host.

It is quite evident, then, if we could eliminate all agencies which damage the periderm, we would effectually prevent the spread of the disease. What, then, are the agencies which cause damage to the "bark" or periderm? These may be included under three heads, namely—animal, physical, and those caused by man.

Animal Agencies.

Under this heading we may include insects, game, squirrels, etc.

The larch-moth caterpillar does much damage to the bursting buds and foliage in spring. This is a time when the tree is in great danger, because, in their early spring condition, the tender buds and leaves are more easily damaged than later on in the season. About the time the foliage is beginning to appear, the larva awakens from its winter sleep, and begins to feed on the young green leaves, and if the transition to the summer from the winter condition is slow, the insect has a longer time in which to do harm. Fortunately, however, this insect is not so prevalent in Scotland as on the Continent, and probably the damage it does is of secondary importance when compared with that caused by the larch aphis (*Chermes laricis*).

The damage done by squirrels is often very serious, the periderm being torn off in long strips, leaving the tissue below exposed and unprotected. Still, I don't know of any authentic case where the canker has been observed to follow the ravages of these destructive little animals. This is a point which might be worthy of further investigation.

Physical Agencies.

Hailstones may do great damage to the periderm, and although hail-storms are more frequent and severe on the Continent than with us, still the past summer has shown that serious damage may be done by hail in this country. At the January meeting of the Society in 1902, a number of specimens were exhibited, which showed clearly that hailstones may cause wounds quite sufficient for the entrance of the fungus.

Again, the accumulations of snow on the side branches may cause them to bend down to such an extent that the periderm is over-stretched and torn at the base of the branch, and this may explain, in some instances, the appearance of the canker at such places. Lightning may sometimes cause wounds of such a nature as to facilitate the entrance of the parasite.

Injuries caused by Man.

In the packing of young trees in the nurseries, and in the course of their transport to their destination, and also during

planting operations, it frequently happens that serious damage is done to the protective covering. Unless, therefore, proper care is exercised in these operations, the periderm is apt to get bruised and torn, and the plants are thus rendered liable to attack.

From the foregoing it is quite evident that there are only too many agencies at work, opening up the way for the germinating spores. When the germ-tube gains an entrance to the living tissues, it very soon begins to form a mycelium, that is, a branching mass of the hyphæ or threads which constitute the vegetative part of the fungus. This mycelium spreads in the tissue of the living bark, and may penetrate through the wood-body to the pith. The living cells around the point of entrance are soon killed, and, on drying up, form shrunken or depressed areas. The tree endeavours to prevent a further spread of the parasite into its tissues by surrounding it with a thick wall of cork, but this barrier is of little use, since it can only be formed in the living bark, and the fungus can therefore gain access to the living tissues beyond through the wood.

During the summer the fungus is held in check by the vital activity of the living cells and the cork layer, but when the tree has passed into the resting condition, and those cells have become dormant, the spread of the mycelium is unhindered, and the fungus is then able to increase the area of the blister. In this way the struggle goes on between the host and parasite from year to year. The cambium round the diseased area keeps on forming new annual rings, so that, ultimately, the canker appears as a flattening, or as a depression in the stem. The supply of food is diverted to the side remote from the blister, with the result that the cambium there being better nourished, forms broad year rings, thus causing a projecting or swollen part on this side. The tensions which are set up between the living and dead tissues cause ruptures here and there, which are followed by an outflow of resin.

If the tree is a vigorous one, and the other conditions not too favourable for the fungus, the struggle between host and parasite may go on for a great many years. Hartig records an example in the Tyrol where the canker was a hundred years old. On the other hand, if the growth of the tree is slow, and the other conditions favourable to the parasite, the stem is very soon completely encircled by the canker and killed.

The disease may be easily communicated from one tree to

another by artificial mycelial infection, *i.e.*, by extracting a piece of diseased tissue, containing the mycelium, from an infected tree, and inserting it into a healthy one. Shortly after the cortical tissue has been killed, small yellow-white pustules, about the size of a pin-head, appear. These are the stromata of the parasite. They produce a number of conidiaphores, either on the surface or in the interior of these cushions. The conidiaphores are erect branches of the mycelium, and at their apices the conidia are to be found. These are supposed to be reproductive bodies, but nobody has as yet succeeded in getting them to germinate on the tree. The stromata are very sensitive to draught, and in a dry atmosphere are quickly shrivelled up and killed. If the atmosphere be moist enough, the well-known ascophores subsequently make their appearance on the same places. The beautiful colours of these bodies are well known.

We have already seen that the mycelium enters and kills the living tissues of the "bark" and wood-body, and this explains why one or a few small blisters may seriously interfere with the growth of the whole stem. On parts of the tree which have been killed, numerous ascophores may break out on the bark at places where no blister previously existed.

The disease has existed in the Alps from time immemorial, but the only places where it becomes epidemic there, are in the moist, damp valleys, and in the neighbourhood of lakes. On the exposed slopes the free circulation of the atmosphere to a large extent prevents the production of ascophores. These bodies only appear near the base of the tree, or on cankered branches, when these are lying on the ground, because the surrounding grass and other vegetation prevent the free circulation of the air, and favour the growth of the young fructifications.

During the early decades of last century, the larch was experimentally cultivated here and there in Germany, with very satisfactory results, which led to its cultivation all over the country; but after smaller and larger plantations had been formed, from the foot of the Alps to the coasts of the North Sea and Baltic, it was followed by its parasitic enemy, which found the conditions on the low ground very favourable for its development. At first large pure woods of larch were formed. Larch was also used to fill up gaps in older beech plantations, and it was further cultivated in places with moist, stagnant air. In addition to this, infected specimens were sent out from the

nurseries, and the disease was carried from place to place. Where the larch throve best was in mixed woods, where it had a start of the other trees, and its crown exposed to the free circulation of the air. The following extract from Prof. Marshall Ward's valuable book on *Disease in Plants*, p. 152, will show how the conditions on the low ground made the cultivation of the larch unsuccessful. "The larch fungus is also to be found on trees in their native Alpine home, but there it does very little damage, and never becomes epidemic, except in certain sheltered regions, near lakes and other damp situations. How, then, are we to explain the extensive ravages of the larch disease over the whole of Europe during the latter half of this century? The extensive plantings providing large supplies for the fungus does not explain it, because there are large areas of pure larch in the Alps which do not suffer. In its mountain home the larch loses its leaves in September, and remains quiescent through the intensely cold winter until May. Then come the short spring and rapid passage to summer, and the larch buds open with remarkable celerity when they do begin, *i.e.*, when the roots are thoroughly awakened to activity. Hence the tender period of young foliage is reduced to a minimum, and any agencies which can only injure the young leaves and shoots in their tender stage, must do their work in a few days, or the opportunity is gone, and the tree passes forthwith into its summer state.

"In the plains, on the contrary, the larch begins to open at varying dates from March to May, and, during the tardy spring, experiences all kinds of vicissitudes, in the way of frosts and cold winds, following on warm days, which have started the root action; for we must bear in mind that the roots are more easily awakened after our warmer winters than is safe for the tree.

"It amounts to this, therefore, that in the plains the long continued period of foliation allows insects, frost, and winds, etc., some six weeks or two months in which to injure the slowly sprouting, tender shoots, whereas in the mountain heights they have only a fortnight or so in which to do such damage. That the lower altitude and longer summer are not in themselves inimical to the larch is proved by the splendid growths made by the trees, first planted a century ago. Then came the epidemic of larch disease; the fungus, which is merely endemic—*i.e.*, obtains a livelihood here and there on odd trees or groups of trees in the warmer or damper nooks in the Alps,—was favoured

by the more numerous points of attack afforded to its spores by injuries due to insects—*Caleophoræ*, *Chermes*, etc., and frost wounds, as well as by the longer periods of moist, dull weather, and the longer season of foliation. Here we find the factors of an epidemic consisting in events which favour the reproduction and spread of a fungus more than they do the well-being of the host."

Note.—The above is a résumé of the matter so far as our present knowledge of the disease goes, and is practically what has been made out by Hartig and other authorities.

A. W. B.

V. *Larch Disease—Investigation by the English Arboricultural Society.*

In 1893 the English Arboricultural Society conducted an inquiry into the disease of the larch by means of the circulation of a series of questions amongst its members. A report by Dr Somerville on the results of the inquiry was published in their *Transactions* for the year 1893-94, and a brief epitome of this report will prove of interest to our readers at a time when our own Society is about to investigate the same important subject.

1. *Cause of the disease.* The prevailing opinion was that frost, either alone or in combination with other agencies, is the cause; but Dr Somerville says that the evidence of those who have investigated the disease in a thoroughly scientific manner makes it practically impossible to doubt that a parasitic fungus is the primary cause, however much the latter may be assisted by accessory circumstances.

2. *Is the disease less prevalent now than formerly?* Though the larch may not be suffering quite so much in some districts as formerly, the disease is, on the whole, as rampant as ever it was.

3. *Age at which trees are most liable to attack.* The attack commences during the early stages of growth, for the most part between the seventh and the fifteenth years; but the younger, that is the upper and thin-barked, parts of the stems and branches of old trees are equally liable to attack. Where the stem is old, and consequently protected by thick bark, the fungus has little chance of obtaining an entrance. The early attack is far more serious in its effects than the later.

4. *Are the blisters more likely to occur at one part of the stem than at another?* In a large number of cases the disease appears near the surface of the ground, also very frequently at the base of a branch. The base of a tree is more continuously exposed to the action of moisture than any other part of the stem. If rank grass, ferns, or other plants cover the ground, they shelter the stem near its base, and by interfering with the free circulation of air, retard the evaporation of moisture. Water also rises from the ground by capillary attraction, and becomes diffused over the surface of the stem, and in these ways the conditions are rendered favourable for the germination of fungus spores. Wounds in

young trees also frequently occur near the surface of the ground, being caused when lifting the plants from the nursery beds[1] by the feet or the tools of the men engaged in planting them, or by rabbits, hares, voles, or other animals. As regards the base of a young branch being a vulnerable point, it may be said that spores are liable to collect and lodge in the upper angle of a branch; and that a wound has frequently been caused at that place through the rupture of the bark, due to the branch bending down under its own weight, or under the weight of an accumulation of snow, or to its swaying during a heavy gale, or to a variety of other circumstances. Hence the base of a branch is a very weak point where disease is concerned.

5. *Do any conditions of climate, soil, exposure, or situation favour disease?* Low, humid situations, and damp, undrained land, are factors predisposing to disease.

6. *Are trees less liable to attack in high, breezy situations than in low, muggy valleys?* The answer is in the affirmative, the conditions at high elevations being unfavourable to the development of the fungus, and late and early frosts being much more frequent at low than at high elevations.

7. *Are trees less liable to attack in mixed woods than in pure ones?* It cannot be said that mixing the larches with other trees is a guarantee of complete immunity from the disease, but the evidence was strongly in favour of a mixture securing comparative freedom from attack. The spreading of the spores from one larch tree to another is hindered by the surrounding trees of other species; and when these latter are dense-crowned, the vitality and rate of growth of the larches are enhanced.

8. *Is there any connection between larch disease and the attack of insects such as the Larch Aphis?* Though the Aphis is not the primary cause of the disease, it is probable that a tree infested with Aphides is more likely to contract the disease than a perfectly sound specimen. The Aphis interferes with the transpiration of water by the leaves; this tends to the accumulation of moisture in the stem, and it thus favours the spread of the fungus. It is also possible that the Aphides predispose to disease by making wounds in the epidermis of the shoots and foliar spurs, through which the fungus may be able to gain an entrance. But the Aphis probably assists the disease more in the former manner than in the latter.

[1] Also by drawing the young plants together in a bundle by means of a green withe.—HON. ED.

9. *Is the disease hereditary? that is to say, is it transmitted through seed?* The disease itself is not directly transmissible through seed. But an inherent tendency to the contraction of the disease, or to immunity therefrom, is transmissible; and for this reason it is prudent to avoid collecting seed from trees which have actually contracted disease.

10. *Is it likely that the disease originates in nurseries, and is conveyed along with the plants to young plantations?* If a predisposition to disease is inherent in certain trees, and if this predisposition is transmitted through their seed to their progeny, it follows that when these latter are planted out they have this tendency inherent in them. It was asserted that actual disease occurs in nurseries. In such a case, even though plants that are visibly affected may be destroyed, it is evident that others, in an earlier stage of the disease, when its detection by superficial examination is impossible, must escape observation, and be planted out when in a diseased condition.

11. *Relative resistance to disease of larches raised from home and foreign seed.* Very little evidence, drawn from practical experience, was adduced; but the great majority of British planters would prefer plants raised from home-grown seed.

12. *Are self-sown larches specially resistant to attack?* There was a preponderance of evidence in favour of self-sown larches enjoying comparative immunity from attack, such immunity being probably due to the fact that when plants are left to grow into trees on the spot where the seed was sown, they are not subjected to risks of injury during lifting, transport, and planting.

13. *Do diseased plants ever completely recover?* When once the disease has obtained a footing on a tree, a return to a healthy condition cannot be looked for. Death, as a consequence of the disease, may, however, be delayed for a long time, and much good, useful timber is often formed after trees have contracted the disease.

14. *Cure or mitigation of the disease.* If the blister spot be carefully dug out with a knife or chisel, and the wound be afterwards dressed with grafting-wax or coal-tar, recovery at the spot so treated may be expected, but such treatment could hardly be applied otherwise than to a specimen tree which it might be desired to retain at any cost. As regards *mitigation*, in the majority of cases the most important measures would appear to be these, viz.:—Cultivate the larch in mixed woods; avoid planting in

humid hollows; plant rather wide apart; thin early and rather severely; and remove diseased trees to as great an extent as possible during thinnings. It can do no harm, and may do good, to destroy the branches of larches that have been felled; and the selection of seed from healthy trees is also a step in the right direction

15. *Can any larch woods, formed within the last twenty years or so, be pointed to as being in a perfectly satisfactory condition?* Of the forty answers sent in, no less than thirty-six showed that the writers had no personal acquaintance with any such woods. Four gentlemen were, however, satisfied with the appearance of certain larch woods with which they were familiar, though, on further inquiry being made, even these four woods were not found to be quite sound.

16. *In conclusion, it was suggested that the following points should be further investigated*, viz. :—

(*a*) The comparative resistance to attack of plants raised from seed produced by diseased and by sound trees respectively.

(*b*) The effect of raising woods from seed artificially or naturally sown.

(*c*) The result of planting larches some years in advance of the other trees.

(*d*) The effects of strong thinning, and of lopping off the lower branches so as to prevent their being dragged down by becoming partially enveloped in a heavy fall of snow.

(*e*) Demonstration of the ease with which the disease may be produced artificially by inoculation, so as to establish its infectious character.

(*f*) The comparative merits of larches raised from native and foreign seed. A variety of larch, for instance, grows abundantly in the neighbourhood of Archangel and throughout Siberia, and it is possible that, through having established its varietal characters in an excessively cold climate, it may be correspondingly resistant to disease.

VI. *The Larch in German Forests.* By Forstmeister Franz Boden.

I. The European Larch.

In a long article published in the *Forst- und Jagdwesen* of April 1901, Forstmeister Boden, of the Hanoverian State Forest Service, gives his views regarding the growing of the European Larch in Germany, its attack by canker, and other matters. He maintains that the fungoid diseases of the larch are, for the most part, secondary phenomena, which make their appearance in localities unfavourable to the growth of the tree; and in this view he claims to receive support from certain scientific men. He contends that the fungus (*Peziza Willkommii*) cannot make good its attack by infecting sound plant-tissues. The disease, he says, is not found otherwise than on weak or decayed twigs and stems, never on those of vigorous growth; but it develops on dead or nearly dead shoots, and because the sap in them has ceased to flow, its presence does not there lead to the formation of a cankerous wound. The swellings which accompany the disease on living stems or branches are due to the action of the flowing sap, but the fungus is the cause of the actual canker. The canker avoids vigorously-growing larches, but successfully attacks trees "in their time of adversity," when their energy of growth is weaker than its own. The author says that the larch in Germany persistently remains for years in an enfeebled condition, making short shoots, and that it then forms a perfect Eldorado for *Peziza*. He quotes Hartig's statement that in summer —that is, at the time of the trees' maximum seasonal development —the fungus stands still in its growth. According to his own observation, the activity of the fungus is certainly thus checked on the green parts of the tree, this being due to the full flow of resin; but he says that the growth of the fungus at this season goes on with undiminished vigour on dead parts.

In regard to crookedness of stem not due to the action of the sap in a cankered tree, he attributes this defect mainly to wind. In a sheltered plantation crookedness of stem appears only at the margins of the crop, and is specially noticeable in the case of isolated trees. On poor soils and exposed situations, however, stems may be cankered and crooked; while a few hundred yards off, on good soil, the stems remain uninjured and straight. There

are few larch districts in Germany which show so small a proportion of straight stems as do those at the higher levels in the Alps; though there the annual shoots are so short, and the stems are so stunted, that the wind has but little effect on them. In such regions it is the failure of the leading shoot to ripen, and the action of the *Peziza*, which cause the crooked stems.

With reference to the nature of the localities which are favourable to the growth of the larch, the author says that whereas *Peziza* and other enemies of the tree are found everywhere on the poor soil of Klosters (3900 ft.), Davos (5200 ft.), and as far up as the Flüela Pass (7200 ft.), as well as in the Oberengadin (6000 to 7000 ft.) right up to the Julier Pass (7200 ft.), these pests are altogether wanting in lower, sunny localities, on the rich slates of Tiefencastel (2800 ft.), as far as Thur (1600 ft.), at Landquart (1700 ft.), Maienfeld, with its great vineyards (1700 ft.), Ragaz, and such places. Only in the dampest and darkest corner of the Via Mala did he find *Peziza* again. It could not be otherwise, because the luxuriant growth of the larch in the low-lying country, with its good soil, renders the existence of the fungus impossible. But on the neighbouring gravels of the Rhine, near Bonaduz, the larch is as sickly as it is on the uncongenial soil of North Germany. In the north, where the amount of sunshine is relatively small, and where, consequently, the larches should have been planted at wider intervals than in the south, and also at high elevations, the density of the stock has been too great. On good soil, and in open, sunny localities, we find noble larches everywhere; but on cold and damp mountain slopes, where silver firs and spruces flourish in their natural habitat, the larch is a failure.

It is true that certain mountainous districts of this nature produce good larch, but these are so few and far between that they do not controvert the above generalisation. The author is well aware that in valleys with a southern or a south-western exposure, and on a slate formation, larches grow well, not only on low-lying ground, but also on dry, rocky hill-tops. Whether it will pay to grow larches in a fir country is a question which must be answered in the negative. On the other hand, there is, of course, no doubt that the tree grows well in a beech country; but the mountain soil is usually so shallow, that on it the larch does not generally yield sawyer's timber.

While on the foot-hills of the northern Alps we find good larch plantations, we observe, as we travel northwards (where.

as we mount to higher elevations, the atmosphere becomes more cloudy and dull, damper and colder), that the larch becomes more sickly, and more victimised by its enemies, in the front rank of which stands the *Peziza*. It is on the lower ground of the northern Alps that we reach the natural home of the larch; and in the country of the vine, the sweet chestnut, and the walnut, we find larches of noble dimensions. Owing to the comparatively warm temperature, not a trace of crooked growth is here to be seen.

On the mountains, the appearance of the larch depends in some measure on the exposure of the valleys, the consequent angle at which the sun's rays strike the ground, and the degree of moisture of the atmosphere. For example, the narrow Val Plavna, in the Middle Engadine, situated in the Eldorado of the larch, is not a larch locality, but is rather one for the shade-bearing silver fir.

It is not correct to assume that great moisture prevails at high elevations in Switzerland. It is well known that the Engadine forms part of the driest district of the Alps; and consequently it is there that the finest larches are seen. The temperature in the Middle Engadine does not differ much from that of the author's part of Germany; and if the air of the latter were as dry as it is in the Engadine, fine larches would be found there also.

As regards rainfall, the important point for the larch is not the total annual fall, but the amount that falls during the growing season, *i.e.*, from the beginning of June to the end of August in the Lower Engadine. At this season there are no fogs, and the sky is seldom overcast; while if a thunderstorm brings down torrents of rain, the insolation is so intense, in consequence of the high altitude and the clearness of the atmosphere, that a few hours after a storm the roads are again dusty. Dry air and much sunshine, which encourage transpiration, are the friends of the larch, but the enemies of the fungus. Moist air and a cloudy sky, on the other hand, check transpiration, and impair the vital force of the larch, while they stimulate that of the fungus. It is only necessary to observe larches growing in a damp, shady place, or in a cloudy region inducing limited transpiration, to arrive at the conclusion that it is quite useless to plant this tree in localities where the air is damp, or where the soil is unable to provide water for active transpiration.

In a damp atmosphere, the maintenance of *Larix europæa* in a dense stock results in failure. In consequence of the clear sky and

dry atmosphere of the Alpine highlands, the larch, when planted there on good, strong clay soils, can stand in tolerably dense masses, and can also bear mixture with the silver fir, in consequence of the lighter needle-growth which the latter tree makes there; but on the northern slopes of the German mountains, and even on the plains, where there is more cloud, a moister air, and a consequently denser growth of the fir needles, the larch does not succeed in mixture with the silver fir. In the latter regions it shuns the zone of the fir and pine, and holds to that of the oak and the beech. If it fails there, this must be due either to the soil or to the exposure.

Of course the larch grows best in its natural home in the Alps; but in the northern Alps and in the German mountains its growth in the pine and fir zone is inferior to that which it develops in the low-lying hills and plains, that is to say, in the zone of the oak and the beech.

[In connection with above, reference may be made to what is said on the subject of the Larch Disease at pp. 32-35 of Vol. XVI. of the *Transactions*, in connection with the Novar Working Plan. —Hon. Ed.]

II. The Japanese Larch (*Larix leptolepis*).

The author is unable to agree in the optimistic views of Von Alten, Schwappach, and other writers, regarding the prospects of the Japanese larch as a forest tree into Germany. He quotes Mayr's statements that if we compare the life-history and growth of the Japanese conifers with those of their German relatives, we shall arrive at the conclusion that none of the former possess any outstanding advantage over the latter, which are indeed the more valuable; that it is still doubtful whether, anywhere in Germany, the Japanese species will attain profitable dimensions, while it is tolerably certain that no Japanese trees from the Chestnut Zone will, in a climate to which they are unaccustomed, attain the size to which they grow in their native land. From this, says Mayr, it appears that the rearing and naturalisation of Japanese trees for purposes of economic wood-production is more difficult, and the result is more doubtful, than it is in the case of North American forest trees; and, where these latter will not succeed, we may reasonably decline to experiment with Japanese species.

Only the warmest situations, and there the best soils, need be thought of for such of the Japanese trees as are worth growing.

Von Alten records the occurrence of *Larix leptolepis* in Japan at altitudes of from 5000 to 7000 feet; but he also reports, without mentioning his authority, its appearance in northern Japan at sea-level. Mayr puts the range of altitude at from 6000 to 8000 feet.

The author makes mention of an old Japanese larch tree growing in the Botanic Gardens at Göttingen. This tree, which has been grafted on to the stock of a European larch, is, probably, between fifty and sixty years old; it stands in a free, though well-protected position, and on good soil. Its total height is slightly under 40 feet. All but $1\frac{1}{2}$ feet of this height was made in the first fifteen years. From the seventeenth year, in consequence of its very small height-growth, and the failure of the new shoots to ripen, the top of the tree has consisted of a cluster of shoots which does not permit a determination of individual years' growth. The favourable nature of the locality is proved by the vigorous development of American walnuts growing in the immediate vicinity. The dampness of the atmosphere, which has no doubt acted injuriously on the growth of *L. leptolepis*, has had a very different effect on a neighbouring Cembran pine, a noble tree such as one might expect to see growing in the southern Alps or in the Apennines. This old Japanese larch may quite well be likened to trees of the European species growing in the Alps on the confines of forest vegetation, at an altitude of from 6000 to 7000 feet.

Forstmeister Boden claims that his previously expressed opinion as to the amount of sunshine in Germany being insufficient for the Japanese larch has been abundantly confirmed by subsequent and more extended observation. Plants when obtained for the purpose of interplanting with firs were found not fully lignified. Owing to the effect of lateral shade in their new situation, the next season's growth was also imperfectly lignified, and the new shoots were consequently eaten by roe-deer almost down to the old hard wood. As he could not protect each plant with a wire guard, he had to give them up, and they now exist as "hedgehogs." This excessive browsing of the Japanese larch is well worth attention. Apart from injury by hares, the European larch does not suffer in this way, though it is rubbed by deer; and against rubbing it is much

easier to adopt protective measures. In another instance, where two-year-old Japanese larches were obtained, five-sixths of them were not lignified; but since plants of this species possess a wonderful capacity for replacing a lost top from a side bud, their height-growth in the nursery was not much interfered with, and only a slight bend remains to record its loss. While it is not denied that lignification is fully effected in nurseries with a warm, sandy soil, and in a free situation, it is equally certain that it does not take place on a stiff soil and under the influence of lateral shade. Under the latter conditions, the side shoots do not end in points but in tufts, giving exactly the appearance which the European larch assumes at high elevations. The author records an interesting case of the observed effect of lateral shade. A rectangular clearing was made in a beech forest, and a plantation of Douglas fir, Sitka spruce, Norway spruce, and Japanese larch was established on the site. The ground was hilly and facing south, the plantation itself lying in an extremely fertile and well-protected hollow. It may be assumed that about one-fifth of the normal sunshine was intercepted and lost to the plantation by the beech forest. In September, probably as much as one-third of the sunshine was lost in this way. Under these conditions, the Japanese larches did not ripen their new wood during either the first or the second years, and they looked very sickly. Then a further clearing was made of the beeches, the nearest of which had stood at a distance of from 30 to 50 feet from the edge of the new plantation. The effect was marvellous. The Japanese larches made a growth up to 3 feet in length in the first year; in the second year the shoot was equally long, and the crowns showed a vigorous appearance. Then came a violent wind, which levelled sixteen out of sixty-nine plants to the ground, and blew all but eight of the others from 4 to 8 inches out of the vertical.

On account of failure to ripen its new wood, and the resulting bayonet-like growth, which in wide planting cannot be prevented by side pressure, the stems show a distinct deviation from the naturally straight habit of the tree, and this will impair the value of the timber. The young trees grow with extraordinary vigour, and this year (1901) the growing season is prolonged even to the middle of October. The needles are both larger and more numerous than those of the German larch, and the rate of growth is therefore relatively very fast. Yet the Japanese larch grows in this manner only on the best soils and in an absolutely free position.

If deprived of these advantages, it must be tied to a stake, which can only be done in early youth, and is out of the question as a forest operation.

Although the advantages of good soil in the production of larger needles and an earlier spring growth, with a consequent better ripening of the new wood in autumn, are recognised, yet, even under these advantageous conditions, the author has noticed a failure to lignify, which exposes the shoots of the year to damage by autumn frost. In youth, when plants are growing vigorously and making shoots 3 feet long, failure to ripen is not so serious a matter as it becomes when the annual height-growth is reduced to a couple of inches.

The rapid growth in height of *L. leptolepis* is certainly remarkable if we compare it with that of *L. europœa*. The latter species demands the best of soil, much sunshine, and a dry atmosphere; high quality of soil, however, not compensating for lack of sunshine. In youth the Japanese species is to a certain extent more adaptable than the other. Provided its water requirements are satisfied, it appears then to stand more lateral pressure than the European larch does, but in a dry locality it needs more light. A plantation of *L. leptolepis* made among ferns 5 feet high, mixed with buckthorn, showed quite phenomenal development, and but little susceptibility to the pressure of the surrounding growth.

The Japanese larch sends out mighty shoots which its great one-year-old needles are well able to nourish; and thus, in its first five to ten years, it outstrips the European species, which soon broadens out if it has room, and assumes a bushy habit with short and strong shoots. The number of buds on the terminal shoots, and on those adjoining them, may be the same on the two species; but the European larch makes but one-half or one-third of the growth of the other, so that, in a given length of stem, the former has twice or three times the number of side-shoots that the latter has; and it follows that, since the European bears more shade than the Japanese larch, and gets rid of its branches more slowly, it must, after a time, steadily overhaul the latter. The sensitiveness of *L. leptolepis* in regard to cover is so great, that the shade of the principal shoots causes the death of the secondary shoots through the non-ripening of their short tips, even when the tree is in an altogether free position. While in the case of the European larch, the oldest shoots are also the

longest, with the Japanese species this is not so. In it, only a few main branches develop, and these, as they grow older, stand out almost horizontally from the stem; the secondary branches hang perpendicularly from them, and so cut themselves off from the sun, and remain with unripened tips. Under too much shade, the branch and shoot development of the European larch is very similar to this. In an isolated position, *L. leptolepis* suffers very much from wind, from which, however, it obtains effective side shelter in a closely planted crop. But whenever the stem-cleaning process begins, and the branches formed in early life are dead, it becomes quite impossible for the few branches of the later period to maintain the earlier rate of development. This period will commence between the fifteenth and the twenty-fifth years, according to the degree of density of the stock. If, in the experimental stations, remarkable results have at first been obtained by means of close planting, the retrogression, when it sets in, will be equally remarkable. The present abundant production of cones warns us that this period will shortly commence, and its arrival will occur the sooner because the restriction of growing-space does not accord with the natural requirements of the tree. Nothing short of a perfectly free position will keep *Larix leptolepis* alive; and on account of the small number of its principal branches, and the bushy nature of its small secondary branches, it will, during its later years, be no ornament to our parks. The author holds that in consequence of its special requirements in the way of light and moisture, and its peculiarities of stem-growth and branch-growth, the Japanese larch is unsuitable for cultivation in German forests.

After noticing its attack by several species of insects and fungi, including *Agaricus melleus*, he repeats his belief that *Peziza Willkommii* avoids all vigorously growing larches, and attacks only such as are in bad health. He then goes on to say that we need not be surprised if the vigorously growing young Japanese larch escapes infection by *Peziza*. Professor Hennings of Berlin has, however, proved the occurrence, since 1895, of the disease on this species, in the Friedrichsruhe Park.[1] The author first found it in certain Prussian experimental stations, which had reached the appropriate stage of unhealthi-

[1] *Transactions of the Natural History Society of Schleswig-Holstein*, vol. xi. part 1.

ness; he does not, however, regard *Peziza Willkommii* as of much consequence, so far as the Japanese larch is concerned. The unhealthy stage at which the European larch remains so long and so persistently, is probably not reserved for *Larix leptolepis*, which, in consequence of its great light-requirement, cleans its stem quickly when once it has commenced to do so, and it will most likely die quickly. In its case, the fungus will probably exist as a saprophyte.

Since, in Germany, the Siberian larch becomes green before the European species, and this again commences its seasonal vegetation before the Japanese species, it is clear that the first-named comes from a colder, and the last-named from a warmer climate than that of Germany. The German fir and pine zone is consequently out of the question for *Larix leptolepis*, and the author considers even the oak and beech region too cool, if the sun's rays are there intercepted from the tree by a surrounding crop. He suggests experiments with *Larix sibirica* and *L. occidentalis*, whose home is in countries where the climatic conditions more nearly approach those of Germany than do the climatic conditions of Japan.

VII. *Report on the Excursion of the Society to Sweden in* 1902.

By GEORGE U. MACDONALD, Forester, Raith, Kirkcaldy.

It was with feelings of intense delight and expectancy that, on Friday, the 18th of July, many members of the Royal Scottish Arboricultural Society boarded the good ship "Balder," which was to convey them from Granton Pier to Gothenburg, where they were safely landed on the following Sunday forenoon. To those of us whose daily occupation is the tending and management of woods, as well as to those who are more directly identified with the manufacture of timber, it is a matter of no wonder that for weeks previously we could think of little else than the lessons we were to learn from visiting a country long familiar to us as one of the greatest exporters of timber to Britain.

In the following remarks it will be the aim of the writer to deal rather with those phases of the tour which bear more directly on the principles and methods on which forestry is conducted in Sweden, than with the daily incidents of the Excursion, which have already been described in the leading newspapers.

Sweden has a forest area of twenty-nine million acres, about one-fifth part of which is owned by the State, the remainder being in the possession of private proprietors. Living in a sparsely populated country, in which there was no great demand for wood, either for home use or for export, it is no great wonder that, some centuries ago, the Swedish people believed that in their vast forests they had a wealth of timber which was practically inexhaustible, and that they had little need to trouble themselves about the conservancy and management on scientific principles of what appeared to them a boundless tract of growing trees. But time works many changes; and the keen-eyed and prudent Swede at length discovered that in his timber-clad slopes lay his country's wealth; that the demand by foreign countries for this natural product of his land was yearly increasing; and that, if Sweden was to keep the lead in satisfying that demand, her people must seriously set themselves to work out the problem whether or not, without any care or protection on their part, their forests could continue, not only to supply their own increasing wants, but could also be relied on as a permanent and ever-increasing source of revenue to the nation, by the sale of surplus timber in foreign markets.

Like sensible men, alive to the best interests of their country's good, they, nearly a century ago, began in a small but deliberate way to frame new laws and to employ new methods, whereby the continuity of their forests' growth was assured; and, through the application of scientific principles to the management of their woods, they are to-day, if not so far advanced as Germany or France, still far ahead of Britain in sylviculture. The interest which the Swedish Government takes in this important industry is worthy of all praise, and is a pleasant contrast to the apathy and neglect which our own Government has ever evinced in all matters relating to forestry. The administrative work of the Government Forest Department is in the hands of a director and chiefs of bureau, who have under them officers and sub-officers. The whole of the State-owned area is divided into districts, of which there are nine; over each of these presides a controlling head, under whom are placed the chiefs of ranges, and under whom again are the forest guards. Young men wishing to train for a post in the Government Forest Department must pass through the Stockholm Academy. This is done by passing an entrance examination, for which a good elementary education is necessary. Afterwards, students are obliged to spend one year at a forest school, where they come in daily contact with the practical work of the woods; then two more years are spent at Stockholm, and an additional year upon a forest range. To successful candidates the title of "Master of the Royal Domains" is granted, after obtaining which they are considered fully qualified to take up responsible forest charges.

Having briefly stated the nature of the education and training necessary for a Government forester in Sweden, we shall now endeavour to describe some of his practical work, as exemplified in the forests which we visited.

On entering the beautiful town of Gothenburg, the Excursionists were greatly impressed by the arboricultural methods practised in this, as in all other Swedish towns they visited. Practically every street has its row of stately limes or elms. In every town there are numerous large squares, or people's gardens, beautifully arranged with ornamental trees, shrubs, and flowers, and usually connected with each other by long avenues composed chiefly of limes. These give to the largest cities a very countrified and attractive appearance, which must tend to promote among the citizens a love of nature and of things beautiful. That the mass of the people

take a personal interest in the adornment of their towns is proved by the fact that the whole of these beautiful gardens are entirely unprotected. The people are free to roam about at will, to rest underneath the spreading branches of the trees, and admire the many tinted flowers; and yet not a branch is broken, nor a flower-bud ruthlessly destroyed. We may well ask when the youths of our Scottish cities will become so enamoured of nature that they can be trusted to wander about in our public gardens without risk of their committing wanton mischief; and yet it may be, that if our towns and villages were more lavishly planted with trees, and if our city toilers had more opportunity of resting beneath the cool shade of their branches, they would learn to appreciate more, and would take a greater personal in, everything tending to the beautification of their surroundings.

It was at Jönköping that the real work of the Excursionists began; the first place of interest to visit there being the famous Munksjö Paper-Mills. Here they saw the actual process by which whole spruce trees, shorn of their branches only, become in an incredibly short time transformed into the strongest roofing paper, or into the thinnest and most delicate tissue paper; and this is accomplished without waste of any of the materials employed. Sawdust, bark, and knots, which cannot be used for pulping purposes, are used in the furnaces as fuel. Unlike ourselves in Scotland, the Swede has discovered the secret of putting almost every description of forest produce to some practical use. Between the making of pulp and charcoal, two very important industries in Sweden, practically every inch of wood is put to a paying use; and herein lies most of the Swedish forester's success.

After leaving the paper-mills, a visit was paid to the world-famed safety match factory. To those of an ingenious turn of mind, and especially to those interested in machinery, was here presented a sight which was worth travelling many miles to see. When following the various stages in the development of the match, from the rough aspen blocks as they are brought into the mills, to the stamped and finished article, one is forced to come to the conclusion that never before was machinery brought to such a state of perfection. Each operation is carried through with the utmost exactness and expedition; and although in this factory upwards of eight hundred men and women are employed, their work is simply to attend to the various machines, each of which has its own particular duty to perform. The invention of

this machinery alone constitutes a lasting monument to the engineering genius of the Swedish people. On making inquiry as to whether the aspen timber, which is being used in this great industry, was grown in Sweden, we were rather surprised to find that practically the whole of it is imported from Russia. This, in our opinion, is not as it should be; for the Excursionists passed through many acres of land well adapted to the growth of this particular species, and indeed in some parts naturally grown aspen saplings could be seen stocking the ground like weeds.

Our attention was next directed to the Government forest of Visingsö, an island beautifully situated in Lake Vettern, where we had our first view of Swedish methods of forestry. The crop, which is chiefly composed of oak, was found to have suffered very seriously from an attack by the caterpillar of the leaf-roller moth (*Tortrix*). The system of management practised in this forest is briefly as follows:—For oak, the rotation or felling-age is one hundred and twenty years. The wood is originated either from acorns or from young plants put out at distances apart of from 5 to 6 feet. These are allowed to stand for about thirty years, when the first thinning takes place. Immediately after the thinnings have been cleared away, another species of tree, a shade-bearer, is introduced to take the place of those which have been cut out, and thus to act as a soil protector, and in other ways to further the interests of the oak, which is to form the principal crop. From this time the plantation consists of what is known as an uneven-aged crop, carrying an upper storey as well as an under storey of two or more species. The under storey is allowed to grow up until it is seen that the crowns of these trees are beginning to imperil the crowns of the oaks, a stage generally reached when the undercrop attains an age of from thirty-five to forty years. The younger trees are then removed, but are immediately replaced by a second crop. In some cases even a third crop may be required to bring the oaks to their maximum value.

While thoroughly agreeing with the principle on which this oak forest is managed, the writer doubts whether enough attention has been given to the question of the species of tree best adapted for planting as an undercrop. Those made use of in the Visingsö forest for this purpose are chiefly Norway spruce; but, in less quantities, silver fir and beech have been used. Judging from what we saw, the Norway spruce has proved the least successful

of the three species, nor is this much to be wondered at. In the first place, spruce can only be classed as a moderate shade-bearer; and, again, the soil best adapted for the growing of oak is not by any means the best for growing spruce. But assuming that the spruce would thrive under these circumstances, the writer is of the opinion that it would do so to the detriment of the oak, because, owing to its shallow root-system, it absorbs so much of the moisture before it can reach the deeper roots of the oak. There can be little doubt that the best shade-bearer, and the tree which best lends itself to various soils and situations, is the beech. It is deep-rooted, and is a better soil protector and fertiliser than any of the firs. In Sweden, too, the beech has another recommendation, which is that it always meets a ready market at a remunerative price. A patch of matured Scotch fir was also seen in Visingsö, and also a few acres of the same species in the pole size, both being very interesting examples of what may be accomplished by judicious thinning. Many of the matured trees had clean boles perfectly free of knots or branches to a height of about 80 feet; and the crop represented about 5500 cubic feet of saleable timber per imperial acre.

In the State-owned woods of the Omberg, which were next visited, Scotch fir, spruce, and larch were found, varying in age from two to fifty-seven years. The forest comprises 3700 imperial acres, one-half of which has been planted, while the remaining half has been raised by natural regeneration. The first block to notice was a larch plantation, fifty-seven years of age, which had originally been planted as a pure crop, but which is at present underplanted with spruce and beech. The trees are about 80 feet in height, with an average diameter of 10 inches at 5 feet from the ground. As yet there is no larch disease in this part of Sweden.[1] The boles of the trees were beautifully clean, and their crowns were in a very healthy condition. The average number of trees per imperial acre was given as 190. Here, again, it was easily seen that beech would have been the proper tree to underplant with. Had beech been used instead of spruce, a greater number of larch could have been retained on the acre for the final cutting. Instead of 190 trees the ground could very well have carried 220 to the acre, and even under this amount of shade beech would thrive well.

[1] In more southerly parts of the country the disease is by no means uncommon.—Hon. Ed.

In this forest was also seen a very interesting plantation of forty years' growth. It consisted of three species planted in rows in the following order: Ten rows of Norway spruce, ten rows of silver fir, and five rows of Scotch fir. It received a slight thinning when the crop was thirty years of age; and its density at the present time is almost perfect, the ground being absolutely free from herbage. The trees stand about 35 feet in height, and are cleaning their stems in a very satisfactory manner. Of the three species, the silver fir, being the quickest grower, is holding the lead. Although this method of planting two or more species in the same plantation is not much practised even in Sweden, it seems to the writer to be infinitely preferable to the commoner method of mixing the different species, particularly in the case of Scotch fir and spruce. It must be admitted, however, that in Sweden the annual growth of the Scotch fir and spruce is much more equal than is the case with the same species of trees in Scotland. Consequently the Swedes have a greater excuse for continuing to mix these species than we have in this country. Besides, the demand for spruce for pulping purposes in Sweden is so great, that most of the spruce will be removed in the first and second thinnings, leaving the bulk of the Scotch fir to form the final crop.

With the exception of this particular wood, the young plantations at Omberg reminded us only too clearly of those we left behind us in the home country. There is a tendency to over-thin at an early age, this being due to the fact that a fair price can be got for all thinnings, these being used either for making pulp for the manufacture of paper, or for conversion to charcoal, for which there is a very large demand.

Plantations in course of formation were also seen here. The plants used are generally two years seedlings two years transplanted; but in many cases, and especially where the surface of the ground is in suitable condition, two years seedlings one year transplanted are used. The number of plants used per imperial acre is about 2720, making the distance between each about 4 feet. On inquiring their reason for not planting closer, we were told that practically every plant which is put in lives and comes away quickly; and there being no rabbits or other ground game, extra plants are not required to take the place of those eaten or destroyed, and consequently the number quoted is found to be quite sufficient. But the saving effected by the small number of plants required per acre, as compared with the number

used in this country (usually 4840), is lost by the expensive method of planting adopted. All plants are pitted. The surface is skinned, and the soil loosened to a certain depth before the plant is inserted. This method is no doubt good for the plants; but in Sweden, as in Scotland, it is too expensive. Notching, which is much cheaper, would serve the purpose equally well.

One important item of expenditure in the formation of new plantations in which the Swede gets off more easily than the Scotch proprietor, is the first two or three years' cleaning of the ground, such as the cutting of grass and other weeds. In many parts of Scotland the cost of the first two years' cleaning of a plantation amounts to approximately as much as that of the initial planting. Few farmers will take the trouble to lift grass out of a plantation even although it is cut for them. In Sweden the conditions are different; for not only are the peasants willing to cut the grass and weeds themselves, at the same time binding themselves to cause no damage to the young plants, but they actually pay the owner a certain sum of money per hectare for the use of the grass so cut. This means an immense saving of money when large areas have to be dealt with.

The Swedish forester employs another curious method—one which most Scotch foresters would hesitate to defend — with regard to the cleaning of plants. After the fourth year, they graze the whole area with calves. They maintain that calves eat the grass without doing any damage to the young trees. Personally, the writer would not think it advisable to experiment in this way with Scotch calves; he fears they would not be so discriminating in their taste as the Swedish cattle appear to be.

A system which is practised in Omberg, and one of which the writer greatly approves, is the rearing of the future crop in small nurseries in convenient centres within the planting-area. This plan not only results in a considerable saving in the carriage of the plants, but it must be of immense benefit to the plants themselves. They are not, as is usually the case, shifted from a warm and well-sheltered nursery to a colder and more exposed situation; nor are they liable to be damaged by long exposure of their roots to the air, as usually happens when they have to be carried considerable distances; besides, they have the advantage of being permanently planted in the situation and exposure in which the seed germinated,

a fact which is of greater importance than many foresters care to admit.

Leaving the State forests, we now come to those owned by private companies, the first of these visited being Finspong, in the province of Östergötland, which has an area of about 125,000 acres. The syndicate which owns this immense forest has one of the largest iron-works in Sweden. For the making of charcoal to smelt the iron, timber to the enormous quantity of five million English cubic feet is annually required. Besides this, 200,000 logs of matured timber are yearly manufactured, partly for sale and partly for home use. The system of management on this large estate is practically the same as that adopted in the State forests. The staff consists of one chief officer, ten foresters, and 150 ordinary woodmen; but besides these, 150 more men are employed in the saw-mills.

The whole forest is worked on a ninety years' rotation, and the most commendable part of the management is the principle whereby the quantity of timber removed yearly is limited to that which the area can annually grow. It is only by such a system as this that proprietors of woodlands can hope to derive every year a nearly equal income. If this admirable system is to be practised, the necessity of framing "working plans" for the management of the woods is obvious.

Although by far the greater portion of this forest has been naturally reproduced, a large area—about 40,000 acres—has been planted; and to this large tracts are added yearly, involving the use of 264 lbs. of forest seed. The method of planting here is practically the same as that already noticed. Here also the seed is sown in temporary nurseries in the vicinity of the planting-area, the soil being protected by a covering of spruce needles and branches.

It is customary for the Swedish forester to allow ground which is going to be restocked artificially to remain fallow, after the final cutting, for a period of five years. This is to lessen the chance of weevils and other insects attacking the young plants. In the opinion of the writer, this method is in most cases a mistake. If the ground is properly cleaned, and all refuse carefully burned immediately after the old crop is removed, there is not much risk of trouble from beetles; whereas during the fallow period all manner of weeds and rank herbage grow up, necessitating the use of larger plants, at a corresponding increase of price; and, at the

same time, the soil is not only deteriorating in quality, but is contributing nothing in the form of an annual production of wood. In the middle-aged plantations it was seen that bunch-planting was the method adopted when they were formed. This system is now almost entirely given up, and the plants are put out singly, as in our own country.

In restocking the ground by natural regeneration, care is taken, at the end of the rotation, to leave a few of the best trees standing, at distances ranging from twenty to twenty-five paces apart, for the purpose of seeding the ground. These are known as "mother trees." On the approach of a good seed-year, the surface on which these trees are standing is fired, so as to rid the ground of all rough herbage, and to allow the seeds to get more easily into contact with the soil. As soon as the ground appears to be well seeded, the worst of the "mother trees" are removed, while the best trees are allowed to stand during a second rotation to grow into heavier timber.

In this forest, as elsewhere in Sweden, we were told that plantations artificially formed give a greater annual increment than those naturally produced. The writer thinks that this may be accounted for by the fact that hand-sown or planted areas are generally more equally stocked.

Here also, the artificially raised plantations consist of a mixture of Scots fir and spruce. They generally get their first thinning when they have attained the age of thirty years, or when the thinnings are fit for the making of charcoal. After this, they get a thinning once in every ten years, about one-tenth of the stock being taken out at each operation. This continues until the ninetieth year, when the final felling takes place. While in thorough agreement with the general principles upon which this forest is managed, it was the opinion of most of the forester members of the Excursion that the thinning of the young plantations was begun too early, and that it was slightly overdone, the fault, as already mentioned, arising from the demand there is for this class of wood for the making of charcoal.

The forests belonging to Österby Bruk estate, in Dannemora, were next inspected. This estate has a forest area of 62,500 imperial acres, the half of which has been planted, the oldest of the plantations being now only forty years of age. The annual production of timber from these forests is put down at one million cubic feet, and the rotation at eighty years.

Formerly, the system adopted was that of clear-felling and subsequent planting with two years seedlings one year transplanted; or regeneration was effected by hand sowing. Now this system has given place to restocking by natural regeneration, and, as was evidenced on every hand, with the greatest success. It could be seen that attention was paid on this estate to the filling up by hand of gaps where the natural seed failed to find a lodgment. This important work was too much neglected in some of the other forests which we had seen. The mode of seeding the ground is the same as that already recorded. Only the Scotch (or red) firs are allowed to stand as "mother trees," and these at distances varying from 30 to 60 feet apart. The seed trees are cut out when the young forest reaches the age of eight or ten years; but a few of the best of them are retained to stand throughout a second rotation and grow into heavier timber. The young plantations on this estate are in very fine condition, and the thinnings appear to be more judiciously executed than was the case on the other estates.

Where such immense tracts of forest as Sweden possesses have to be maintained, it is absolutely essential that a great deal of the renewal of the crops should be naturally effected; and such being the case, it is rather remarkable that in all the forests we visited the plantations were invariably grazed over by cattle and horses. In some instances, as previously noticed, calves are allowed to graze in plantations which have passed their fourth year, and in plantations that are either hand-sown or self-seeded, cows and horses wander about at will after the seventh year. This practice must undoubtedly militate against the growth of the plants. Another important consideration is the fact that, owing to this practice of grazing, all nurseries and areas inside a forest tract which are being planted have to be fenced, the initial cost of restocking being thus largely increased.

When travelling by train through miles of forests, it was a common remark amongst members of the Excursion that there was no sign of fire having occurred through sparks from passing engines. By Swedish law, the funnels of all locomotive engines must be fitted with patent spark flanges, which make it well-nigh impossible for fire to be emitted through them; but in the event of a casual fire being started by the engine of a passing train, the railway company is at once compelled to make good the loss. It is surely time that the railway companies in our own country were

made responsible for damage caused by fire in this way. Until they are compelled by law to compensate landowners for the damage occasioned by such fires, there is little hope of their putting themselves to much trouble to remedy the present unsatisfactory condition of things.

Before visiting this interesting country, the writer often speculated as to how it was possible for timber merchants in Sweden to land in our ports timber of the various classes at such cheap rates. One of the reasons undoubtedly consists in Sweden's numerous waterways. Nearly the whole of this large country is intersected by lakes and rivers, so that lumber can be floated for hundreds of miles at a very small cost. Her system of railways, too, gives her an enormous advantage over our country. Narrow gauge lines penetrate into the heart of all large forests wherever they are too far removed from floating facilities. Owing to the comparatively flat nature of southern Sweden, the lines can be constructed at a much cheaper rate per mile than similar railways in our country; and the rate per ton for the carriage of timber on railways is also much cheaper than it is with us. By taking full advantage also of their enormous and well-distributed water-power for the working of machinery, the cost of converting the timber is reduced to a minimum. Their machinery, too, is of the most modern and labour-saving type, as was witnessed in the huge saw-mills at Gefle. There does not appear to be much difference in the cost of labour between the two countries, but any difference there may be is in Sweden's favour.

When summing up the experiences of our visit, we have reluctantly to admit that we did not find the Swedish forests in that perfect and well-managed condition which most of us expected. The probability is, however, that those of us who were making a foreign trip for the first time had allowed our imaginations to form rather sanguine impressions of what we were to see on first landing on Continental shores. When, however, we look into the history of the country, and remember the comparatively short time that has elapsed since Sweden took up the important question of State forestry, we cannot but congratulate her on the forward strides which she has already made. Everywhere it was evidenced that not only the State, but also private proprietors, were giving a great deal of money and attention to the better management of their woods. They have already travelled far in

the right direction; and the writer has little doubt that, in the course of time, Sweden will be as far advanced in the scientific treatment of her forests as are her Continental neighbours to-day. She is far ahead of us with her forest schools and museums, and with the other educational machinery which she has provided for the training of her foresters, who are not mere theorists, but are, what is more to the purpose, practical men.

There was much to learn and much to interest throughout the twelve days' tour; and the cordial reception which was everywhere accorded us, with the polite and pleasant manners of the people, will be long and gratefully remembered by all those who had the good fortune to take part in it.

VIII. *Excursion of the Royal Scottish Arboricultural Society to Sweden in* 1902. By Fraser Story, The Glen, Innerleithen.

The s.s. "Balder," bearing the Scottish party, sailed from Granton on 18th July 1902, bound for Gothenburg. The little vessel carried an unusually large number of passengers, upwards of seventy members of the Society being upon her decks. In 1895 about half that number only went over to Germany. The German visit was the Society's first essay at foreign travel, and Scottish caution may have prevented some of the members from taking part in its experiences. But it was a success. The present year's augmented numbers testify to this, though the increase also indicates the continued activity of the Society. Almost before the members had rightly located their berths, they might have imagined themselves in Sweden. "Svenska" sounded on every side; the ship was manned by Swedes, and the courtly presence of Captain Dahlstrom, a true Viking, was remarked upon the bridge. At lunch the fare was yet more Swedish still. Many small but dangerous dishes, comprising, as the members learned later, the "Smörgâsbord," preceded the meal. The strange assortment was not the best, perhaps, with which to begin a voyage, and it did not seem to tend to the company's later happiness.

Be the reason what it may, it was with feelings of gratitude that the majority of the passengers entered quiet waters on the following Sunday morning. They were in the Göta Älf, proceeding between storm-swept islets and signalling stations towards their port of landing. The Secretary, Mr Galloway, had made all preliminary arrangements, and everything was ready for a start when the party reached Gothenburg. There Mr Nilson, who did so much for the members during the tour, joined the company. Mr Nyman also was upon the quay to render his first attentions. Walking a short way through the town, the party reached one of Gothenburg's public parks—Slottskogen, and later on visited the Horticultural Gardens. The treatment of the city gardens is a fine feature in every Swedish town. They are always bright spots, fresh and gay, pleasing the eye by their arrangement and natural beauty. Nothing about them is stiff or formal; they present no geometrical puzzles. They are flower-gardens for

the lovers of flowers, not botanic gardens for the science student. Their attractions are their brightness, their bands, and their restaurants.

As Gothenburg was to be revisited, the party did not pause long in it,—Jönköping had to be reached that night. An interesting but poor country lies between the two towns. Much of it is moor, bearing what may naturally come up upon it. Small cultivated patches, worked by peasant proprietors, have crops of rye, oats, potatoes, flax, and hemp. Turnips, Swedish or other, are seldom seen in Sweden; their place in the rotation is generally taken by bare fallow. The most remarkable characteristic of the country is the extraordinary number of lakes. They seem to have been ground out by glacial action, and, being recently formed, have not yet been silted up. Inland waters are always beautiful; in Sweden they are also useful. Their abundance has suggested the formation of vast water-ways for the transport of merchandise. Everywhere one finds these intersecting the land, and rendering its resources available. Sometimes a river, as at Motala, has aided the engineer, but, in the absence of a river, canals have been formed. Carriage is so much less expensive over water than over land, that this system has helped greatly in the development of Sweden. Stretches of level land are seldom met with, nor is there much of the other extreme. Gentle undulations, low rounded hills sloping gradually down to meadow lands or quiet waters—these are the abiding impressions of the scenery of southern Sweden. It is a prospect tame, but not unpleasing.

The people seem to have been moulded by their environment. They have neither the cold austerity of the Scotch, nor the lively passion begotten under southern skies. Simple, equal-tempered, kindly, they show the truest courtesy to the stranger, and command his respect. Theirs is a courtesy that is not servile; it sits becomingly upon the people, being at once easy and dignified.

Over the shoulder of Mount Taberg the moon had risen, and was shining full across Lake Vettern, as the party reached its destination. The arrival of the Scotsmen created a sensation in Jönköping, where, outside of the station, a crowd awaited their arrival. It was difficult, however, to read in the impassive countenances the kind of impression the "foreigners" made. Jönköping was quite approved of by the foresters. The hotel

was spacious and well appointed—good hotels seem common in Sweden. The towns, speaking generally, are well arranged, the houses substantially built, and the streets broad, while gardens and open spaces are numerous. The inhabitants lack none of the amenities of modern civil life.

At Jönköping the Arboricultural Excursion began in earnest. The Munksjö Paper-Mills were first inspected. At this factory five hundred people are employed. The pulp used for paper-making comes chiefly from spruce wood. Ordinary round logs are brought into the mill, cut crosswise into short lengths, and passed up a moving inclined plane to men who quickly strip off the bark, partly by means of machinery, but partly also by hand work. The short logs are then conducted to the chopping machine, which cuts them into small, thin sections. The chips pass up on broad revolving belts into the "cooking" vats. During their passage they are examined, and all knotty or otherwise defective pieces are removed. In the boilers the wood is reduced to pulp by a chemical process—calcium-sulphite and caustic soda being used. After twelve to eighteen hours of this preparation, the pulp is brought into the paper-making mill. It leaves the boilers as small, much macerated, brownish pieces. Pounded and mixed with water, it flows in semi-liquid condition on to fine sieves that have a forward motion. Conducted by these to rollers, it is pressed; again sieves free it from moisture, more rollers follow, until, in a matted sheet, it reaches steam drying drums, and the paper-making process is complete. Paper of many qualities and degrees of thickness is made at this mill, which is also well known for a certain roofing felt or tarred pasteboard that is largely exported. The Munksjö Company owns forests from which it annually fells for paper-pulp 750,000 cubic feet[1] (English measurement) of timber, and the demand is constantly increasing.

From the paper-mill the party went on to a match-making factory. Jönköping is famous for its matches. Individually so insignificant, matches become in their wholesale manufacture an important industry. The wood of the aspen poplar (*Populus tremula*) is preferred to all others, but the local supply being

[1] The conversion of Swedish measurements into their British equivalents has been effected by taking the hectare as being equal to 2·5 acres, and the cubic metre as 35 cubic feet, with a reduction of 25 per cent. to allow for the British quarter-girth system.

exhausted, this timber is brought to the factories from Russia. The special product of the factory visited is the *säkerhets-tändstickor*, or safety match, which, as all the world knows, is without sulphur or phosphorus. Jönköping is, indeed, the birth-place of the safety match, for it was there that Lundström made the invention in 1855. The machinery that daily turns out matches, to the enormous number of one million boxes, is marvellously ingenious and effective. The slicing of the timber into sheets, the forming of the "splints," the shaping of the box, the affixing and printing of the labels, the "heading" of the matches,—all the processes from first to last were seen by the admiring party. It is a wonderful evolution, accomplished with a speed and economy that surprise. The eight hundred people who find employment in the works are well cared for; everything that can be done for their health and personal safety receiving due attention. No harmful chemicals are used, and the building being lined with zinc, floored with stone, and having ceilings of concrete, is proof against fire. In case of a conflagration, sections of the building can at once be filled with steam to check destruction to stock. Every detail seems to have received consideration. The match factory will long be remembered.

The Swedish town has always its tree-garden (*trädgärden*), that is, an open-air restaurant where, under the light shelter of broad-leaved trees, the people gather to listen to the band and indulge the national weakness for "punsch." Owing to one of these gardens being connected with the hotel, the evenings at Jönköping were not without their entertainment; and the ordinary programme was extended to include certain national airs and ballads worthy the occasion. Never does a Scotsman feel more Scotch than when he is abroad: to appreciate the full meaning of "Auld Lang Syne," one must be far from Scotland.

A sail of about an hour and a half's duration from Jönköping brings one to the little island of Visingsö, in Lake Vettern. The Crown woods there were gone over by the Society. They are not of great extent: about 1000 acres are under oak, and 450 acres under spruce and silver fir; while a part of the area is under pure crops of Scots pine. Systematic management has been brought to bear on the woods. Oak, now seventy-five years old, had been underplanted at thirty-four years with spruce and silver fir. These latter have grown well, and are

indeed beginning to encroach upon the oak crowns. The more aggressive of them will at once be taken out, and the whole of the conifers will soon be felled. Small-sized timber of this kind finds a ready market in the neighbouring pulp factories. Immediately upon the present underwood being cleared, a second and similar one will be introduced, which will be felled with the oak when the latter has reached the end of its rotation of one hundred and twenty years. In some cases there are three rotations of the shade-bearer to one of the oak. Beech has been tried, but, owing to the treatment it has received, rather than its unsuitability to the situation, it has not succeeded very well. The silver fir has grown better than the spruce, and ought to be chosen before it in future underplantings. As is well known, the spruce, with its shallow root-system spreading through the upper soil, deprives the deeper roots of the oak of the moisture and nutriment the tree demands. Spruce cannot be said to be a good species for the underplanting of oak, and one was surprised to see it thus used in otherwise fairly well-regulated woods. Some young mixed woods of spruce and silver fir were looking well; a middle-aged wood of Scots pine had been recently treated with an underwood of spruce. Scots pine was seen planted at distances apart in the rows of 3 feet, the rows being 6 feet apart, and the intervening space being filled in with spruce. "Patch planting" with prepared pits is resorted to, the soil always receiving some sort of cultivation at the time of planting. A wood of mature Scots pine, which had apparently been grown pure, was admired on account of the clean-grown stems. The trees were one hundred years old and 88 feet high. Oak and larch in mixture together were also seen. As with the pure oak, they had been underplanted. Caterpillars of the oak-leaf-roller moth (*Tortrix viridana*) were seriously affecting the oak; but next year, being the third year of the insect's presence, is expected to bring the attack to an end.

The prices obtained for timber in this locality would be considered very low in Britain. Oak ranges from 7d. to 9d. per cubic foot; spruce, silver fir, and Scots pine are classed together, and fetch from 3d. to 5d. per foot. Birch for firewood brings in 1½d. to 2d. by English measurement. The prices are those "in the forest," the buyer having to remove the timber at his own expense.

Before leaving Visingsö, the members visited Brahe Church,

which is a quaint old building with its rough wooden beams strangely decorated. There are in it carved figures of great antiquity intended to represent the twelve apostles, but their faces have been turned to the wall because they made the small boys laugh. They are curious effigies. The ancient bell-turret, as is common in many parts of Sweden, is at some distance from the church. Built of wood, and with great beams supporting overhanging cross-gables, these so-called *klockstaplar* have a most picturesque appearance.

On the eastern shore of Lake Vettern, and north from Visingsö, is Mount Omberg, which was visited by the Society after leaving Jönköping. Stripped of all coverings down to the Archæan gneiss, the Omberg stands out boldly above the surrounding country—the Östgöta Plain. Its hummocky bosses of rock are rounded and polished by the action of ice. The property extends to about 3000 acres, and belongs to the State. Half of the area consists of natural wood, chiefly spruce, and the rest has been stocked by planting. For the latter, "ball plants," raised in temporary nurseries, are largely used. Such nurseries were seen at several points immediately beside areas about to be planted. In the seed-beds, broadcast sowing is not practised, but single drills, in which the seed is sown, are made about $2\frac{1}{2}$ inches apart. By means of dead branches thrown over a lightly constructed frame-work raised 3 feet from the ground, sensitive species are sheltered from frost and "frost-lifting." The first wood entered by the party on their visit to Omberg was an excellent one. Larch of fifty-seven years old, originally grown as a pure wood, had been underplanted about fifteen years ago with spruce. The larches are now about 75 feet high, straight and free from side branches. Their diameter at breast-height averages about 10 inches. One hundred and ninety trees of the overwood, representing about 3800 cubic feet (quarter-girth) of timber, are said to stand upon the acre. Irrespective of the underwood and thinnings, this shows an increment of 67 cubic feet per acre per annum. The timber is used locally for the construction of boats. The plantation is only a small one, and no definite plan has been proposed for it; but the larch will be allowed to grow as long as it remains sound. A small part of the wood has beech instead of spruce for soil-protection. It is desired to encourage the beech, but it is only possible to raise it under some form of shelter. Without protection, young beech at

Omberg does not survive the frosts of spring. With the exception of this wood, the estate has little to show the forester, much of the ground being occupied by very open woods of mature spruce. These have sprung from naturally sown seed, and no effort appears to have been made to maintain a full density of crop. A better example was afforded by a wood of forty years old, planted in about equal numbers with silver fir and spruce. It has been twice thinned—the first time when the wood was twenty-five years old. It now contains about 3300 cubic feet per acre. The planting distance of some fresh, recently planted areas was objected to by the Scotch foresters; spruce and silver fir were seen planted in rows 6 feet apart, with 5 or 6 feet between the plants in the row. At such distances, the young plants develop strong side branches, and the annual rings are unduly wide.

Near Alvastra station, at Omberg, is a curious barn, which excited some interest. It is built entirely of wood, and consists of two storeys, with a platform or broad gangway in place of a third storey. The approach to the gangway is outside the building, and is arranged on an inclined plane. Loaded carts of straw and hay can be taken by horses right up to the highest part of the building. From thence the fodder is easily emptied into the hay-loft below, to be conveyed as it is required through trap-doors into the stables and cattle courts situated on the basement.

From Alvastra to Norrköping, the party proceeded by train through an agricultural district, where the people were mainly employed in securing their hay harvest. Diminutive drying-racks are fixed up temporarily in the fields. They are made from rails held in place by light crossed poles; and the hay is hung over the rails to get the full benefit of sun and air—a useful plan on swampy ground. The plentifulness of timber in the country districts is at once evident in the fences, slim poles of spruce and pine, run up diagonally from the ground, with upright posts of birch, holding them together. Such fences are a characteristic feature of Swedish rural scenery.

For two nights Norrköping was the headquarters of the Society; and from thence was made the memorable visit to the Finspong forests. The company that owns these forests was one of the earliest to realise the necessity for forest conservancy, and the importance of systematic work. So long ago

as 1860, well-regulated plans for felling and planting work were instituted. Since that date, 37,000 acres have been artificially stocked with trees, and the company now look upon the results with satisfaction. Operations are on a very large scale. The area of the estate is 125,000 acres, of which 106,000 are under forest. Mr Axel Ekman, R.V.O., Managing Director of the Finspong Company, most kindly arranged everything for the reception of the arboriculturists. They were his guests for the day, and benefited much by his forethought on their account. A statement expressly prepared for the use of the visitors gave many interesting details of the management. The objects the proprietors have in view are the production of large-sized timber for manufacture in their saw-mills, and the maintenance of a supply of wood-charcoal for their iron-works. Apart from the forests, there are 8000 acres of agricultural land, and 7000 acres under pasture and scrub wood. The country people over a wide area are largely dependent for their livelihood on work obtained in the forests. Five million cubic feet of wood are annually converted into charcoal, and 200,000 logs go to the saw-mills, of which there are five on the estate. The manufactured wood amounts to about 4500 standards per annum. One hundred and fifty workmen are employed at the saw-mills, and about one hundred and twenty in the forests. One chief forester and ten district-foresters control the workpeople.

It is doubtful if on any other private estate in Sweden afforestation of fresh areas has been carried out on as extensive a scale as at Finspong. Some twenty-nine millions of trees have been planted, and three and a half tons of seed have been sown, within recent years. Scots pine is the predominating species; its rotation being fixed at ninety years. It is interesting to notice that artificial stocking has been found to give a larger quantity of wood, in a given period, than that yielded by natural sowing, the difference being chiefly due to the patchy distribution of the crop under the latter system. It cannot be said that all the woods present the best possible appearance. The influence of density upon the crop does not seem to have been fully appreciated, as the woods are too open in character. The admixture of spruce in the pine woods also has not been a success. Probably the opportunity to make small timber into charcoal has proved too attractive for the wood managers, and has tempted them to enter the plantations for thinnings too early

and too often. The most commendable part of the administration lies in the control exercised over the amount of the fellings. The quantity of timber which the area annually produces has been calculated, and no more than that amount is abstracted. The year's felling is thus balanced by the year's growth, and an almost equal annual income is assured, without impairing the forest's resources. Mr Ekman paid the Society the compliment of entertaining the members to luncheon in his magnificent house. His kindness and courtesy were highly appreciated, and will long be remembered with pleasure. It was interesting to hear that in the forests of Finspong and neighbourhood, elk are numerous, hares also are in considerable numbers, while rabbits are almost unknown ; of game birds, capercailzie, blackcock, and partridge are found.

On the morning after the visit to Finspong, a very early start was made. Rising at 3.30 A.M., the party reached Stockholm in the forenoon, and later in the day visited the Royal Forest Academy, the Botanic Garden, and Skansen Park. The Academy is an unpretentious building, but is fully equipped with lecture theatres, laboratories, and a good collection of natural history specimens. The staff at the college comprises the director and eight lecturers. This is the college through which all forest officers must pass. Forest guards, who are not qualified so highly, do not go there, but undergo a simpler training at a forest school. There are six institutions for the guards, and two training colleges and the Stockholm Academy for the officers. Candidates for the higher positions begin by passing an entrance examination. Then follows one year at a provincial forest school, such as the arboriculturists saw at Omberg. There the students come into touch with the practical work of forestry, and also receive some instruction in elementary science. Leaving the forest school for Stockholm, they take the two years' curriculum there. Should they be successful in passing the examination at the end of that period, they go to a *revier* or forest district for one year more, and then receive their diploma, with the title of Master of the Royal Domains. There were, at the time of the Society's visit, some sixty students at the college. So great a number could not hope to find employment each year as officers in the State woods ; but there is always a demand for well-trained men amongst owners of private forest lands.

At a short distance from the Academy is the Biological Museum, and upon hearing that it was the only one of its kind in the world, most of the members visited it. Its treatment certainly is original, and deserves every praise. Nearly three thousand animals have been brought together, classified not as in ordinary museums in genera and species, but as they are found associated in nature. With the aid of panoramic effects, the natural surroundings of the animals have been reproduced. In their natural positions and environment, specimens of nearly all the Scandinavian fauna are found there. Usually even the commonest animals exhibited in public repositories are rendered difficult of recognition by their inartistic treatment. Confined within angular cases of glass, they require for their determination the help of a largely written label. In the Djurgården Museum, however, birds appear flying in mid-air, or perched upon the actual trees of their native forest. Coveys of moor fowl are amongst the heather; guillemots crowd upon ledges of rock that reach down to the blue sea; ospreys, sandpipers, oyster-catchers, cormorants, are upon the shore. The effect is both realistic and educative.

Skansen Park also deserves mention. It is a unique and typically Scandinavian institution. Indeed, it aspires to epitomise in graphic manner the past history of the Swedish nation. In it are vestiges of the Stone Age, in Druidical remains, stone chests and urns; mud huts are represented; farm buildings of long ago are there, with implements and household utensils—the distant prototypes of what are used to-day. Buildings of historic interest are preserved or reproduced in Skansen; for instance, the house of Emmanuel Swedenborg, peculiarly formed granaries from Östergötland, stone huts from Holland—all fittingly treated in their surroundings. With Skansen is associated the Hasselbacken restaurant. It so happened that the Scottish Society dined at Hasselbacken on the 26th July—the great anniversary of the poet Bellman. Bellman is Sweden's Robert Burns; he is the popular poet, the writer of songs and lyrics. A statue to his memory has been erected at Hasselbacken; and on the evening of his anniversary, Stockholm gathers round it as at a shrine, to sing his songs and his praises. The arboriculturists had thus an opportunity of seeing life in the Swedish capital at one of its gayest moments.

The places of interest that the Society visited in Stockholm are too numerous to describe at length in this report. Riddarholm Church, with its memorials to Sweden's kings, and many trophies of war; and the Royal Palace, an enormous building, devoid of architectural grace, but containing much that is valuable, were sought out by the members. Stockholm has probably the best telephone system in the world, and the visit to the telephone tower was one of the most interesting. Outside of the city the Society visited King Oscar's Summer Palace at Drottningholm, on the beautiful Lake Mälaren; and its members were called upon to choose for a further excursion between the inspection of a model dairy farm, or a trip to Saltjöbaden and the Baltic Archipelago. The party divided, and both sections returned with glowing accounts of their visits. Cow-keeping seems to have been brought to the highest state of perfection near Stockholm. All over the country one finds the most delightful dairy products — Scandinavia is world-famous for them; but still the visitors were surprised by what they saw. The health of the cows is attended to in every particular; the space provided for their accommodation is the result of the closest search into the laws of milk-production and hygienic science. But as illnesses will occur where two or three hundred cows are kept, a fully-equipped hospital is provided within the grounds to receive the bovine patients. Much of the heavy work, as, for instance, that connected with the feeding of the cows and the cleaning of the byre, is done automatically. In Britain, dairy workers are becoming scarce, and one may reflect that if the drudgery work were performed by means such as those seen at this farm, they would be obtained more easily. We have advanced somewhat in dairy matters, but we are seen to be still far behind if we compare our own with institutions like that near Stockholm.

Those who went to Saltjöbaden and the group of neighbouring islands, found a type of scenery with which we are not familiar at home. Saltjöbaden is the retreat of Stockholm's wealthy business men. They find in it the antidote to the poisons of the town. Its virtues may be thought to be negative: there are no streets, no shops, no theatres. A few lightly-constructed wooden houses are dotted over the little peninsula. Were all the soil on it gathered together, it would hardly suffice to form one respectable garden. All is bare smooth rock, and around it

the salt sea. It is in the form of an inverted bowl, and almost as featureless. Its charm lies in its being absolutely opposite in character to the city. It compels the townsman's thoughts to Nature, and thereby saves him.

Upon leaving Stockholm it was felt the three days spent in it had not been misspent; something had been learnt of Swedish civil life. The absence of "slums," and the class of people we associate with them, was frequently commented on. Even the lowest quarters, with lanes and narrow streets, have nothing objectionable about them, either by day or night. The general situation of Stockholm, its waterways, its gardens, its buildings, and its people—all were the subject of admiration.

On Sunday, 27th July, the party visited Dannemora and the Österby forests. The train conveying the members passed through historic Upsala, regardless of the relics of Linnæus, and reached Dannemora about midday. Our school-books used to contain the statement that the iron of Dannemora makes the finest steel in the world. And this is actually so. No iron-ore can be more pure than the black oxide, free from phosphorus, that is there excavated. The mine has a very striking appearance: open to the surface, a huge perpendicular quarry descends to the depth of 600 feet. Its working was begun in the fifteenth century, and about 15,000 tons of ore are yearly taken from it. Nearly eight hundred workers are employed. As the iron occurs chiefly in crystalline schistose rock, coal is not associated with it. But in the blast-furnaces wood-charcoal takes the place of coal, and it is possible that the superiority of Swedish iron is almost as largely due to this fact as to the purity of the ore itself. The absence of sulphur in charcoal constitutes its superiority over coal for this use. The forests of Österby supply part of the charcoal. They are almost immediately adjacent to the mine, and extend over some 63,000 acres, of which one-half is under young woods. The areas recently stocked will be kept with a full "normal" crop up to their eightieth year, when they will be felled. The expectation is that they will then yield 3780 cubic feet (quarter-girth) per acre—a quantity that, without reckoning thinnings, represents a yearly increment of 47 cubic feet per acre. The species employed are Scots pine and spruce. The former of these species is now raised by natural reproduction. When nearing the end of the rotation, mixed woods have the spruce taken from them; and

the Scots pine that are selected for sowing the ground are gradually isolated, until, upon the appearance of a seed-year, they stand at distances apart from each other of about 25 yards. No cultivation is given to the soil; the regulation of the canopy, so as to prepare the seed-bed, is all that is necessary. What is most to be avoided is an accumulation upon the surface of hard, undecomposed humus. When the young crop is fairly established, most of the older trees are removed, and when the former has reached the age of eight or ten years, but few of the latter remain. It is better, indeed, that they should be gradually but entirely removed within that period.

Upon the whole the system has been successful at Österby; little "beating up" is required, the parent trees stock the area plentifully, and the only costs are those for superintendence and the loss of timber-production while the stock is incomplete before the seeding. With clear-felling and subsequent regeneration by sowing or planting, the expenditure is more apparent, but it is probably not really greater than the unreckoned loss in natural restocking. The latter method requires more care and skill in management, the felling operations are more protracted, the occurrence of seed-years is uncertain, and the risk to the standards from wind is considerable. It has its advantages, but it is doubtful whether they counterbalance these drawbacks.

Many of the woods are composed of Scots pine and spruce in even-aged mixture. The combination is an unhappy one. The two species seldom make a similar growth in height, and in localities where the disparity is very marked, they are better separate. Where the spruce claims ascendancy, it is useless to attempt to maintain the pine in the mixture, for it cannot endure the shade of the spruce. Then in places—as at Österby—where the situation favours the pine, the opposite condition obtains; the pine asserting itself from the very beginning, and by its vigorous growth suppressing and ultimately killing the spruce. This might matter very little were it not that the pine takes advantage of the unintended accession of space, caused by its neighbour's death, to overdevelop its lateral branches at the expense of its growth in height. But if exception be taken to the management of the Österby woods in some matters, in others it is to be praised and emulated. Most of the woods look well, and it is not too much to say that the best forestry seen in Sweden was that at Österby. This good appearance is largely

due to the method of tending. Thinnings are not commenced till the woods are about thirty years of age. Even then, only a light cutting takes place, by the removal of dead, quite suppressed, and undesirable trees. The growth of the forest indicates when other thinnings are to follow; but they are frequent and light. What they yield is made into charcoal; the kilns being erected within the forest area in October, when there is little fear of damage to the forests by fire. As a precaution against fire, the woods are divided into compartments by belts of birch, or by open rides at intervals of 100 yards. Cattle are allowed into the woods when the trees are eight years old, the great scarcity of pasture being offered as excuse for the practice. At present, the woods are said to yield annually over 1,000,000 cubic feet of timber and charcoal. There is a much greater local demand for charcoal than can be satisfied. The day at Österby was one full of instruction. Mr O. M. Strömberg, R.V.O., did everything in his power for his visitors, and received them at his house with the utmost hospitality and kindness.

The party travelled the same evening northwards to Gefle. Gefle is described in the Society's itinerary as "a very going ahead place," and so it is, no doubt, for it is one of the foremost towns in Sweden. Still, to a Briton it appears quiet enough. There is nothing about it of the hum and bustle of a British town of like population. The streets have an almost deserted look, no one is hurrying; apparently this placid people conducts its business with less fuss than we do! Its chief interest for the arboriculturists lay in its timber trade and saw-mills. The Korsnäs Saw-mill at Skutskär, visited under the guidance of the managing director, Mr Martin, is a huge concern. The company brings its timber from Dalecarlia, 300 miles away, where it owns 850,000 acres of forest. The logs, felled, marked, and dragged to the waterways in winter, are floated during spring and summer by rivers and lochs, supplemented by canals, up to the doors of the saw-mill. In the water the logs are held, floating behind a boom or breakwater, until they are required; some being stacked over the ice for use in winter. By means of chains they are drawn up wooden slides into the factory, where the frame-saws are ready to receive them. The Korsnäs Mill is considered to be the most up-to-date in Europe, all the latest mechanical appliances having been introduced to secure

speed and efficiency. Log upon log succeed each other in a constant stream; they press forward upon the vertical saws, and are borne off in front in many forms of planking. Thirty high-speed frame-saws are working together under the one roof; and they convert annually upwards of 6,000,000 cubic feet of timber, most of which comes to this country. Three engines aggregating 7000 horse-power, maintain the work of the mill by incessant labour day and night. They receive no fuel other than the waste sawdust, which is brought to them automatically. Everything about the mill is economically arranged, neither time nor material being lost. The slabs, planks, etc., coming from the saws are quickly assorted, each to receive further attention. Mechanism has been called in as far as possible to take the place of manual labour, and there is the most complete dispersal of the several products; much of the material being despatched to the planing-machines, sapwood going to the charcoal kilns, and rough ends becoming firewood. The same company that is felling the trees of the northern forests exports wood finished with a moulding, and boards ready planed and mortised. A complete village is included within the boundaries of the property, comprising houses for most of the thirteen hundred to fourteen hundred workpeople employed at the mills. From works like this it is amply evident that Sweden means to make the most of her vanishing timber supply. No longer does the produce come over to us "in the round"; instead of that, Swedish machines and Swedish labour now wring from it the last *öre* of profit.

Almost due west from Gefle is Falun, the capital of Dalarne, which was visited by the Society. It is only a small town, but it has been famous from early times on account of its rich copper-mine. The Falun mine has, since records have been kept, yielded 500,000 tons of copper, valued at £50,000,000. Its deepest shaft descends to 1200 feet. The arboriculturists entered the mine, but explorations at a much less depth satisfied them. Round about Falun the country is absolutely desolate, being bereft of all vegetation by the poisonous fumes from the furnaces. The aspect was not cheering, and did not encourage further investigation. The members who ventured underground were therefore the more surprised at the wonderful reception that awaited them. Before going down, they were provided with a picturesque attire—a long tunic fastened about

the waist by a leather belt, and for headwear, a broad soft-brimmed hat. As they entered the mysterious darkness of the mine, each was given a lamp, whilst guides placed here and there bore torches. The descent was not accomplished by an ordinary shaft, but by winding passages hewn out of the rock at an easy gradient. Several archways led to a great central hall or grotto, known as the Cave of Peace. As the foresters approached it, soft strains of music met the ear. These proceeded from a band of musicians secreted in a darksome corner. But much of the cave was lit. Candles and torches, arranged in pyramids and long lines, broke up the Stygian darkness natural to it. Fair attendants, like nymphs of the grotto, appeared in costumes that lent effect to the scene, and generously dispensed "the nectar of the gods." After speeches, in which national courtesies were exchanged, the company proceeded farther into the mine, and emerged upon an open quarry, from which the ascent was made by ladders. On every hand, one heard commendation of the mine-manager's unique entertainment and hospitality.

The Excursion thus drawing to a close, the party left Falun for the south. A distance of about 250 miles had to be travelled before reaching Trollhättan next morning. But the members were not anxious. The special train provided for their use was eminently comfortable, an excellent view was to be had of the country, and, when darkness fell on the scene, the adjustable "bunks" allowed of a good night's rest. The railway journeys were often most instructive. From the vantage ground of the corridor window one could see much of the country's forest growth. It did not impress the travellers favourably. They were too often in the track of the lumberman for that. The lumbermen of former times have left unmistakable marks upon the land. From the original forests they have taken the best. One regrets they did not take all, for, irregularly scattered over the ground, rise second rate, open-headed, isolated trees—the rejected fragments of the exploiter. Between and around these is an indiscriminate natural growth of birch, pine, spruce, and juniper. The first of these has especially asserted itself. Being hardy and seeding plentifully, birch settles itself on all situations, to the exclusion of more valuable species. Its presence is unfortunate for Sweden, as there it can only be described as a "beautiful weed."

At Trollhättan, the celebrated cataract of the Göta river was visited. The members gathered together upon the island of Toppön, which is simply a great gneiss boulder in mid-stream. On both sides of it the foaming torrent roars and bellows as it throws itself over the rocks. There is a majesty in such a splendid exhibition of power. Other falls and rapids farther down the river have received names that reflect the feelings they engender. Dödens Gång is the "Way of Death," Jättegryta is the "Giants' Cauldron," while "Hell's Gate" is yet more dreadful. The canal locks, by which vessels avoid the falls, are very wonderful. They allow of navigation up a river whose waters fall more than a hundred feet in a short distance. The Swedish Government realises that in Trollhättan Falls exists an enormous energy capable of being put to use; but a disputed question of ownership must be settled by litigation before the State can erect works. At present, water-power equal to only 4000 out of an estimated total of 220,000, horse-power, is utilised. One of the factories using the water-turbine was visited by some of the members, and the party returned to Gothenburg in the evening.

The Society had taken a long and interesting circular route; and it only remained to thank those who had so largely contributed to the success of the Excursion. Lord Mansfield, in the name of the Arboricultural Society, despatched a message to His Majesty, King Oscar, who responded graciously. Mr Nyman was heartily thanked for his able direction in conducting the tour. No office was more important than his, and he fulfilled it well. To Mr Nilson a special mark of esteem was shown: with everyone he had been the same painstaking worker, ready and anxious to give all information in his power. Personally, I desire to acknowledge my indebtedness to him, for my notes are mainly taken from facts he acquainted me with. In their forest guide the arboriculturists were most fortunate.

The passage home was accomplished in the s.s. "Bele," and proved less terrible than the outward voyage; it occupied almost exactly two days. The Society arrived at Granton on Sunday the 3rd of August.

The Excursion of 1902 has been a memorable one. In it the Society made the acquaintance of Britain's largest exporter of timber. The conditions under which Sweden procures the timber it sends to us are now more exactly understood. It is the product of primeval forest, that lies far to the north of the

country. All of this forest cannot be reached; much of it being so inaccessible that its felling would not be remunerative. What is accessible is being exploited with regard only to present profit. Sweden exports annually to Britain alone about 100,000,000 cubic feet of coniferous timber. In this way the country that the Society has just visited may be regarded as antagonistic to British forestry. The timber it exports comes to us in tempting form. It has been grown in regions where the natural density of the forest has not been interfered with. It has passed through saw-mills where the extent of the operations has allowed of the work being done cheaply. Water transport abroad, and preferential railway rates at home, have helped its transmission. All the conditions of its production and sale are against the British woodgrower. He has not cried out for protection, simply because he has so little to defend. It is yearly becoming more evident, indeed, that encouragement rather than antagonism must be the British attitude towards those from whom the timber comes; but it is the Home foresters' plain duty and interest to render Britain more independent by extensive planting. Only this month (October 2nd) the *Scotsman* published a telegram from Sundsvall, Sweden: "The timber exporters of North Sweden have decided to restrict the cutting of wood for export purposes by 25 per cent. as compared with last year." The attention of foresters has often been drawn to the failing foreign supplies, but now that so many of them have actually seen a once densely afforested country largely depleted of its timber, they are naturally more impressed. Trees take long to grow, but they are quickly felled—that is the feeling with which one returns from Sweden.

IX. *The Utilisation of Waterworks' Gathering-Grounds by Afforestation.* By W. G. Smith, Yorkshire College, Leeds.

The following is an account of the earlier stages of a scheme which, if imitated, would constitute an important development of Forestry in Britain. The case is that of a special locality, but it is very similar in character to the hilly districts from which so many of our municipal bodies have the right to collect a water-supply. The prime mover was Mr W. B. Crump, M.A., of Halifax, who as a botanist knows Yorkshire well, and has recognised, amongst other things, that the present extent of woodland in the county is far below what it might be. Mr Crump has given his views in the *Halifax Naturalist* (April 1902), and as, probably, few of the readers of these *Transactions* have seen this periodical, portions of it are, by permission, here reproduced.

Mr Crump's Article in the "Halifax Naturalist."

A splendid opportunity awaits the Halifax Corporation and other corporations. They have become the owners of considerable estates, which they are anxious to preserve for all time unpeopled and uncultivated. Farms have passed out of cultivation, and will revert to moorland, in this neighbourhood at all events. In a sense this land is unproductive, and yet by afforestation it could be made productive, without in any way interfering with the primary object of its acquisition. On the contrary, it is certain that the presence of forest would promote in no small degree this primary object—an abundant and regular supply of pure water. It would also furnish employment, to some extent, for those who have laboured on the land and who are now being driven off it.

In the Hebble valley alone, from Mixenden to Ogden Moor, the Corporation owns at least a thousand acres. It is true a large proportion, the moorland, is unfit for immediate planting, but let woods be once well established on the slopes, and the afforestation of the moor will only be a question of time and skill. As to the rest, the Corporation is in a singularly fortunate position: there are no restrictive conditions, no shooting rights or sporting interests, no heavy outlay on draining and fences to be considered, such as too often deter a private individual. Of course there are many who appreciate the beauty of woodland, and would welcome the planting of trees in our particularly bare and barren valleys. Pretty woodlands and tree-covered parks are not, however, the ideals of the forester. Our existing woods produce, as a rule, little marketable timber and much waste, partly as a consequence of lack of management,

but also because it is worth no one's while to give proper treatment to a single wood a few acres in extent.

The following statement, advocating the afforestation of their gathering-grounds, was recently placed before the Halifax Waterworks Committee, and was ordered to be printed.

Mr Crump's Report of March 1902 to the Halifax Corporation Waterworks Committee.

A short time ago I approached your chairman with the suggestion that much of the drainage area around the Corporation reservoirs, and especially the farm-lands that have been more recently purchased, might be planted with trees on a large scale, or afforested. I found that the proposal had already been advocated, and my offer of help was most cordially welcomed. I had already interested Dr Wm. G. Smith, of the Yorkshire College, and Mr Wm. Forbes, Lord Masham's forester on the Swinton estate, in the scheme, and personally I am much indebted to them for the invaluable assistance they have rendered. I have the pleasure of submitting for your consideration a letter from Mr Forbes, and a detailed report on the afforestation of the Mixenden and Ogden areas from Dr Smith. Mr Forbes was unfortunately unable to accompany us on our visit of inspection to this area.

As Dr Smith and I went over the ground together, and discussed on the spot the questions considered in his report, there is no necessity for me to say anything on the details covered by it, except that I thoroughly endorse his views. I propose therefore to confine myself to a few other considerations.

(1) Planting the gathering-grounds will be beneficial to the water-supply, both as to its quality and quantity. The only precaution is to safeguard the reservoirs from the accumulation of dead leaves, which may be easily done by adopting Mr Forbes's suggestion of an inner belt of conifers.

(2) Under right management the timber produced will, after the lapse of forty or fifty years, produce a regular income, and eventually a good profit, both on the cost of upkeep and the capitalised value of the land with interest. Nor will this involve any further capital expenditure. The cost of establishing the plantations may easily come out of the income of the waterworks, by distributing it over a number of years, and after the first unremunerative period, out of the return from the plantations themselves.

(3) Though the other gathering-grounds belonging to the Corporation should not be overlooked, there are many reasons for choosing Ogden and Mixenden to commence with, and but one possible disadvantage. The large area of pasture, the nature and depth of the soil, the shelter afforded by the higher land on the west, the accessibility and nearness to a railway, are all decided advantages, not to mention the improvement which would be produced at Ogden by the presence of pine woods on the hill slopes: in itself an inducement to incur some expense. Smoke is the only danger. Conifers or evergreen trees will not flourish and come to maturity near the

town. However, Ogden is sufficiently far away to reduce this risk to a minimum, and at Mixenden there is but little risk, whilst there is hardly any need to plant conifers, as the more profitable deciduous trees will readily grow there. Fortunately both places are north-west of Halifax, and the prevalent winds will therefore be almost free from smoke. Further, the bend in the Hebble valley at Wheatley prevents the smoke from Halifax drifting up it towards Mixenden. We actually saw no injury done by smoke, and found that firs had been grown and felled for timber near Mixenden Reservoir.

(4) A "working plan" is absolutely essential for the establishment and maintenance of plantations and woodland, if they are to be managed rightly and yield their full profit. A skilled forester should be consulted and employed to draw up one. He should also supervise the management by occasional visits. On the working plan the ground will be divided into sections, according to the nature of the trees on it: the period at which each section is to come to maturity, the frequency of fellings, the order in which thinnings are carried out, and such matters, will be determined by it.

(5) There is one point in Dr Smith's report that perhaps needs emphasis —the manner of planting. Most of the woodland in this district is natural, and left more or less to itself. In hardly any case, where it is renewed, are the plantings made thick enough. To secure clear, straight timber, the ground must be well covered at first and afterwards, and the wood thinned only with this in view. Also it would be an advantage to start a plantation with very young trees, two or three years old; perhaps 4000 or 5000 to the acre, not more than a foot or two high. The aim should be the production of "high forest," free, or nearly so, from coppice and underwood. Shade-bearing trees may afterwards be introduced under the shelter of the old crop, so that the soil continues to be protected, whilst the area is carrying two distinct woods of different ages.

The results of this preliminary inquiry are freely placed at your service, in the belief that the proposal merits and will receive your serious consideration.

The following is Dr Smith's Report above referred to.

Mr W. B. Crump, of Halifax, recently suggested to me that the planting of trees appeared to offer an opportunity of increasing the value of properties owned by the Corporation of Halifax in connection with the Waterworks. In view of the deterioration which lands suffer when thrown out of cultivation, through their enclosure as gathering-grounds for Waterworks, the suggestion is one of considerable importance, and I willingly accepted an invitation to accompany Mr Crump and the Parks' Superintendent, Mr Tate, on a visit to the properties round the reservoirs at Ogden and Mixenden.[1] A considerable portion of the ground was carefully inspected, and the results are here submitted.

[1] The altitudes of the reservoirs are 1000 feet and 800 feet respectively. Both are in well-sheltered valleys.—W. G. S.

The previous treatment of the land of the area divides it for purposes of tree-planting into certain divisions, each requiring separate treatment.

(a) *The Farm-land.* This consists of small farms, at present or until recently under grass, cultivated in the way generally found in the Halifax district. The soil in most places seems sufficiently drained and in good condition; the places are generally sheltered from the prevailing winds, and otherwise well situated; the fencing is also in good condition. So far as we can judge, this farm-land is ready for immediate planting of hardwoods with a small initial expenditure. Only a few trees grow here at present, on rough or steep parts less suited for farm-land; they consist of Sycamore and some Ash, as a rule healthy, growing well without any attention, and showing no traces of smoke-damage. Sycamore seems particularly at home in this district, and at present it is, when well grown, in good demand at a good price in local markets. There is evidence also that at one time trees grew in much greater number than at present, and there is no reason why this farm-land should not bear good crops of all the hardy northern hardwoods, such as Sycamore, Ash, Beech, Elm, Oak, etc. It is important that this land should be planted at once, before it has time to deteriorate. It is equally important that the plantations should be as large as possible, and treated according to the best principles of recent forestry. As all this class of land lies near the reservoirs, the suggested plantations would at once enhance the appearance of the surroundings; they would also act as natural fences, and in time would assist in preserving the purity of the water, as well as reducing evaporation, while the root-action of the trees would go a long way to prevent the ground-water from becoming sour and stagnant. These hardwood plantations would in time become an asset of no small value. The suitability of this recently cultivated farm-land for tree-planting is already evident in the nursery for park trees formed at Ogden; the trees there promise well, although the nursery is only recently laid down.

(b) *Farm-land which has been only grazed, and not manured.* There is a considerable area of this class of land. At Mixenden it lies on the upper edge of the farms, and away from the reservoir. At Lower Ings, and on the western and northern slopes of Ogden, the land is almost all of this class. The vegetation at present is chiefly grass, with little peat beneath; there is, however, distinct evidence that heather, bilberry, and other moor plants are increasing, with the result that peat also increases. In order to retain the present grassy vegetation, extensive grazing would be required, which, in the case of water-supply, has certain objections. These grass-lands are in good condition for the planting of Scots Pine, Larch, Spruce, and other conifers, with admixture of hardwoods in suitable places. It is advisable that these lower slopes should first be planted, so that if in the future the high-lying heather-moor should be planted, it can be done by extending existing lower plantations upwards, thus ensuring better shelter. The slopes on both sides of Brookhouse, and on the western side of Ogden, appear to be the bests sites for immediate planting. Woods of Scots Pine, Larch, and other conifers give quicker returns than the hardwoods; they should begin to yield pit-props at about twenty-five to thirty-five years old, and be ready for felling at about forty years for pit-wood, or about seventy years as full-grown timber.

(c) *Rough, stony, or shaly Moor-edge or Clough-head.* These could be planted at a small outlay with Gorse, Birch, and Mountain Ash. The crops would not have a high value, but they would assist in binding the loose slopes and in preventing landslips; in time they would prepare the soil for more profitable trees. The embankment at Mixenden would be greatly improved by similar planting.

(d) *The heather or high Moor.*[1] This was not so carefully inspected on this visit, because it is advisable to have the lower grounds planted first, and thence to extend the woods on to the high moor. Moors of this kind have not been much planted near Halifax, except in the Hebden valley, but in the North Riding and in the north of the West Riding, plantations of conifers do well on the moorland. The financial success of moorland woods has been shown in many parts of Scotland, where we have seen timber felled which brought a high price. It might be suggested that in the case of the moors above Ogden, some experimental plantations should be made to test the capacity of the soil, and to ascertain the most suitable trees.

Altogether the area seems well adapted for the formation of woods, while at the present time it offers great facilities for economical planting. At present the timber-supply of Britain is mainly dependent on imports, but those qualified to judge are unanimous in their opinion that the supplies of exporting countries cannot long be maintained. The present price of well-grown timber warrants a good return for the outlay incurred, and the proximity of many manufacturing centres ensures a market. As to initial expenditure and cost of upkeep, I leave others to speak, but it seems to me that an annual grant, continued for a number of years, is the best means of meeting the case. If the scheme is to be a success, the object to be kept always in view is the production of good timber. This can only be attained by making the plantations large, planting the trees thick, and maintaining a regular system of tending and thinning. The haphazard filling of odd corners with trees, or making thin belts or small clumps, can yield no profit; one 50-acre wood well planted is much more valuable than fifty 1-acre clumps.

In this part of Yorkshire the scheme will be a new departure in the utilisation of waterworks grounds, but elsewhere they are utilised for woods. Loch Katrine, from which Glasgow draws its water-supply, is closely wooded almost all round. Dundee draws its water from two distinct areas, and on each of these, woods are being formed on deserted farms or moorland. Lord Masham's estate at Swinton, one of the new areas from which Leeds is to draw its water-supply, is in many respects an area similar to Ogden, and tree-planting is in progress there on a scale which promises to make it one of the best wooded localities in Yorkshire.

So far as we can judge, there is no reason why the land at Ogden, Brookhouse, and Mixenden should not be planted with trees, and become in a short time a valuable asset, and later yield an actual revenue to the Waterworks scheme.

[1] The moorland lies at an altitude of from 1000 to 1400 feet. A good pine-wood near Skipton extends to 1300 feet above sea-level.—W. G. S.

Mr Forbes's Report.

Mr William Forbes, who is a Local Secretary of this Society for Yorkshire, also made suggestions, and strongly urged the scheme to the consideration of the Corporation. After consideration, the Waterworks Committee recognised its practicability, and in July Mr Forbes, with Mr Herd, of Messrs Herd, nurserymen, Penrith, were invited to go over the ground and consider the question of making a start in planting. The principal points of general interest in Mr Forbes's report, which also contains valuable practical suggestions for the stocking of the area with trees, are here summarised.

"After a personal inspection of the ground belonging to the Halifax Corporation, which forms part of the gathering-ground for the Mixenden and Ogden Reservoirs, your Reporter is fully satisfied that it is capable of producing timber trees which will become a valuable asset, and would advise your Corporation to commence the planting of forest trees without delay." He suggests a local nursery on the area, and names the kinds of trees that should be raised in it. He says that the woods to be raised, if properly planted and worked systematically, will ultimately yield a paying revenue. He suggests that, as a source of revenue, the reservoirs should be stocked with fish, to be raised in a hatchery. He considers that in the course of a few years a good rental could be obtained from a shooting tenant.

Conclusion.

The Halifax scheme has now taken practical shape, and Messrs Herd report that they have just completed the planting of the first 50 acres. The selection of trees has been made to suit the ground, and varies from place to place. The hardwoods include Ash and Sycamore, with one plantation of Beech. Scots Pine has been largely planted either with Alder and Spruce, or with the above hardwoods. Larch has also been used in suitable places. The object is to obtain a permanent hardwood crop, the Larch and Scots Pine coming out as required.

In regard to planting by other corporations, a few more details may be added. Messrs Herd are planting 80 acres for the Corporation of Birmingham in Radnorshire, as the beginning of a large scheme. Liverpool, at Lake Vyrnwy, seems to have made the greatest progress of any Corporation in afforesting their waterworks area. Manchester has also done much, but the chairman of the Waterworks Committee (Sir John Harwood)

states that they are severely handicapped; the best lands are let as sheep farms, and the part available for planting is rocky and difficult of access, so that the timber is not easily removed. Leeds has done little, although there is a fine area available for planting. Recently the writer saw a conifer plantation felled and replanted near one of their large reservoirs. The grounds at Loch Katrine, utilised by Glasgow, do not belong to them, and the woods are in the hands of the proprietors. In regard to the waterworks grounds of other Scottish corporations (*e.g.*, Edinburgh and Dundee), there are Members of this Society who are in a much better position than the writer to give exact information.

It is gratifying to hear from a nurseryman who does a large amount of tree-planting, that he has "never known so much planting in hand as there is this season in all parts of England."

X. *Creosoting Timber for Estate Purposes.* By George Leven, Forester, Auchencruive, Ayr.

The preservation of timber by one or other of a number of systems has been attempted with more or less success for many years; but while admitting the value of salts and other substances for certain classes of timber, it is generally allowed that what is known in commerce as "creosote" is the best preservative of wood to be used for outside work.

The method of creosoting mostly in use in this country is what is known as the closed cylinder system; but while this method can be adopted profitably on extensive estates, where the plant may be kept continually at work, on small or even on medium-sized estates the capital expenditure is too heavy, as the smallest plant costs at least £300 to set agoing.

A simple and very efficient system of creosoting has been in use on some estates in this district for a number of years, the initial cost of plant being about one-sixth of the above. An egg-end boiler, 23 or 24 feet long by 3½ feet in diameter, with an opening cut along the upper side, is carefully built up with fireclay and firebricks, surmounted by a cement coping to within a foot of the opening, this being necessary in order to withstand the heat to which the boiler is subjected. The boiler thus rests on two butts or bridges, with a furnace and flue running underneath, the draught being regulated by a damper at the foot of the chimney-stalk. The furnace is made 6 feet long, in order to take in slabs and other rough wood. At the end opposite the furnace, and from the lowest point of the boiler, a pipe with a valve attached discharges surplus oil into two cow boilers (of 200 gals. capacity each), connected by a syphon and surmounted with a hand-pump to return the oil to the boiler. In a case with which the writer had to do, where the boiler was second-hand, and advantage had been taken of an existing chimney-stalk which had been erected in connection with a saw-mill, the cost of the plant, including all material and labour, amounted to £54, 14s.

The process is as simple as the plant. It consists of placing the wood to be creosoted in the boiler, covering it with creosote, bringing the temperature slowly up to a little over the boiling

point of water, and keeping up that heat for forty-eight hours, when the fire is withdrawn, and the oil is run off while hot, in order to dry up any that may adhere to the surface of the wood. The wood is then removed when cool enough to handle.

The plant with which the writer has to do is employed chiefly for creosoting fencing material (stobs and palings), every description of wood being used for this purpose. Fast grown, immature wood, such as exists to a great extent in this country, lends itself readily to this treatment, and becomes practically of as much value as good larch. In practice, every description of wood, with the exception of larch, is creosoted, all that is required being a medium to hold the preservative substance. As might be expected, the different species do not absorb oil to the same extent, beech taking in much more than any other species, while practically the whole of the other broad-leaved species absorb less than the conifers. But a great deal depends on the rate of growth, as open-grained wood may absorb twice as much as wood that is slow grown. The degree of seasoning has also an effect on the absorbent power of most species; but it is not essential that the wood should be thoroughly seasoned before being submitted to this process.

The creosote used is obtained from tar distillers, and costs $2\frac{3}{4}$d. per gallon at the works. It has a specific gravity of not less than 1008; and its boiling point being considerably higher than that of water, advantage is taken of this fact in the system described. The sawn stobs and palings being stacked conveniently near the boiler, are seasoned as far as circumstances permit, and treated in succession. The stobs are packed as closely as possible into the boiler in tiers, beginning at one end of the boiler, and are then covered with creosote as above stated, a barrel mounted on wheels being used for the conveyance of the oil from the chemical works. The fire is then started and kept going until the temperature rises to a little above 212° F., when the moisture in the timber is driven off in the form of vapour, the creosote taking its place in the tissues of the wood. Besides this mechanical action, a chemical change undoubtedly takes place whereby the contents of the cells and intercellular spaces are coagulated and fixed, and are thereby rendered less liable to attack from fungi and insects, or, in other words, to decay, some of the constituents of the creosote acting as an antiseptic. The effect of the process is also to prevent, at least for a time, moisture from again entering the tissue. Paling rails

are creosoted in exactly the same manner as stobs. It is thus seen that the process acts in a threefold manner, and it appears to have decided advantages over any system where pressure is used with either cold or heated oil; while in this process, the heat being applied while the wood is under oil, the quality is in no way deteriorated, but is in many cases improved.

The crucial point is, of course, the durability of the timber creosoted in this way. Beech stobs, 4½ feet × 3 inches × 3 inches, have been examined by the writer and others after being in use for ten years, and, more recently, after fifteen years, when they were found to be in an almost perfect state of preservation. Similar stobs not creosoted are worthless in two years. In removing, some time ago, a fence erected in 1895 with creosoted wood, some very good examples of the value of the process were seen. Some stobs of lime wood, which were not thoroughly impregnated, but had only been in contact with the creosote on one side, were found to be completely decayed, with the exception of the thin portion creosoted. Scots pine showed the same thing. But spruce and Scots pine paling was practically as good as when it was erected seven years previously.

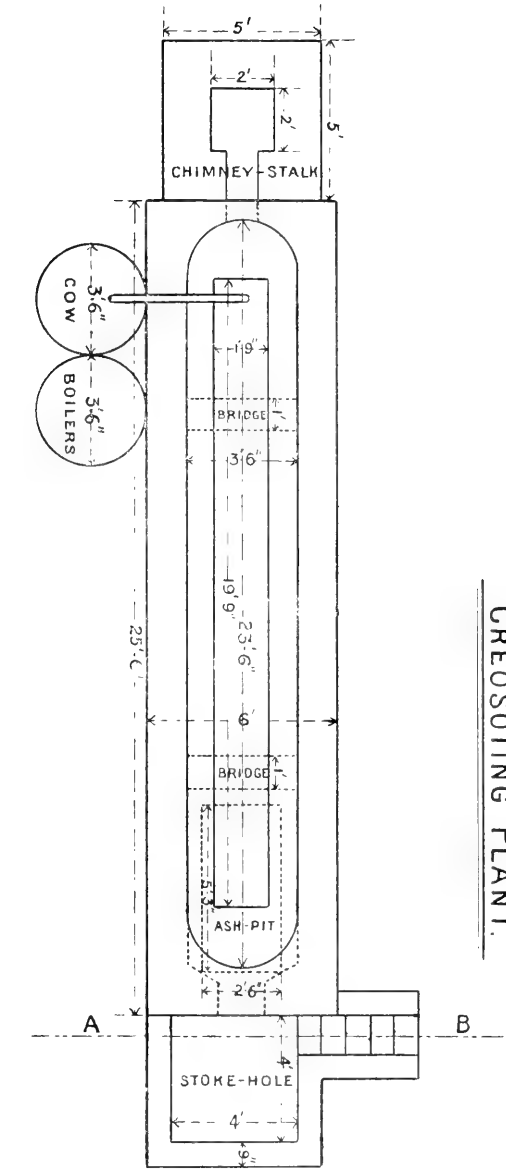
The cost also determines, to a great extent, the success of the process, and with creosote at 2¾d. per gallon, assuming that there is a uniform absorption of one gallon per cubic foot of wood, the cost for oil alone amounts to about one penny per stob of the size stated above, and to somewhat under 9d. per 100 lineal feet of paling rails, 4 inches × 1 inch. In practice it is found that the absorption is not uniform, but is dependent on the quality and class of the wood; but the average cost works out at 1½d. per stob and 1s. 3d. per 100 feet of paling, including the whole expense of fuel, labour, and plant.

The writer has confined himself to fencing material, though the process is equally applicable to timber to be used for hay and other sheds connected with agricultural properties. That large quantities of inferior timber could be profitably utilised by taking advantage of this process there is no question; it would open a market for thinnings that are of little value as pitwood, in competition with the superior article imported in large quantities from abroad.

Timber of good quality is yearly becoming scarcer at home, and as the forest-covered area recedes from the sea-coast of exporting countries, it must naturally become dearer. It therefore behoves

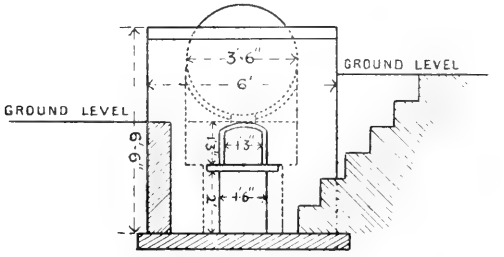
all who have to do with the production of timber to do what they can to increase its durability; and on the plea of economy alone, the writer would urge that there should be a creosoting plant of some description on every wooded estate. The saving on the labour bill for renewing and repairing fences alone would soon repay the cost of the plant, while timber of the better classes would be available for sale.

The writer has had numerous inquiries regarding the above system of creosoting, and these, together with the importance of the subject, have led him to explain the matter in as practical a way as possible. The accompanying plan, section, and photograph will serve to illustrate his description.



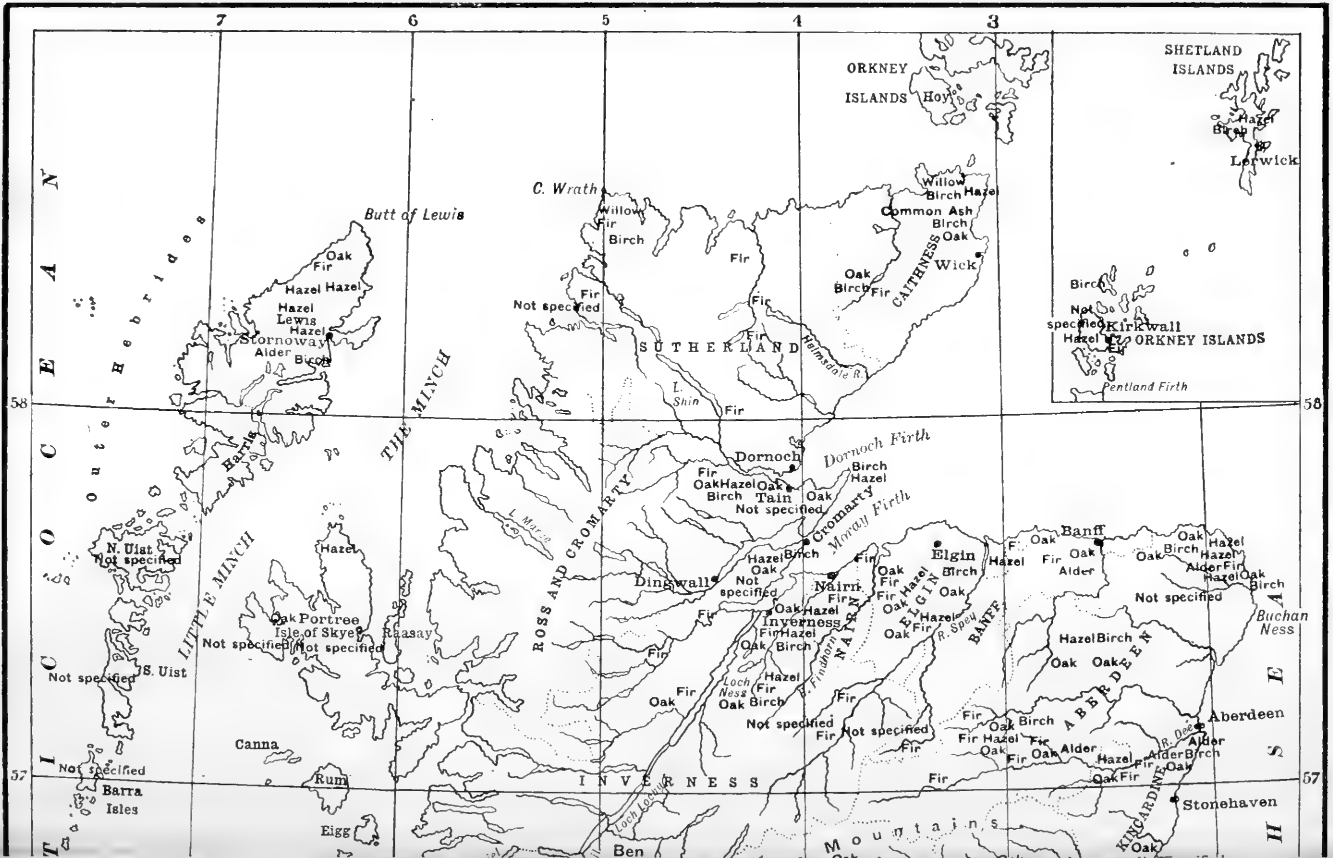
Plan of Creosoting Plant.

Scale 1 inch = 6 ft.

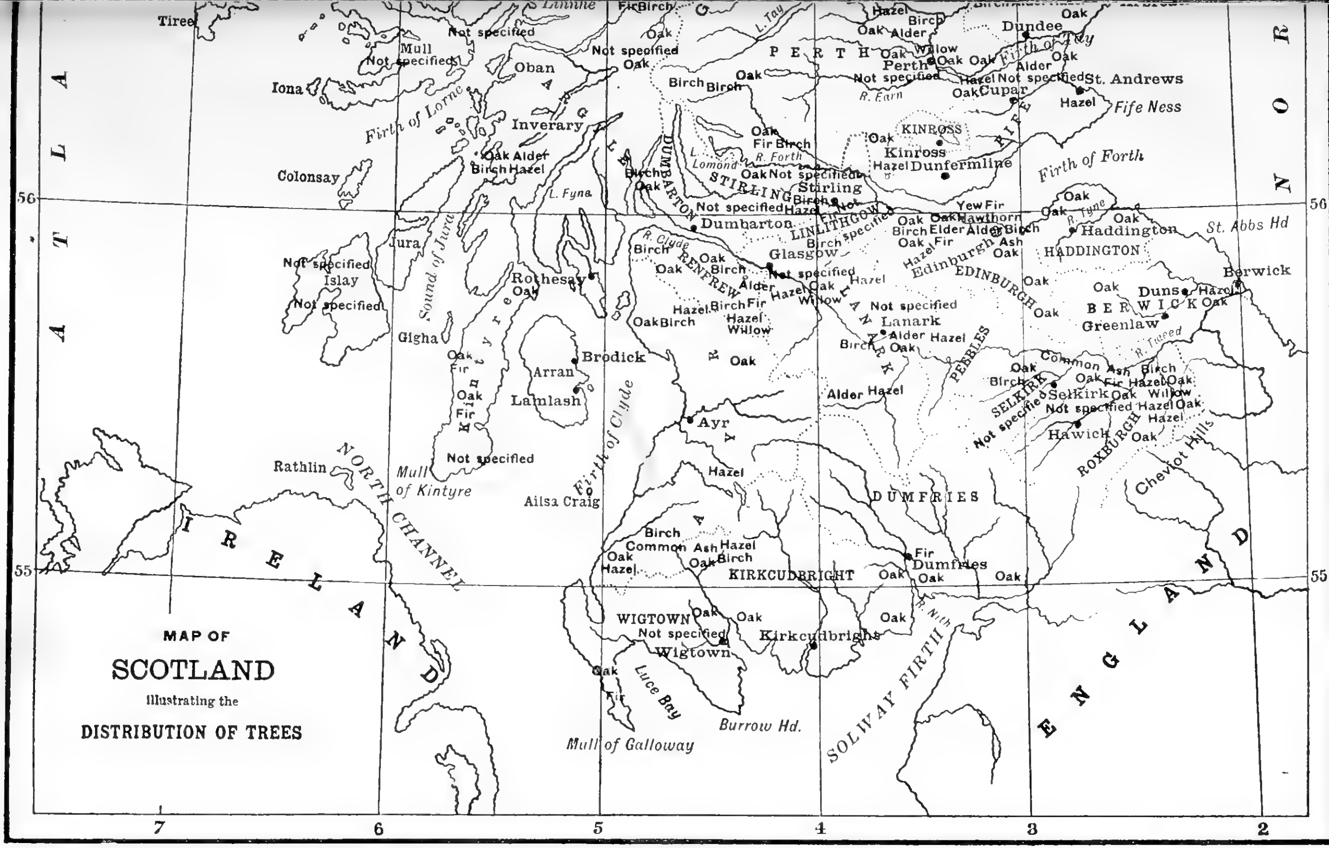


Section on A. B.

PHOTOGRAPH OF CREOSOTING PLANT.



ORKNEY ISLANDS
Hoy
SHETLAND ISLANDS
Lerwick
Kirkwall
ORKNEY ISLANDS
Pentland Firth
C. Wrath
Butt of Lewis
Lewis
Stornoway
Harris
Outer Hebrides
THE MINCH
LITTLE MINCH
N. Uist
S. Uist
Barra Isles
Canna
Rum
Eigg
Isle of Skye
Portree
Raasay
SUTHERLAND
L. Shin
Helmsdale R.
CAITHNESS
Wick
Dornoch
Dornoch Firth
Tain
Cromarty
Moray Firth
ROSS AND CROMARTY
L. Maree
Dingwall
Inverness
Loch Ness
Nairn
NAIRN
R. Findhorn
ELGIN
Elgin
R. Spey
BANFF
Banff
ABERDEEN
Aberdeen
R. Dee
KINCARDINE
Stonehaven
Buchan Ness
INVERNESS
Loch Lochy
Mountains
Ben
OCEAN
ATLANTIC
NORTH SEA
Not specified



MAP OF
SCOTLAND
illustrating the
DISTRIBUTION OF TREES
ATLANTIC
NOR
IRELAND
ENGLAND
NORTH CHANNEL
SOLWAY FIRTH
Firth of Clyde
Firth of Forth
Firth of Lorne
Sound of Jura
Firth of Tay
Mull of Kintyre
Mull of Galloway
Luce Bay
Burrow Hd.
St. Abbs Hd
Fife Ness
Cheviot Hills
Tiree
Mull
Iona
Colonsay
Oban
Inverary
Jura
Islay
Gigha
Rothesay
Brodick
Arran
Lamlash
Ailsa Craig
Rathlin
Ayr
Dumbarton
Glasgow
Stirling
Perth
Dundee
St. Andrews
Cupar
Kinross
Dunfermline
Edinburgh
Haddington
Berwick
Duns
Greenlaw
Lanark
Selkirk
Hawick
Dumfries
Kirkcudbright
Wigtown
PERTH
KINROSS
FIFE
STIRLING
DUMBARTON
LINLITHGOW
RENFREW
EDINBURGH
HADDINGTON
BERWICK
LANARK
PEEBLES
SELKIRK
ROXBURGH
DUMFRIES
KIRKCUDBRIGHT
WIGTOWN
AYR
ARGYLE
KINTYRE
L. Fyne
L. Lomond
L. Tay
R. Forth
R. Earn
R. Clyde
R. Tyne
R. Tweed
R. Nith
7
6
5
4
3
2
56
55

XI. *On the Distribution of certain Forest Trees in Scotland, as shown by the Investigation of Post-Glacial Deposits.*[1] Paper read before the Botanical Section of the British Association on 13th September 1901. By WALTER N. NIVEN. [With Map.]

It is proposed in this short communication to bring before your notice some results of the investigation of post-glacial deposits, in so far as they throw light on the distribution of the trees composing the forests which covered the whole of Scotland in early post-glacial times. It is well known that these forests were largely destroyed by changes in climatic conditions, by the submergence of many parts of the land, perhaps by the blowing down of entire woods by wind, as in the case of Drumlanrig Wood in Dumfriesshire in 1756, and by other means. Man also played his part in the process of destruction. In early historic times we read of the Romans cutting down trees, and utilising their trunks for roadways across marshes, and for bridges. This is confirmed by the discoveries in Lochar Moss and Flanders Moss respectively. It will therefore be seen that if we wish to obtain information concerning those ancient forests, we must search for it in the submerged forests around our coasts, in the peat or peat-bogs of our Highlands and Lowlands, and in the numerous fluviatile and lacustrine deposits throughout Scotland.

As many of the buried trees are found in an upright position, there should be no difficulty in acknowledging that they must have grown at the places where now discovered. In many cases the trunks, and very often the leaves, are found scattered throughout the peat. It is to be regretted that only a very few of the deposits have been systematically examined, *e.g.*, Cowden Glen in Renfrewshire, Hailes and Corstorphine in Edinburghshire, and Elie in Fifeshire.

The information on this point has been obtained principally from occasional references in topographical books of Scotland to the discovery of trees in particular districts, in digging peat for fuel, in making railway cuttings, and in similar operations. The following trees are so recorded:—

[1] Reprinted from *The Scottish Geographical Magazine* for January 1902.

Hawthorn, elder, common ash, birch, alder, hazel, oak, willow, yew, and fir, all of which are, with the exception of the ash, commonly regarded as indigenous to Scotland. In addition, according to Dr James Geikie, the cones of the silver fir, which is not considered a native, have been discovered in Orkney (*Great Ice Age*, 3rd ed., p. 287).[1] Several shrubs, including the juniper and raspberry, as well as many flowering plants, have also been unearthed. The localities where the various trees have been found are marked on the accompanying Map.

The records, which have been obtained from references in over seventy volumes on Scotland, are probably not complete, but those collected may be considered sufficient to show the ancient distribution of the forest trees. On glancing over the Map, it will be seen that there are few parts of Scotland, however treeless at the present day, that were not, in remote, and even in comparatively recent times, covered with a considerable quantity of woodland.

As the deposits are too numerous to describe in detail, a few only will be mentioned, which will give an indication of the nature of the records collected. Mr George Low, in his *Tour through Orkney and Shetland*, published in 1774 (p. 146), states that he observed, when crossing from the parish of Delting to Yell, in a bank where the sea had carried away the loose earth, a layer of large pieces of wood in a horizontal position, a few inches above the hard gravel, and covered with about 10 feet of moss. He also further remarks, that this layer continued, so far as he could ascertain, the whole length of the bank, and probably round the bay; it consisted of pieces from eight inches to half an inch in diameter, roots, stock, and, in a word, all parts of a tree. He was of opinion that the wood was hazel. From other records I find recorded birch and hazel in the Shetland Islands, and in the Orkneys fir, birch, and hazel.

The Rev. Charles Thomson, minister of Wick, writing on this parish in the *New Statistical Account* (vol. xv. p. 129), dated 1841, mentions that "in the Bay of Keiss, between the links and the sand, and running down under the sea, there

[1 Professor Geikie now thinks this determination is doubtful. It was given by him on what was stated, in the work consulted by him, as "good botanical authority," but he has mislaid the reference.—Ed. *S.G.M.*]

are found remains of a submarine forest. The barks of the various kinds of trees are quite discernible, and even the seeds of the birch and ash are so well preserved as to appear but lately fallen from the tree." This is the most northern record of the ash we have. In Inverness-shire, while making excavations for the Caledonian Canal, numerous trees were found, principally very large oak trees, some of which measured 24 feet in circumference (*New Statistical Account*, vol. xiv. p. 9). In the parish of Croy and Dalcross, in the same county, it is recorded that there were extensive forests of oak, birch, fir, and hazel, which had been converted into moss, upwards of 20 feet deep. In a moss in this district, 400 feet above sea-level, oaks of extraordinary size have been dug up, some of them measuring 50 or 60 feet in length, and of proportional thickness. At a height of 800 feet, large blocks of fir have also been found. In some of the peat-bogs in Glenavon, Banffshire, roots of pine have been found at a height of 3000 feet above sea-level (*New Statistical Account*, vol. xiv. p. 449; *Old Statistical Account*, vol. xii. p. 451).

Throughout the midlands there are abundant records. Coming south to Renfrewshire, where we have now no natural woods, remains of what seems to have been the forest mentioned in the Chartulary of Paisley Abbey have been found in the parish of Kilbarchan (*Old Statistical Account*, vol. xv. p. 484), where, in the mosses, oaks have been found in a perfectly fresh condition, standing in their original position.

From the ancient lake of Cowden Glen in Renfrewshire, birch and hazel have been unearthed. This deposit has given rise to much discussion, some being of the opinion that it belongs to the inter-glacial period, while others believe, judging from the discovery of plants of recent occurrence, that it should be considered a post-glacial deposit.[1]

The writer has examined the peat-bogs above Greenock and at Bishoptown, but has only been successful in finding, in the peat near Loch Thom, at a height of upwards of 500 feet, the roots and trunks of birch trees. There is much difficulty in making fresh discoveries; the only way in which this can be done successfully is by making extensive excavations in

[1 The deposit in question rested upon and was covered by glacial accumulations, and there can be no doubt, therefore, that it is of inter-glacial age.—Ed. *S.G.M.*]

the peat, as the trees are usually found many feet below the surface, but this is now almost impossible.

Around Edinburgh, the lake deposits of Corstorphine and Hailes, the raised sea-bottom of Fillyside, and the peaty deposits of Gayfield and Redhall, have been carefully examined by several authorities, including the late Mr Bennie of the Geological Survey. In them the following trees have been reported: —Hawthorn, elder, birch, alder, hazel, yew, and fir. It should be mentioned that the Corstorphine deposit is considered by some authorities to belong to the late glacial period.

In the extreme south of Scotland, close to Monreath at the Mull of Galloway, Sir Herbert Maxwell, Bart., M.P., has observed fir and oak trees. In this county, Wigtownshire, Sir Arthur Mitchell has made the following observations on the ancient forest of Cree, which may be of interest. "The trees, which as far as I know are all oak, are found in two distinct positions, first, in the channel of the Cree, or projecting into its channel from the banks at the side, many of these last having 10 to 15 feet of sandy clay above those parts of them which are on the bank, and an unknown number of feet of clay below; and secondly, under the peat on the surface of the clay. The existence of this ancient Cree forest does not rest on our finding some half dozen trunks. You may count them by the hundred, exposed in the bed of the river, between Newton-Stewart and Barsalloch, and you may reckon roots by the score where the moss has been cleared away near the mouth of the Lorne Burn. I say roots in this case, because such trunks as are discovered in peat castings are carted off at once. The trees are described as of great size, and specimens measuring 15 feet in girth and 50 feet in length are not uncommon" (*Proc. Soc. Ant. Scot.*, vol. v. pp. 20-29).

With those short notices of a few of the deposits, I will now sum up briefly the general distribution of the trees as shown by the deposits in general.

The oak is very widely distributed. Its most northern occurrence is Caithness-shire, and it is recorded in every other county. It has even been found in the now treeless islands of Lewis and Tiree. We have already noticed its occurrence at a height of 800 feet, where no oak can flourish now. It is interesting to notice that many of the oaks are of enormous size. Sir John Clerk reports having seen an oak 70 feet in length at Drumcrieff (*Reliquiæ Galeanæ*, p. 333).

The Scots fir, probably *Pinus sylvestris*, is another widely-distributed tree. It is common in the northern counties, in the Orkney Islands and Lewis, in all the midland counties, with the exception of Forfar and Fife, but in the southern counties it is only recorded in Renfrew, Edinburgh, Roxburgh, Dumfries, and Wigtown.

The hazel has been found in the submerged forests and in many parts of the Orkney and Shetland Islands, and also in some of the Western Isles. There is no record of its occurrence in Sutherland, but throughout the midlands it is fairly plentiful, and in the lowlands it has been found in all the counties with the exception of Haddington, Linlithgow, Selkirk, Dumfries, and Wigtown.

The birch is another common tree. It is recorded in the Orkney and Shetland Islands, and in the majority of the counties from Caithness to Wigtown.

Regarding the other trees there are few records. The alder is recorded from Lewis, Banff, Aberdeen, Kincardine, Perth, Fife, Argyll, Lanark, and Edinburgh.

The willow, which variety I am unable to say, occurs both in Caithness and Sutherland in most northerly situations. It has also been obtained from the peat-bogs in Renfrew, Lanark, and Roxburgh.

The ash is reported, as already stated, as having been found in the Bay of Keiss, Caithness-shire. It is also recorded from the mosses in Ballantrae, Ayrshire, and Bowden parish, Roxburghshire.

The only records of the occurrence of the hawthorn, yew, and elder are obtained from Edinburghshire. This scarcity of records must be due to a want of investigation, for there can be no doubt that those trees must have been widely distributed throughout Scotland in the past.

The results derived from this investigation of post-glacial deposits are twofold: (1st) they show that the principal forest trees were formerly more widely distributed than at present; (2nd) they indicate which trees must be considered indigenous in Scotland.

We have just seen that in early post-glacial times, the now bare and bleak Orkney and Shetland Islands, and the treeless Western Isles, were covered with trees; the oak, for example, flourished in all the counties, though now, according to Pro-

fessor Trail, in his "Topographical Botany of Scotland," published in the *Annals of Scottish Natural History*, it does not grow in the Orkney and Shetland Islands, Caithness, Ayr, and Selkirk. In the Hebrides it was introduced by man. In a note on *Quercus Robur*, Professor Trail states that the fact that this is native in the Highlands is shown alike by the remains in peat-bogs, and by the frequency of the Gaelic name in the names of places, and that probably it has been introduced into every other district in which it was not already native (*Annals of Scottish Natural History*, No. 31, p. 166). But the investigation of peat-bogs and the other deposits shows that the oak was one of the prevailing native trees of the ancient forests, and flourished all over Scotland. With regard to the alder, this tree has been supposed to have been introduced by man into the Hebrides, but here again it must be considered native, as it has been found in the peat-bogs of Lewis. Finally, the ash is stated by Sowerby, in his *English Botany* (p. 56), "to be perhaps not indigenous in the Highlands and extreme north of Scotland"; in Bentham and Hooker's *Flora*, it is said to be common in Britain and truly wild, excepting in the northern parts of Scotland; while Professor Trail, in his "Topographical Botany," states that its nativity is scarcely to be determined. But from the evidence I have collected, it might be said with some certainty that the ash is indigenous not only in southern Scotland, but also in the north. The record of it in the Bay of Keiss, which has already been mentioned, may be considered as trustworthy, and its occurrence in the peat-bogs of Ayrshire and Roxburghshire must also be accepted. Hugh Miller has also reported finding the ash in the brick-clays of Portobello, which, however, belong to the glacial period. Confirmation as to its existence as a wild tree in the south is derived, further, from the fact that many of the implements found in the crannogs are made of ash wood.

In closing, it should be noticed that while we have been only endeavouring to illustrate, as far as possible, the distribution of the forest trees found in the various post-glacial deposits, there is no doubt that if a more minute examination was made of many of them, shrubs, flowering, and probably some flowerless, plants, would be discovered. This would, as in the case of the trees, indicate which of the existing plants are native, and where they grew in the past.

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XII. *The Forests of the Basses Pyrenées.* By GEORGE CADELL, late Indian Forest Department.

OF THE FOREST AREA AND ITS DISTRIBUTION.

In the department of the Basses Pyrenées we find two distinct regions which have been sharply delimitated by nature, the one which touches the Spanish frontier being mountainous, and the other consisting of isolated hills and plains. The proportion of forests to the total area, which is 17 per cent. for the whole of France, rises here to 20 per cent. Agriculturally, the land is largely pastoral, and is very much parcelled out, a small appanage of forest being as it were attached to each holding. So much is this the case, that without counting the large amount of the forest which is under the control of the Communes, there are no less than 33,000 private forest proprietors, who hold between them 73 per cent. of the forests of the plains. On the mountain slopes the forests belong principally to the Communes, the proportion being no less than 85 per cent., and as the Communes do not in many cases submit their forests to the management of the special department, it follows that little more than one-third of the forest area is under expert surveillance. Further, it is not always found advisable, or, if advisable, possible, to maintain a strict forest *régime*. The woodland, and even the forests in the plains, are not cleared under a hard and fast revolution, but as exigency demands. They may rightly be considered as existing for the requirements of agriculture, and not for the growth and production of timber. In this respect they differ from those of the neighbouring district of the Landes, where the welfare of the trees is the chief care of the Forest Department, and where these trees, the well-known maritime pine, repay both by their resin and their wood the care bestowed upon them.

OF THE SOIL.

The soil is less calcareous than is generally the case in France, most of the calcareous soil being found on the mountains. In the plains most of the forests rest on arenaceous, argillaceous, and gravelly accumulations of Tertiary age. The proportion of alluvial deposits is very small.

Of the Kinds of Trees.

Coming to the kinds of trees of which these forests are composed, we find that oak constitutes more than 50 per cent. of the whole, followed by the beech, which is accountable for 33 per cent., chiefly on the mountain ranges. A very small percentage is thus left for other varieties, the most important of which is the spruce. The trees which we associate generally with the south of France, namely, the cork oak and the olive, are conspicuous by their absence; while the maritime pine, although it grows in isolated patches on the sea-coast, keeps to the dunes farther north. It may be remarked concerning the last-named tree, that it seems to have a very limited area where it grows to perfection. A most reliable authority, Mr D. Cannon, formerly of Mysore and now of Salbris, tells us that the pines of Sologne are cut down at the age of about twenty-five years, at the very period of their growth that, in the Landes, they begin to yield their valuable resin, a product which, if permitted, they will continue to furnish for a full century. Under Government working, however, the pine forests have a revolution of seventy-five years only, when the *coupe de regenération* is made. It is impossible to pass by without regret the susceptibility of this most valuable tree to the rigours of winter, and its consequent unsuitability, speaking generally, for planting on our own seaboard.

The oak (*Quercus pedunculata*) of the Basses Pyrenées deserves more than a passing notice, as well from its preponderating quantity as from the excellence of its timber. Like our own oak, it was formerly in great demand for shipbuilding, the oak of the Adour, so called from the river of that name, being well known and much sought after in naval dockyards. The very qualities, however, which gained for it this reputation, militate against its more general use for less important purposes, on account of the hard labour involved in its conversion. The price obtained for it is considerably less than that readily commanded by the Dantzic oak, which is imported to Bayonne. In the rich soil of the valleys it grows rapidly, so that it is not unusual to see trees of sixty years of age possessing a girth of 3 metres, or about 3 feet 10 inches. A great proportion, however, of the oak in the plains is pollarded every eight or ten years, the loppings being used for agricultural purposes. The products of the oak are, moreover, of

importance. The bark, which is particularly rich in tannin, confers a well-earned celebrity on the leather which is cured in the Department; while the acorns fatten a special race of pigs, who in their turn furnish the locally famous hams of Bayonne. The gall-nuts taken from the holm oaks are used for dyeing scarlet. The beech occupies in the hills the same place as the oak does in the plains, and grows to the extreme limit of forest life, about 1800 feet; but, owing to its inaccessibility, the timber is of little value. Of the spruce, it may shortly be said that its quality is quite equal to that of the trees brought over sea. Under the forcing sun of June, the bamboo, it is quite credibly stated, makes a spurt of growth at the rate of 30 centimetres, or 12 inches, in the twenty-four hours; but this is, of course, not maintained as in India, where bamboos attain a height of 80 feet in a single season. The short but sharp frosts of winter forbid the general use of even semi-tropical plants in the open.

Of the Exports and Imports.

There are no exports of wood from the Department, any shipments of timber from Bayonne consisting of pit-props furnished by the forests of the Landes, and generally destined for England. Imports, which are landed also at Bayonne, consist of the Dantzic oak (as has before been noted), the Norway spruce, and the pitch pine.

Of the Woods under Forest Administration.

The area of the woods submitted to forest administration in the Department is 55,691 hectares, a little over 136,000 acres, of which 70 per cent. are situated in the mountains, where alone they are of any great extent. The forests of the plains are isolated, and do not exceed 216 hectares in area. The most important of the latter is the Forest of Bastard, which was a royal domain previous to 1669. It lies a short distance to the north of Pau, and is managed as underwood under high forest, with a revolution of twenty-five years for the underwood.

Of the Nature of Treatment.

Pure and mixed forests divide almost equally the area of the State forests, the former being generally on the mountains and

the latter on the plains, where the proportion rises to about four-fifths. The spruce, which is almost the only conifer, is always cultivated along with the beech. The mountain forests are treated as high forest, those on the plains as underwood under high forest, the rotation for the underwood being, with few exceptions, one of twenty-five years; but this is not, as we have already seen, always practised, the trees being often heavily lopped every twelve or fifteen years. When a modification of the forest *régime* was introduced, each Commune was bound to maintain a forest nursery, and each proprietor was bound to plant four trees annually; but this double obligation has gradually been allowed to fall into disusage, and the so-called forests have become simple pastures.

Of the Production of the State Forests.

(a) *In Material.*—The preponderance of mountain forest is responsible for the small average yield of the State forests generally. It may be stated as a broad explanatory fact, that while the forests of the mountains constitute 70 per cent. of the whole wooded area, they produce only 20 per cent. of the total returns yielded by this area. This reduces the average general yield in wood, which would be far greater if calculated on that given by the forests of the plains separately, to 1·284 cubic metres per hectare, or a little over 18 cubic feet per acre, by far the greatest proportion of which is yielded by the firewood. To this, however, must be added the produce of the bark of the oak and the resin of the pines.

(b) *In Money.*—The mountain forests are similarly responsible for the small returns in money given by the State forests, which is only 4·78 francs per hectare, say 1s. 7½d. per acre. Here these low returns are due:—

(1) To the difficulties of working and transport, and
(2) To the low value of the beech wood.

The price obtained for the wood generally is also very low, depending upon the nearness of the market and the facilities for removal. The secondary products of the forest, together with the sale of the rights of shooting, grazing, gathering acorns, etc., come to the assistance of the general receipts.

Of the Damages Done to the Forests.

There is no appreciable damage done by animals or insects in the State forests; on the other hand, however, the damage done by fire and by wind is very considerable. One tempest of wind alone uprooted 41,967 trees in the mountain ranges in 1886. Fires are even more destructive, and necessitate special precautions. Observatories are erected to watch the outbreak and trend of these, and the forests themselves are as far as possible safeguarded by wide fire-trenches, which divide them into blocks. When a fire breaks out, the mayors have the power to requisition workmen and tools in order to make counter fires, recusants being punishable by fine. As to the causes of fires, these are often owing, as in our own country, to sparks from engines, but more frequently to the grass fires, raised in spring to induce a growth of fresh herbage, but which frequently get out of control. This cause of forest fires is unfortunately too well known in all hot countries, and many a fine forest has succumbed to the ravages of what was intended to be merely a local grass fire.

Of the Introduction of Cattle and Rights of Grazing.

According to Article 112 of the Forest Code, the ingress of cattle and sheep is permitted in nearly all the forests of the Department, "licences" being granted by the municipalities, and the receipts brought into the municipal treasuries. Except in times of drought and scarcity of outside pasturage, this would appear to be a measure of doubtful utility. The number of sheep ostensibly admitted to the mountain forests is about four per hectare. The word "ostensibly" is here used, for the returns are not accurately made. The mountaineers, who enjoy rights of firewood and of timber for the repair of their cabins, make false returns of the number of their flocks, and claim rights of free grazing. Detection is not easy, and the result of judgments, even when obtained, is not satisfactory.

Resumé.

It is not possible to consider the Forest Department in this part of France as a revenue-producing branch of the State. Although in the abstract the forests cover one-fifth of the whole area of the province, the exigencies of agriculture on the plains,

and the necessity of keeping the slopes of the mountain ranges clothed with protecting forests, militate against any scheme of regular exploitation. The way to look at the usefulness and value of forest administration is rather from a negative than from a positive point of view. France has learnt too dearly the danger of denuded hills, again to disafforest for the sake of revenue. The losses sustained by the vines swept away by torrents from the once clothed Alps and other mountain ranges, have brought home to her a lesson which she will not easily forget. And the cost of revetments, embankments, and water-channels of all sorts, has entailed on her a capital expenditure, the effects of which will for a long time dominate her forest finance. Those who visited the Paris Exhibition of 1900 will remember the series of raised plans and maps which were displayed in the Palais des Forêts, in order to illustrate the effects of planting on mountain streams, by which a steady flow of water was secured, instead of alternate torrential floods and droughts.

XIII. *Botanical Geography and Biological Utilisation of Soil.* Extracts from a paper by MARCEL HARDY, published in *Scottish Geographical Magazine*,[1] 1902.

It is interesting to compare, by contrast, what has been the action of man on his surroundings. From this point of view the majority of the countries bordering on the Mediterranean furnish the most striking examples. That these regions, formerly covered with forests, have been ravaged in utter disregard of natural laws, has been many times demonstrated. We know that this is the result of short-sighted clearings, of an ignorant and mischievous treatment of the forests, and of the excessive pasturing of sheep and goats. This blow at the equilibrium of nature could not remain unpunished. The first consequence has been the disappearance of one of the most important resources of the country, of an object of the first necessity—the wood. At the same time, agriculture has been stricken in one of its fundamental elements; for the waters, instead of the more or less abundant and regular flow which they might have had, have become quite intermittent and temporary, but at the same time torrential and destructive. Now the soil, formerly held together on the slopes by the vegetation, is dried up by the sun and washed away by the rains. Freshets have become frequent and destructive in consequence of the enormous quantities of materials worn away from the mountains with which the rivers and streams are charged. The climate itself has acquired an extreme and irregular character. Thus have been formed those immense unproductive stretches which, in certain parts, give to these unhappy regions the aspect of a desert.

The Alps and the Pyrenees, exposed to the same treatment, have been similarly affected. The deforestation paralyses the development of the pastoral industries in these regions by lowering the limits of forest vegetation. The valleys are ravaged by a devastating erosion. Entire mountains slide down slowly, carrying with them the pastoral villages which they bear on their surface, accumulating ruin and disaster. The human habitation is little by little driven back towards the plain.

These processes do not affect the mountains alone. For, by

[1] Extracted by permission.

the very fact of this deforestation, the rich plains of the Garonne and the Loire are subjected to disastrous floods, which make the fate of agriculture in these regions extremely precarious. This state of things has not failed to arouse apprehension among the inhabitants. Researches with regard to the question have shown that the devastating character of these inundations is due to the destruction of the forests which formerly covered the central plateau and the Pyrenees. The waters no longer absorbed and regulated by the forest vegetation, flow away on the surface in enormous and sudden waves. The debris thus carried away in vast quantities contributes to the formation of barriers, and give to the waters their destructive power.

But the danger does not cease there. The navigation of the great rivers, gradually silted up by this waste from the mountains, is rendered very difficult. So much is this the case, that even Russia, a country so uniformly flat, is threatened in the use of its great waterway, the Volga. The investigations ordered by the Russian Government have demonstrated that this is the result of the drainage of the marshes and the deforestation of the low hills which give birth to the river. In other parts of the country similar effects are observed. Wœikoff further cites numerous examples of the power which erosion may acquire in the Russian plains, in consequence of an improper treatment of the soil.

To come to our own countries of north-western Europe, what shall we say of. Scotland itself? The utilisation of the soil there has been bad from the first. Deforestation has long since finished its work. Forests, properly speaking, exist no longer. Heather-moors, peat-bogs, neglected pastures, and deer forests cover the whole tract of country to the north of the Highland border. Forest industries do not exist. The lack of wood prevents pastoral industries. Flocks from which their owners derive but little profit hinder all spontaneous reproduction of the forests. Even the numerous industries which might make use of the motive power of the waterfalls of the country would be compelled to have recourse to foreign lands for the timber which is indispensable to them. The country continues to grow poorer; the ruins accumulate; the young population emigrates to the cities or to the colonies, on account of the impossibility of finding employment and earning a livelihood on the spot. The rural population, represented by the miserable crofters, seems to have been smitten by a complete arrest of development.

This is certainly a typical example of that disregard of physiographical data which carries with it its own punishment.

Should such a state of things be allowed to continue? The negative is the only possible answer.

Now, have we the means of obtaining a superior yield from the soil, and of correcting the faults which we have committed? Science replies in the affirmative, and offers clear and practical means of retrieving our position. The attempts made in accordance with her directions have been crowned with success.

It is essentially a question of returning to the observations of nature.

. . . . . .

Since we have insisted on the question of the forests, it is fitting to show that this question is of the first importance in Scotland, and to explain how botano-geography intends to solve the problem. We have here the most striking example of the necessity of applying scientific methods to agricultural economy.

In the first place, the world production of timber is absolutely insufficient. This conclusion results from the examination of the customs statistics of the principal countries (Mélard). We see, in fact, that the imports exceed the exports in England, in Germany, in Belgium, in Holland, in Switzerland, in Denmark, in France, in Spain, in Portugal, in Italy, in Greece, in Servia, and in Turkey. Such countries as the United Kingdom, Germany, and Belgium are thus every year debtors to foreign countries to the extent of millions of pounds. The excess of imports in the United Kingdom alone is about £19,000,000. Note that this deficit has been increasing since 1860, and sometimes in enormous proportions. In Belgium it has sextupled, in Germany it has quadrupled.

As to the exporting countries, they are not numerous, and the supply of the majority of them is decreasing. Norway is in this position, and will soon have to be content with supplying its own needs.

In Austria and Hungary the birth-rate is increasing, and with it, national industry and demand.

Finland and the United States of America seem to have reached, if not passed, their natural limit.

Russia, with its increasing population and the development of its industries, consumes more every day. Besides, for the benefit

of her climate and agriculture, she must preserve great stretches of forests.

Sweden and Canada alone constitute a safe reserve. But the disastrous forest-fires which occur in Canada, and the development of the pulp industry, arouse a certain degree of uneasiness with regard to the forests of these countries. As to China, Egypt, South Africa, the Argentine Republic, and Australia, they are all timber-importing countries.

In short, the demand for timber keeps on increasing. Its price rises in proportion. The supply seems to have reached nearly its maximum under the actual conditions. Over-production is not possible without dooming the forests to destruction.

We are advancing towards a timber famine. "In western and southern Europe there is not a single country where one could not find thousands and even millions of hectares of uncultivated lands, the agricultural utilisation of which has ceased to be profitable. All these lands ought to be reforested. The states ought to lavish encouragement not only by exemption from taxes but also by free gifts of seeds and seedlings, and by putting their staff of experienced foresters at the disposition of the owners for their guidance. They should not hesitate to acquire part of these areas themselves. And for the taking of these measures there is not a moment to be lost. Forest production cannot be improvised. It requires a century and a half to grow timber fit to be sawn. And the timber famine will perhaps become acute before fifty years" (Mélard).

Now, could we not apply these authoritative words to Scotland? Is there not here a sure source of regeneration for all the country that lies to the north of the Highland border? We shall try to prove that this is the case. With this end in view, let us examine first the physical conditions of Scotland in comparison with those of similar regions, such as Scandinavia, Finland included. From the fact that both are placed on the north-western coast of Europe, in the same position with regard to the atmospheric and marine currents, there results a great similarity of climate in Scotland and in Scandinavia. Let us say at once, that if the climatic features are homologous, the temperature is milder in the former. Its lower latitude is the chief cause of this. We must add, further, that Scotland feels more directly the influence of the warm current of the Gulf Stream and of the westerly winds.

Thanks to the bend towards the south which characterises the course of the isothermal lines in these parts, the north-eastern point of Scotland enjoys a temperature several degrees higher than that of the south-western extremity of Scandinavia, the most temperate portion of the latter country. We can therefore say that heat conditions are more favourable in Scotland than in Scandinavia. As for the rainfall, it is practically equal in the two countries, and its variations are parallel, Scotland being divided into a moister western portion and a drier eastern portion, and Scandinavia being divisible in a similar manner.

If we compare the direction and the force of the winds, the parallel is not unfavourable to the Highlands. In a word, the analysis of the principal climatic factors reveals a striking analogy in their course and relative influence. There is, therefore, from this standpoint, no reason why Scotland should not be as well wooded as Scandinavia.

Let us next consider the geological data. We can group Norway, Sweden with the exception of Skäne, and Finland as a single mass superficially separated at present by the Bothnic depression, but as having formed a continental area since Silurian times. A large portion of this Scandinavian group belongs to the crystalline rocks known in their entirety under the name of Archæan rocks. In the second rank comes the Precambrian system, occupying nearly a tenth of the surface. We have therefore almost everywhere a substratum of granite, gneiss, and mica-schist.

While, in Norway, the drifts cover scarcely a tenth, at the most, of the surface of the country, in Sweden nearly the whole of the forest soil is made up of glacial till. The morainic gravels and clays form good arable land.

We need change these general features very little in order to identify them with those of the Scottish Highlands. And it is impossible to say that the geological conditions are more unfavourable to forest vegetation in the Highlands than in the Scandinavian countries.

Now Scandinavia has always been covered with vast and vigorous forests. In the southern part of the peninsula the beech finds favourable conditions up to the altitude of 300[1] m. The oak forms forests, the upper limit of which is still at 500[2] m. in 60° N. lat. As we ascend, we cross the coniferous zone, which, on the average, does not extend beyond 600[3] m., with *Pinus sylvestris*

[1] 1000 feet. [2] 1600 feet. [3] 2000 feet.

and *Picea excelsa*. Still higher we find a zone in which the birch predominates, extending from 900 to 1100[1] m., traces of which are still found on the high plateau of Finmark.

Within the Polar Circle 6 per cent. of the surface is wooded. There also the birch dominates, the pine is secondary, *Picea* does not exist.

Why should it not be the same, and with still more reason, in the Scottish Highlands? They were formerly covered with forests: the most positive natural and historical evidence places this point beyond dispute.

According to Dion Cassius and Herodian, the Roman legions and the auxiliary troops were employed by the emperor Severus, in the year 207 of our era, in cutting down the forests: 50,000 men they say, perished in this enterprise. The ancient forest, Sylva Caledonia, which had originally an area of 20 miles, is now represented by a few small forests such as that of Coille-More, or Great Wood, and that of Marr in Aberdeenshire. According to old maps, forests surrounded Stirling, Elgin, Banff, Aberdeen, Kintore, and Paisley. The great wood of Drumselch partly covered the neighbourhood of Edinburgh. Selkirkshire, formerly called Selkirk Forest, must have been very well wooded. Vast stretches of heather, peat-bogs, and marshes have replaced these old forests. Amongst the causes of destruction, particular to Scotland, we must mention the attempt of the Government to take away from the Highlanders the refuge which they found in the depths of the forests. John of Lancaster employed 2400 workmen to cut down the forests of Scotland. Robert Bruce destroyed a great number of them in his expedition to Inveraray against Comyn. In the northern part of the kingdom the Danes burned extensive wooded areas. We find an order of General Monck, dated 1654, which commands the destruction of the forest of Aberfoyle.

Tradition and the ruins which each step in the glens compels us to observe, witness that the soil formerly supported and fed a much denser population.

Beside the documents afforded by the local archives and folklore, we find in the soil itself certain proofs of this former state of things. For, in many places, and in different parts of the country, we come across entire forests still apparent by the stumps buried in the bogs or in the water.

This is convincing evidence that the limits of tree-vegetation,

[1] 3000 to 3600 feet.

put at 600[1] m. by Robert Smith, ought in fact to be placed much higher. Furthermore, Smith himself recognises that the character of the vegetation does not become plainly Alpine until we reach the height of 900[2] m. Here again we are dealing with one of those phenomena of lowering of the treeless limit which Prof. Flahault describes in the Alps and elsewhere.

From this rapid exposition of the facts we may draw the following conclusions:—

1. That there were formerly forest areas in Scotland which have been destroyed by man within historic times.
2. That there is in Scotland a combination of all the physical conditions favourable to forest vegetation.
3. That the actual circumstances render essential the reconstitution of a wooded area as large as possible.

In the Scandinavian peninsula, the lumber trade employs about 83,000 workmen yearly. If we consider the families of these workmen, the numerous kindred industries, and all the industrial and commercial population which the support of these people requires, we can appreciate the important *rôle* which this addition might play in the regeneration of the Highlands.

It is well to mention that the work of reforestation would tend to do away with a large part of the mountain peat-bogs which have owed their extension to deforestation alone. Drainage, moreover, would contribute to the salubrity and habitability of the country. We have only to glance at the admirable work of the French foresters, in particular at the preliminary works and the reforestation of Mont Ventoux, Mont Aigoual, etc., to gain confidence with regard to this.

[1] 2000 feet. [2] 3000 feet.

XIV. *The Origin and Development of Heather Moorland.*

By Dr W. G. Smith.

(Extract reprinted from *The Scottish Geographical Magazine* for November 1902.)

Development of Heather Vegetation from Forest.—The development of heath on bare sand is probably the more primitive mode, yet Graebner [1] considers that the majority of the existing heath areas in North-West Germany have been developed on the sites of former forests. This is admitted by most observers, and although the German plain is an area of low altitude, the results are worth considering in regard to the origin of British heather moorlands. R. Smith [2] decided to adopt 2000 feet (608 metres) as the approximate upper limit of the heather moor; above this limit the heather either ceases or becomes a subordinate element in the blaeberry (*Vaccinium myrtillus*) type of vegetation. The birch wood or thicket also ceases about this altitude, and is the highest of our forest zones. Woods of larch and Scots pine occur in Northern Perthshire up to 1800 feet, but White's *Flora of Perthshire* gives isolated pines up to 1900 feet altitude. In Aberdeenshire, Dickie's *Flora* gives 2200 feet, and quotes from Watson's *Cybele* the finding of a pine trunk, 8 feet girth, in peat at 1650 feet. Geikie [3] says that pine trunks in peat are not uncommon from 1800 to 2500 feet altitude. The agreement between the upper limit of the principal heather area and the higher forest zones in Scotland is suggestive of a possible origin of the heaths from forests; in many cases this was doubtless so, but more evidence is required before this course of development can be admitted as universal. In North Germany the conversion of forests of a high national value into heather wastes of little value is an important economic question. The problem has naturally attracted much attention, and Graebner had it before him as one of his chief objects. The explanation most widely accepted is that of Krause and Borgreve; the forests have been exploited by man for the timber, and the failure to

[1] *Die Vegetation der Erde*, edited by Engler and Drude: vol. v. *Die Heide Norddeutschlands*, by Dr Paul Graebner.

[2] Smith, Robert, *Botanical Survey of Scotland:* I. Edinburgh district; II. Northern Perthshire. John Bartholomew & Co., Edinburgh, 1900.—Also *Scot. Geog. Mag.*, July and August 1900.

[3] Geikie, J., *Trans. Roy. Soc. Edin.*, xxiv. pp. 363-384, 1865-66.

re-establish them is the result of errors in cultivation, of which the chief is the destruction of seedling trees consequent on the grazing of forest land by cattle and sheep. Graebner differs from most of his contemporaries. He regards the above view as too narrow, and considers that the climate and impoverishment of the soil are the chief causes. His arguments are here summarised. The rainfall of the "Heide," as already stated, is higher than the adjacent Steppe area of Northern Germany, and the soils are generally sandy. Rainfall on a heavy clay, or other soil of close texture, results chiefly in erosion, because the rain-water flows over the surface; on a sandy soil of loose texture there is more percolation. Rain-water sinking through the soil carries with it dissolved substances, which are either absorbed by the roots of plants or pass below into the subsoil. This action will in time reduce a sandy soil, moderately rich in soluble matter, to a condition when little soluble matter remains. According to Graebner, this condition is indicated by the spontaneous appearance of a heath vegetation. If the area be under forest, the trees assist in the removal of mineral food, but this will be returned to the soil if the trees fall and rot *in situ*. The exploiting of timber will reduce the material returned, and it is generally assumed that one-third of the mineral matter taken up by the tree is thus removed. Tables are given to show that there is a loss by removal of timber, and analyses by Ramann are quoted to show that fallen leaves do not replenish the soil for tree-growth so much as is frequently stated. Graebner ascribes the disappearance of forest to impoverishment of a naturally open soil by rain, assisted by removal of timber, so that the materials necessary for vigorous growth are no longer available. Thus beech forest, with its subordinate vegetation of plants requiring a rich soil, gives place to a heath vegetation of dwarf growth and meagre needs. In the transition it is not uncommon to find a phase with Scots pine or spruce forest, since either of these is less demanding than beech. Graebner (p. 70) admits that the process of impoverishment in the way just described must be slow, and is limited to open soils poor in plant-food to begin with. The development of heath from forest may be accelerated by other changes which produce a condition of poverty in the part of the soil available for plant growth; the most important changes of this kind are accumulation of humus and the formation of moor-pan.

Humus consists of the debris of plants, which being returned to

the soil become incorporated with it. The soil of a heavily-manured garden or farm is rich in humus, which is rapidly disintegrated and decomposed, largely through the agency of bacteria. In forests and under close masses of vegetation (*e.g.*, heather) the plant remains decompose slowly, and tend to accumulate as raw humus. Under such conditions light and air are deficient, and physical disintegration proceeds slowly, while bacterial action is largely replaced by the slower action of true fungi. The leaf mould of gardeners is raw humus collected in woods, while peat of various kinds is the raw humus accumulated under heather, cotton-grass, bog-moss, or other moorland plants. Raw humus may be formed on soils naturally rich or poor, and in all cases it masks the true action of the soil. The effects of raw humus on vegetation have been described by Grebe.[1] A layer of moderate thickness cuts off the underlying soil from oxidation and other atmospheric action, so that roots of plants are imperfectly aerated. Under heath vegetation the raw humus, combined with the roots of plants, forms a felted mass which interferes with the circulation of air and water in the soil; it hinders evaporation of superfluous water in spring, while in summer it forms a dry felt which prevents dew and light rains from reaching the soil. The raw humus, in short, renders the soil unfavourable to plants which require fresh soil, active aeration, and sustained moisture. The formation of humus is accompanied by the development of organic acids, which in the case of raw humus are imperfectly oxidised, and their accumulation gives rise to changes prejudicial to the growth of most plants. The heath vegetation is adapted to growth in moor-humus by its modified xerophytic character and by the shallow growth of underground parts. The adaptations of heath-plants are dealt with in a paper by L. C. Miall (*Nature*, lviii., 1898, pp. 377 and 401), and in this or the special works of Warming or Kerner the details will be found. Two forms of heather vegetation are recorded on the Scottish maps, of which the one with shallow peat is the drier; the other is the bog or moss, with deep peat.

The formation of moor-pan may precede or follow on the accumulation of raw humus. Its effect is to assist in masking the true fertility of the soil. Graebner's account of moor-pan is the best we have seen, and throws considerable light on the formation of heaths and peat. Moor-pan, as we translate the German word

[1] *Zeitschrift für Forst- und Jagdwesen*, xxviii. (1896), pp. 513-542.

'Ortstein," may frequently be seen in drain-trenches or other exposures on our moors. It is a layer of humus-sandstone which may be recognised at the base of the peat if one probes with a long knife-blade downwards from the peat into the soil beneath; if pan is present, a distinct hard layer is met which turns the knife like a soft sandstone, and when exposed it can be removed as cakes of a dark brown stony material. A form of pan is familiar to farmers on certain classes of soil as a hard layer just beneath the ploughed soil; its effects are to stunt the root-growth of crops, hence it has to be periodically broken up by deep ploughing. Graebner's account of the development of moor-pan is as follows: The removal of soluble salts and the accumulation of raw humus lead to the exhaustion of the upper soil, which loses its powdery, crumbly texture, and becomes caked together. The percolation of rain-water carries humus compounds and dissolved salts in solution downwards through the poorer layers of the soil to layers below as yet unexhausted, and here ensues a precipitation of both humus and mineral matter. The process may be seen when a deep trench is freshly dug in a heath area; water flows in from the peaty soil, and on reaching the bottom of the trench it meets the subsoil richer in mineral matter; there then occurs a precipitation of a gelatinous brownish layer, which when dry is insoluble in water. Graebner also succeeded in making an incipient pan in a glass tube filled with heath sand. The occurrence of moor-pan in heaths has been proved by borings, and Graebner gives several of these. One locality may be given as an example: (*a*) heath-peat, 15 cm. (*i.e.*, 6 inches); (*b*) bleisand, 20 cm.; (*c*) moor-pan, 4-10 cm.; (*d*) marl-sand, 40 cm.; (*e*) diluvial sand. This arrangement of the layers is almost constant, though the thickness varies; the moor-pan is always deep enough to be protected from the action of frost, which breaks it when shallow. Chemical analysis of borings shows that below the moor-pan there is always a marked increase in the amount of soluble mineral matter. A well-developed moor-pan may resist the penetration of the roots of young trees or other plants, hence it cuts off the best part of the soil, and limits the plants to the upper impoverished layers. In replanting the heaths of North Germany with forest trees, it is now considered necessary to break up the moor-pan by deep subsoil ploughing, previous to planting.

Minor causes of disforestation occur locally. Thus the influence of man in digging drains, building reservoirs, and otherwise disturbing the existing conditions of drainage, may favour one vegeta-

tion at the expense of another. Wind-borne sand may also overwhelm forests or other vegetation, and lead to the development of heath or other sand types.

One of the objects of the Scottish botanical survey is to ascertain the extent of our primeval forest, hence the importance of Graebner's observations. The origin of the heather moorlands in Scotland has a very direct bearing on the afforestation of our moors, a prominent item in the work of the Scottish Arboricultural and kindred societies. In many instances it has been proved that, with proper treatment, our moors may be converted into forests of Coniferæ. This would indicate that the soil of our moors, especially the drier types of heather moor, is not yet too exhausted to carry forests. The extensive and successful conversion of heather moor into farmland in earlier times also points this way. At present we consider that a large proportion of the heather moorland in Scotland has been derived from ancient forest, but in the Pennine chain in England there is less evidence of this. The heath vegetation is the result of a moist climate, which favours the accumulation of raw humus cut off from the true soil by a moor-pan or an impervious layer of fine clay. Natural poverty of soil in itself is only responsible in a few cases, such as the thin, stunted heaths of sand-dunes. Other causes of conversion are the influence of man through sheep-grazing and drainage, and, in a less degree, through the favouring of heather and its associates by the regular burning of grouse-moors.

XV. *The Injurious Effects of Smoke on Trees.*[1]

By JOHN BOYD.

It requires no argument to persuade the most casual observer that serious injury is done to trees in localities where there is much smoke; and not only to trees, but to all vegetation. The injurious effects are most apparent on long-lived plants. On annuals and herbaceous plants the pernicious results are not so noticeable, although, even here, the influence of an impure atmosphere is often only too evident. Even at this season (February), when the vegetable world is, so to speak, at rest, I am sure the members of this Society, who are taking frequent excursions into the country, cannot fail to observe the different appearance of the grass-fields, trees and plantations in this vicinity, compared with that which obtains thirty or forty miles out, where there is a clear, pure atmosphere, and all nature, although brown and bare, has something bright and refreshing to the eye that is awanting within what may be called the smoke area. This difference is even more marked after a spell of close foggy weather, when everything becomes quite polluted, and blackish-brown in colour. A very good illustration of the blackening properties of the atmosphere around Glasgow may be seen in the animal world in the case of sheep. It is quite a common practice, just after harvest, for flocks of sheep or lambs to be brought down from the Highlands and located in the district surrounding the city, where in a few weeks these beautiful, almost white, fleecy animals, become black and disreputable in appearance. As a proof of the filthy state pasture assumes in the winter months, it is frequently seen that if a field is left rough, and sheep or cattle are put on it after the growth has stopped, they will almost starve rather than eat it. Even rabbits will scarcely attempt it after the season has well advanced. They prefer gnawing the bark of trees or shrubs, the outside of which is perhaps no cleaner than the grass, but they nibble that off and get into the fresh under-bark. Experience proves that the ravages of ground game on trees are much worse in smoky localities than in others; the reason being, as already stated, that they will scarcely touch the old grass after the month of November. That is, however, an indirect result, and one which can very easily be removed if the parties concerned are willing.

The direct results of injury from smoke constitute a more

[1] Reprinted by permission from the *Annals of the Andersonian Naturalists' Society.*

serious problem, with which it is difficult to grapple. It is even questionable if it can be absolutely remedied. The damage directly done by smoke and its allies is of a threefold nature. *First*, there is the killing of the living matter in the green parts of plants, particularly in the leaves, caused by acid in the smoke; *second*, the clogging-up of the stomata of certain plants by soot, and the general coating-over with the same of all their parts; and *third*, the effect of the smoky atmosphere in obscuring the sun. It is difficult, or even quite impossible, to define exactly the amount of damage done by each cause, because their action is always combined. Yet it may be as well to consider separately, as far as practicable, how the plants are affected by each of the causes detailed above, afterwards looking at the effect of their combined action.

Effects of Acid.—The gaseous acid in the smoke enters into the leaves during the process of carbon assimilation, at once attacking the living matter in the cells, and destroying it by oxidising or bleaching it, therefore rendering the affected portion absolutely useless. A leaf affected by acid, if held up to a strong light, shows little clear spots wherever the action has begun. Through time, these spots usually become brown, almost black in some plants, and they might readily be taken for an attack by a fungus. On a closer examination, however, a clear margin is seen round the coloured part, which distinguishes it from any disease. This form of injury is generally attributed to sulphurous-acid gas, which is always given off in the burning of coal and particularly dross, in varying quantities, according to the quality of the article being consumed, and there is little reason to doubt but that it is the chief factor in the mischief, although there are other gases given off in limited quantities from various works which assist in the injury to vegetation. The effect of acid may be seen more or less in almost all species of broad-leaved trees growing in any smoky district, and is very easily recognised in its early stages on trees with coloured leaves. The various trees, however, are not all affected to the same extent, neither is any one species affected alike during all the growing season. It seems to be worst when the leaves are at their most active stage, very young leaves not being so readily injured as those that are fully developed, and are, so to say, in full swing at the process of carbon assimilation. Neither are leaves so readily affected when the season has well advanced and their working power has begun to wane. On Pollok Estate, this form of mischief is particularly

noticeable in the early part of the season, no doubt because, at that time, east and north-east winds are more prevalent, and drive the smoke of the city over the place. On several occasions in recent years this was very noticeable. It so happened that, when the earlier trees had just got into full leaf, we had a continued spell of east wind, with the result that the foliage was very seriously injured. The leaves in many cases no doubt suffered from other causes, which was shown by the edges becoming brown, but there were also decided symptoms of the effects of acid in the manner already mentioned, with very serious results as regards the health and appearance of Horse-Chestnuts. Their growth was entirely stopped until after mid-summer, when Nature, trying to recoup herself, sprang away with a young growth, rather a rare occurrence with these trees, which gave them a somewhat remarkable and not altogether pleasing appearance. Among forest trees, Oaks (particularly the Moss-cupped or Turkey Oak) seem to withstand or resist the attack of acid better than any others. Ash may be said to come next, followed by Elm and Sycamore. The Ash, however, has a decided advantage over the others, in that it is generally the last to put forth its leaves, and casts them early, thus having them exposed for a shorter time. Service trees, Birch and Rowans, especially the two former, are also well suited for growth in smoky localities, and are not so partial to a good soil as the others mentioned.

What has been said is chiefly applicable to broad-leaved, and especially deciduous trees. The same form of injury is, however, not wanting among conifers, although possibly on the narrow leaves it is not so apparent at first sight. On careful examination, however, the leaves are frequently found spotted in the same manner, and at times the spots go right round the needles, and cause the outer portion to die off, giving the injury the appearance of that caused by frost. The result in both cases is the same, the green living matter being killed, the power of the plant for carbon assimilation is reduced, and causes the leaves to fall prematurely. The balance of nature is interfered with, and the health of the trees in this way seriously impaired, making them more susceptible to attack from other causes, either by insects or fungi, especially the latter. Attacks by insects on conifers are fortunately less frequent on the trees which are most affected by smoke than one would expect. Indeed those insects which breed on sickly pines are conspicuous by their absence in this locality. Although they are occasionally found, there has

not been noted anything like what might be termed a general attack, which would lead one to the conclusion that they have an aversion either to the dirty trees or the impure atmosphere. This is especially the case with the Pine Bark Beetle (*Hylurgus piniperda*), which very often proves to be a serious pest in pine woods, where the trees are in such a state of health as obtains in the surrounding district.

Effects of Soot.—The next point of importance is the sooty part of smoke and its effects. It is argued by some that this factor is not at all injurious to broad-leaved plants, and especially to deciduous species, and I do not doubt but that, with such plants, it is of minor importance compared with the effects of acid gases, but I am inclined to believe that it does considerable harm, particularly to Evergreens; an instance of this was brought under my notice last summer in Messrs Smith and Simons' Nurseries at Kennishead. There were several days of very dense fog, towards the end of January 1899, which blackened everything to a remarkable degree, the leaves of Evergreens being simply painted with soot, and, for the want of a good day's rain immediately following, it got fixed on and adhered to some extent for a considerable time, the result being well demonstrated in the instance referred to, where a few plants in a plot of Aucubas were, by a mere chance, syringed and freed from this coating, with the result that they looked healthier all the year, and made a better growth than the average of the remainder of the plot. This seemed to show that the soot on the leaves has to some extent a prejudicial effect on the plant, not in the way of injuring them, for those that were not cleaned were free from any particular injury by acid in the soot, but, in my opinion, by the coating in some way affecting the action of the chlorophyll, presumably by the sun's rays having less power, through having to penetrate this film or scum on them. This may also apply to deciduous plants, but in a less degree, because their leaves have a much shorter life, and have not the chance of becoming coated to the same extent, although that they do get blackened any one may prove by drawing a few leaves through a clean hand, or, better still, through a clean white handkerchief. It is admitted, however, that the injury done by smoke in this way to such trees is very little compared to what happens with conifers, which, with a few exceptions that may be overlooked, are Evergreens. In the first place, the particles of soot in the air seem to adhere more to the leaves of the majority of such trees than is the case with the

others. This may be accounted for, with some, by the resinous and sticky nature of the skin of the leaves, but with others, such as *Cupressus*, etc., it is due to some extent to the position of the leaves, which forms a kind of trap for collecting it. Further, the formation of the stomata permits of such particles entering in, and more or less choking them, which means partial starvation and suffocation for the plant. Some leaves taken from Scots Firs on Pollok, and cut into sections, showed almost every pore to be more or less closed in this way. This is bound to impair the health of the plants in no small degree, through the leaves being unable to perform their functions properly, and it also causes premature leaf-shedding, which is, however, greatly assisted by the leaf-shedding fungus (*Hysterium pinastri*), a disease which, unless in seed-beds, is not characterised as of a serious nature; but, when the young pine trees are in an unhealthy state through the effects of smoke, they are attacked all over by it, with very serious results. From this cause, last year, over 10,000 Scots Fir plants between twelve and twenty years of age had to be cut down on Pollok Estate.

Effects of Darkened Atmosphere.—This brings us to the third way in which the trees are affected, viz., through the smoke in the atmosphere. I do not know if this source of damage has been much noted, but it is none the less present, although possibly not noticeable at first sight, particularly with trees standing singly. In woods or small thickets of trees, however, its effects are at once apparent, and I believe are much more widespread than either of the previous evils. It neither affects the health of trees standing singly, nor those in open woods, so much as it does those in close woods. The treatment of woods within a radius of six or seven miles of the centre of the city, or in any locality where there is much smoke, is entirely different from the ordinary routine. Woods, notably pine woods, must be kept much opener, to admit of the plants getting sufficient light to keep them in anything approaching a healthy condition, and I am of opinion that the continuous darkening of the atmosphere by smoke must take a great share of the blame for this. However, as previously stated, it is quite impossible to draw lines of distinction between the amount of injury done by each of the various causes, and having now considered how the trees are affected by them separately, a brief consideration of the total injury done in regard to appearance, health and growth, must suffice.

Summary.—In appearance the natural beauty of the trees is marred. The freshness of Spring disappears sooner, through the blackening effect of the smoke, which is a great loss and disadvantage to many who are prevented from seeing nature unless in the public parks and woods in the immediate neighbourhood of the city, and throughout the whole year there is a lack of brightness, but of all the seasons, it is in Autumn that the greatest contrast is seen. Where are all the varying tints and shades of colour of the fading leaves of the woodlands in our glens and vales away out in the country? There is no comparison between trees in such places and those in the parks and suburbs of our city. No doubt there is a certain degree of this natural beauty left, but it is like a dim and imperfect copy of some fine picture. And what about the evergreen shrubs? At this season of the year, instead of being objects of beauty, they are frequently very depressing to the eye, being black, and in many cases tufted and open, rather than a dense mass of foliage, owing to the leaves falling off months or sometimes a year or more too early. Common Hollies are possibly the worst victims in this class of plants, good specimens of which are scarcely to be found in this neighbourhood. I have already said that coniferous plants, and particularly Scots Firs, are the worst sufferers of all. But, before adding a little about their appearance, I would remark that, at no very remote time, the residents in this city who like to see a good Scots Fir tree will have to travel some distance to gratify their desire. Those near at hand, old and young alike, are without exception more or less seriously affected, their state of health being far from satisfactory. Their leaves fall off a year or more too soon, it being quite common to see them, at the beginning of the growing season, with nothing but the previous year's leaves adorning them, instead of two years complete and the greater portion of a third, thus detracting very much from their appearance, giving them a thin, tufted, stunted and unhealthy look.

On approaching the city from any side, particularly from the east or north-east, the general effect of smoke is in evidence, I think I may say, on all trees, some certainly being affected more than others; and any one of an observant nature, who travels to and from the city for a number of years, cannot fail to recognise the fact that the effect of smoke is of a cumulative nature as regards the health of the trees. If once a tree is noticed to be decidedly suffering from that cause it is doomed, its death being

only a matter of time, it may be long or short, according to the species or variety and its suitability to the soil on which it is growing. The first sign is the early fall of the leaves, then the crown gets thinner and the annual growth less, until it is practically at a standstill, and gradually the tree dies a premature death. Such symptoms are no doubt mainly due to the first-named cause, viz., the presence of acid in the atmosphere—the other causes lending their assistance, but certainly to a less degree. On going farther afield, the injurious influences gradually become less discernible, and it takes a much longer time before there is any serious result, unless with very susceptible trees.

From what has been said, I am sure anyone will assume that the annual growth of trees is greatly reduced in smoky atmospheres, particularly those in the immediate vicinity of the city, but it is also quite noticeable a considerable way out, where the traces of injury through acid are scarcely to be found. On Pollok Estate I have watched this deficiency in growth with no little interest for the last seven or eight years, and I calculate that the different trees are affected to something like the following extent in the various woods and plantations—those nearer Glasgow being decidedly the worst. With Oaks, Ash, Sycamore, Beech, Elm, Hornbeam, Birch, Service trees, Rowans and Austrian Pine the diminution in growth will vary in the different species from 10 to 20 per cent. in the immediate neighbourhood, and farther out it will not be more than something like 5 to 7 per cent. If, on the other hand, the worst sufferers, such as Scots Fir, Weymouth Pine and Spruce, are compared, it is found that in plantations at the extremities of the estate, the annual loss in growth is about 10 to 20 per cent., and in those near hand it is as much as 25 to 40 per cent., and gradually getting worse. Now if to this is added an equal reduction per cent. of stems per acre, it is at once evident that it is absolutely impossible to cultivate trees successfully from a commercial point of view in any smoky locality. In fact the great concern of those who either own or manage woodlands under such conditions is not how to make them pay, but how best to treat them so that they may be kept in anything like a satisfactory state of health. I think no one will deny that the smoke question as applied to the vegetable kingdom is quite a serious problem, and any one who finds a remedy will create a name for himself, and confer a blessing on his fellow-men.

XVI. *On Thinnings in Planted Spruce.* Abridged from an article by M. Ch. Broilliard in the *Revue des Eaux et Forêts* for January 1902.[1]

Planted spruce, like the sons of Eve, are addicted to original sin. In their case it lies in the equality of age and of spacing. On the other hand, they have generally a single purpose to serve in each case. It may be hop-poles, telegraph-poles, cellulose, carpentry, sawyer's timber, or what not. They are sometimes mixed with other fast-growing conifers, such as pines or larch. These three orders of facts produce complications in thinning.

In order to understand how *natural* spruce crops differ, it would be well to know their origin and history. They start from natural seeding, capricious in distribution, different in age, variable in density, from one point to the next. How were they produced? Was it in open land void of pre-existing trees or shrubs? Were they always unmixed with broad-leaved species, birches, or beech, or silver fir? M. Mathey is probably the first, in his work on *Le Pâturage en Forêt*, to point out some of the accessories, alder, juniper, hazel, whitethorn, etc. Foresters whose work lies in spruce can assist. Here are a few instances recalled from the days when my work was in the mountains.

One spring day, while resting in the shade of the forest of Brey, on the edge of a mossy meadow sweeping down to the tail of the lake of Remoray, I saw young seedlings of spruce coming up all around in the open. Were there any left at the end of the summer? None seemed to have survived from previous possible seedlings.

Another time, in the commune lands of Boujeons, grazed over by cattle every year, I was struck by the appearance of some bushy little spruces showing black against the sunny snow. Some of them had sent up a shoot that might be considered safe from cattle. Were not these the precursors of a forest?

Above the forest of Outriaz, or La Condamine, was a sheep pasture, with the grass, as usual, bitten down to the ground, and the gravel soil showing between the tufts. Spruce was establishing itself by degrees under the protection of juniper bushes, in spite of the daily access of the sheep. The action of each juniper sheltering its one or more spruce of 6 inches or more in height,

[1] Reprinted from the *Indian Forester*.

was very evident. The spruce, as it became larger, produced a similar effect, so that the forest was actually spreading by the absorption of groups along its borders.

In 1857, at the bottom of the commune lands of Malbuisson, on a plateau not far from the old forest, was a very irregular but almost continuous thicket. One could still walk about in the cattle tracks, and even shoot hares between the dense clumps of spruce, each clump with its tallest and best in the centre. To-day this is probably to all appearance an even-aged crop.

In the forest of Grand-Cote, Canton Maclin, the southern slope was entirely occupied by a beech thicket. In 1857, the conservator, M. Vouzeau, and myself, at that time a Garde General, both lamented the purity of the crop. Thirty years later I had the satisfaction of seeing the leaders of spruce shooting up from among the beech. Indeed, I have seen that in many blocks covered with broad-leaved pole crops, coppice, or seedling, the spruce will frequently be found, of all sizes, in the underwood, some ready to break forth into the light, some patiently waiting their opportunity; others too that had lost hope and died. But, in the long run, it was the spruce replacing the broad-leaves. Is not this likely to be how some of the splendid spruce forests of the high Jura arose?

In this region, in the mixed forests of fir[1] and spruce, with the latter in a majority, it is usual to see the spruce reproducing itself beneath the firs, germination being favoured by the better vegetable soil formed under the latter. There, under the cover of the great firs, the spruce gathers itself together into a sort of loose ball, awaiting the light from above which shall enable it to shoot up to heaven. Under the spruces themselves the soil is generally covered with a carpet of dead needles, the vegetable soil is acid and black, and young spruces are generally absent. Under the spruce it generally happens that the seedling is of silver fir, whose heavier seed and longer tap-root may succeed in piercing the dry or acid covering of the soil, and establishing a plant; thus groups of fir often replace groups of spruce. The latter, in France and particularly in the Jura, thus presents the tendency to change of place, it reproduces with difficulty on the old site, and the close crops of pure spruce seem to arise from seedlings originally very unequal in age and consistence. Con-

[1] Silver Fir.—Hon. Ed. *Trans.*

sequently, early thinnings may be long deferred, and the later ones made with great moderation, without endangering the prosperity of such natural high forest.

The case is different with artificial spruce crops planted in a single operation, in lines, triangles, quincunx, etc., on bare soil. All these plants start together, and the struggle is between equals. Here comes in a question which has never had, and can never have, a general answer. It refers to the spacing of the plants. Practice varies from 2 to 10 feet. In fact, the distance depends on the object in view. Hop-poles to be cut clean at about twenty-five years old, must be close grown, say 4000 per acre. For paper pulp, or useful poles to be cut at about forty years old, two-thirds of the number will suffice. For telegraph poles or small carpentry, to be cut at sixty years, 2000 plants will be about right. For sawyer's timber no more may be needful than 1200 to 1600 planted 5 or 6 feet apart, or better still if irregularly spaced.

It is true that widely spaced plants, sturdy from their youth up, make strong and quick-growing trees. But for good useful timber it is absolutely necessary that the lower branches must perish and fall while still thin, leaving a trunk clear and free from knots. Upward growth is the great point; the crown pushing rapidly up suffices amply for the prosperity of the tree when it occupies no more than a fourth of the total height. Young growing spruce must therefore be thinned with extreme moderation, and the density must be kept as close as is consistent with good growth. Thinnings in even-aged young spruce are certainly more difficult, and more necessary, than in natural crops. The principle to be adopted is, to free the tallest and reduce their number without removing the weakest (unless their tops are dry), since these latter ensure natural pruning, cover and protect the soil, and add the strength of a close canopy. The spruce is truly named *excelsa*. Not like the ash *excelsior*, "above my neighbours," but simply *excelsa*, "ever upward." The fir, though often taller than the spruce, ends by acquiring a flat, tabular top, whilst the spruce points upward to the last.

In order that the spruce may have a sufficiently rapid growth, as well as a clean bole, the crown must be allowed a duly proportionate height, say, one-fourth of the total height of the tree. This proportion can be assured by maintaining a suitable density in the crowns. If the crop is to grow on to the age of sixty,

eighty, or one hundred years, it is clear that the stems should be thinned out gradually but a little more freely, so that the rate of growth in thickness may not become too slow.

Given, for instance, a crop composed of 600 good dominant stems per acre, with an average diameter of 6 inches, by the time the stems are 12 inches thick there should be no more than 240 per acre; when they are 16 inches there may be 140 to 160, and when they are 20 inches there may be 100 to 120. The gradually decreasing severity of the operation thus becomes plain. While we remove perhaps half the stems when they are 4 to 6 inches thick, we take out no more than one-tenth when they have attained 20 inches. In any case the operation should be frequently repeated, say, every five or six years, so as to avoid anything like heavy fellings or the opening of the canopy. The true forester, imbued with the sentiment of the forest, going to work with prudence, will let his eye wander among the crowns continually, but will only take out one here and there, not one of the best nor one that is practically suppressed, for suppressed trees have their utility. The term "selection thinning" has been applied to such an operation as this, and has also been objected to on the ground that selection means the removal of the biggest. The objection is invalid, since the essence of selection lies not so much in the size of the trees as in the diffused nature of the felling.

The figures given above can evidently not be taken as the measure of the operation in all cases. The forester has to find this measure on the ground, for it will vary with the activity of vegetation, with the state of the crop, and with the periodicity of the thinnings themselves. Many owners would like to know how to set about finding this measure. Given a young planted pole-crop hitherto untouched, containing 1400, 1600, or even 1800 dominant stems per acre, with their crowns shooting up vigorously to the sky, dominated stems may be neglected. It is easy to find the number of stems per acre, since a square of 22 yards side is the tenth part of an acre. Suppose there are 160 stems, and they average 12 inches girth, they are too close, and too equal among themselves, to prosper for long; but what is the measure of prudence? When the stems are twice as thick, there should remain hardly more than one-fourth of their number. If the rate of growth gives fifteen to twenty years to attain that size, the thinning may pass thrice over the ground during the period, removing each time one-third or thereabouts of the crop. Here

is the measure, one in three, the thinnest, and maybe the tallest, or oftener the mean of three contiguous stems, so as to relieve the best. At this rate, after fifteen or eighteen years there will only remain some 440 to 480 of the original 1600 stems. But a certain number of formerly dominant stems, notwithstanding the two first thinnings, will, by the time of the third, have fallen to the dominated state. Hence it will be wise to estimate afresh the number of dominant stems before proceeding to the third thinning. If this new estimate should produce only 560 dominant stems, the third thinning will be only at the rate of one in four, so that about 400 stems may remain. In any case the thinnings will have allowed the utilisation of all that there was to utilise. The dominated stems do more good than harm, and they should be kept so long as their leaders are not dry. Once the leader is dry, they should be utilised. A spruce that has relapsed into the dominated state does not live long, hence all broad-leaved species that may be found in the crop are valuable, and should be carefully preserved even if they have shot up above the spruces, provided they are not too numerous. Such trees are the friend of our friends the birds, the worms and slugs, and other things that find no living in pure spruces.

Suppose, again, a fine young crop of spruce poles forty years old, unequal in size, and the biggest of them barely 8 inches thick. There are about 400 stems per acre in the upper story which sees the sky. It is too many. In thirty years' time one half the number will be sufficient. At that time 200 stems, seventy years old, per acre, should be 14 to 16 inches thick. Three thinnings, at the rate of one in five, will halve the present number in the thirty years' period.

Always try to have some broad-leaved species in the lower story, but especially, as the canopy is opened, introduce the silver fir. A number about equal to that of the spruce removed will ensure an excellent state of vegetation for the latter. If the situation is not too warm, the firs will prosper rapidly twenty or thirty years later, when the rest of the spruce are felled. Thus, to perfect a spruce forest, plant it with silver fir.

The statement that three thinnings are better than two is hardly capable of proof, but it is the key to the situation. If there is a case in which caution is especially needed in opening out a canopy, that case is the case of a tall spruce forest. The prescription one in four, or one in three, is not in practice carried

strictly out over the whole area. Before many acres have been thinned the operator will have got the resulting density so fixed in his mind that he no longer has need to count. The degree of thinning will vary from one forest to the next, according to the activity of vegetation and other factors, which it is the operator's business to understand. The result of the first thinning will enlighten him, those of the second will confirm his experience, while the third will make him a finished forester. Later, the amateur will probably become overbold; the professional will remain cautious.

The thinning of crops beyond seventy years old can hardly be profitably discussed on paper, the proportions being so diverse and the conditions so complex, according to the variations of soil, aspect, mixture, etc., that it would be rash to give any definite figures. Still, as a last instance, may be considered the case of a much too dense pole crop, whose dominated story has disappeared, and which contains on the average some 400 to 480 stems of 10 inches diameter per acre. An incautious thinning may imperil the whole crop, but if not thinned it will languish. By removing only one tree out of every eight or ten, the risk will be very small. By renewing the operation every four years, the total number will in twenty years' time be reduced to half. A sluggish crop will have been awakened into active growth, and perhaps some 2800 cubic feet of timber per acre may have been realised in five operations. Each operation will be a guide to the next.

XVII. *Note on the Collection and Preservation of Entomological Specimens, with a Description of the Methods to be employed in the Study of Life-Histories of Insects.*[1] By E. P. Stebbing, F.L.S., F.E.S., Instructor in Entomology at the Forest School, Dehra Dun, India.

General Remarks.

During the past few years I have been often asked how insects should be killed and preserved, and how packed when it is required to send them away for identification purposes. The question has also been put, "How shall we study the life-histories of insect pests?" I propose giving here information which will, I trust, enable those who wish to work at this important branch of Zoology, to do so with profit to themselves and to the advancement of our knowledge of the subject. To the practical Forest Officer the study of the millions of insect enemies which annually commit depredations in his forests should be one not only of interest to himself, but also of the very first importance in carrying out successfully the work entrusted to his care. It is no more possible for us to prescribe remedies, or to even say whether such are practicable or otherwise, until we know the life-history of a pest, than it is possible for a medical man to physic his patient until he has diagnosed the complaint from which he is suffering. The opinion is held by many that perfectly healthy trees in a forest are never killed by insects. Under normal conditions this may be admitted. That a giant of the forest, one that has resisted the storms of a century, should succumb to the attacks of an insect, countless millions of which would be required to equal it in bulk, seems almost absurd; yet it is nevertheless true, though not, as a rule, quite so literally as it reads. Most of our forest trees support an immense insect population, but it does not necessarily follow that they will show ill-effects from it. Given a perfectly healthy tree, it will bring to maturity a host of feeders upon its foliage, upon the smaller shoots, in the injured or broken twigs or branches, in its fruit, and even in its woody tissue. Comparatively few borers or other

[1] The hints contained in this note, though written for the use of Indian foresters, will be found equally useful by their British brethren. It is reprinted from the pamphlet issued by the Government of India.—Hon. Ed.

insects are able to maintain themselves in the growing wood of large healthy trees, and when these occur in moderate numbers they inflict only such wounds as are easily healed, corresponding to mere scratches in the human skin. Under some conditions, these insects increase abnormally, and then thousands of acres of timber may be killed off. As the bleeding from many small scratches may drain the human body of blood when they are kept constantly open, so the boring of thousands of beetles, insignificant individually, may weaken even the forest giant; and when this occurs, when there is no longer a healthy, resistant tissue, then another host of other species steps in, adds to the injury, and paves the way for yet further armies, leaving only a dead stick with bare branches, sooner or later prostrated by a storm, and then slowly reduced to dust by yet other agencies, insectile, fungous, or microbic in character. It is the alteration in the normal conditions of a virgin forest which the Forest Officer, on making his appearance, brings about that renders them more susceptible to insect attacks, and makes the study of their life-histories of such importance. It is the certain conviction that in proportion as scientific forestry progresses in India, and more and more of our woods are treated on true sylvicultural lines, so will the attacks of devastating insects make themselves more and more felt, that leads me to endeavour to obtain as many recruits as possible in the study of this very important, but much neglected, branch of Forest Science.

Collecting Apparatus.

It will be first needful to consider what implements are necessary to enable us to prosecute our campaign with success. An examination of Entomological Catalogues presents to us a diversity of apparatus, much of which is far above the purchasing means of the average collector, whilst being at the same time far from necessary. The collecting materials essentially required may be of the simplest. Pill-boxes, small glass tubes, and a stout glass pickle or jam jar should accompany the collector in the field, and in addition, if it is required to collect *Lepidoptera* (butterflies and moths), a stout net.

Pill-Boxes.

Pill-boxes should be preferably glass-topped. They can be obtained in nests consisting of four boxes, one fitting within th

other. Small beetles and minute moths (*Microlepidoptera*) may be put into pill-boxes and killed after reaching home.

Glass Tubes.

These may be specially made tubes, but in their absence, quinine or other small medicine bottles will serve equally well. Larvæ and grubs of all kinds, both leaf-feeding and wood-boring, should on collection be at once placed in a small glass tube,[1] filled with alcohol (methylated spirits or diluted whisky), or better still with formalin. They should be placed *in separate tubes if they are taken from different trees or localities.* At the same time a small slip of paper must be put into the tube, on which should be written in *pencil*, locality of capture, date, elevation, and plant from which taken. The spirit will not deface the pencil writing, although it might if it were written in ink. This point should be remembered.

The Glass Jar.

The glass jar should have a wide mouth. In it place two or three pieces of cyanide of potassium, which should be covered with cotton or wool about half filling the bottle. Over this a thin circular piece of card-board, cut to fit the inside of the bottle, is next placed, and pressed down so as to lightly touch the cotton. The card-board should be pierced with fine pin-holes. The card-board is required in order to prevent the insects from getting lost amongst the cotton. A stout cork should fit the mouth of the jar. Imagoes of all the different orders of insects, *Orthoptera*, *Coleoptera*, *Lepidoptera*, etc., should be killed in this bottle. The cyanide of potassium must be changed every three months or so, as it deliquesces, thus losing its force. It must be remembered that it is a strong poison. Instead of the cyanide, a piece of wool soaked in chloroform or benzine will do, but this requires repeated changing, since the vapour rapidly evaporates. The benzine has the additional advantage of removing greasy stains from the wings of moths.

Another very good way to kill insects is to place a drop or two of the essential oil of almonds on to a piece of sponge and place

[1] Of course larvæ and grubs will be kept alive when their life-histories are to be studied. At the same time a few might be put into spirits at once, in case anything happened to the rest.

this in the jar or in an old tobacco tin. Strong fumes of prussic acid are given off, and soon kill any insect placed in it.

The Net.

A good useful stout net can be easily made by obtaining a thin piece of cane or bamboo, bending it into a hoop-shape, and tying the ends together so as to form a short handle. This gives us the frame. A piece of muslin should be sewn round the hoop, and then the sides stitched together so as to form a bag. This will enable the collector to catch flying insects.

Preservative Materials.

Having obtained our insects, it is next necessary to preserve them. Alcohol (methylated spirits, dilute whisky or rum) or formalin should be used. If formalin is made use of, it should be diluted with at least fifteen times its bulk of water. Insects do not lose their colour in this, but it is liable to render them brittle. All insects may be put into one of these solutions, save butterflies, moths, and hairy *Hymenoptera* and *Diptera*. "Hard" insects (*e.g.*, beetles and most *Orthoptera*) need not always be preserved in spirit: sawdust impregnated with creosote or turpentine or carbolic acid is a very good preservative for them. Camphor may also be used, or better still naphthaline: pieces should be placed within the box in which the insects are kept. If it is required to keep insects in store-boxes or in a cabinet as a collection, they should be painted over either with benzine or turpentine, oil of cloves, or creosote. This will preserve them from other insects and from mould.

Transportation of Insects.

For travelling, all hard-bodied insects should be put into bottles with any of the above-mentioned liquid-preservative materials. The greatest care should be taken to guard against the breaking of the bottles in transit. Parcels are continually received containing when opened, only a broken bottle or two with a few shrivelled up and useless specimens scattered about. In a tropical climate like India, it is of the very first importance that bottles should be completely filled with the preservative liquor and hermetically sealed. This latter can be effectively done by covering the cork and the top of the jar entirely with

bees-wax or dough. This helps to prevent the quick evaporation of the liquor, which always takes place at a rapid rate in hot climates. It should be remembered that *sealing-wax should not be used if the bottle contains spirit*, as the spirit oozing through the cork dissolves the sealing-wax and makes an awful mess.

The bottle should be placed in a stout box filled with either cotton, wool, torn up pieces of paper, or best of all, sawdust. It should be borne in mind that if any portion of the bottle touches the side of the box, the chances are that it will reach its destination broken. Hard-bodied insects are better sent simply packed in dry sawdust which has been disinfected with creosote or carbolic acid.

Lepidoptera and other soft-bodied insects may be well preserved by placing them in square pieces of paper folded in a triangular form with the edges over-lapping. Put up in this way, many can be packed away in tin boxes, and will bear transportation to any distance.

In sending live larvæ by post, they should be enclosed with leaves and a little moss in small tin boxes. The tin boxes should *not* be perforated to give the larvæ air. In forwarding specimens in alcohol, the box should be light but strong. No bottles or specimens of any kind should be sent without being first properly labelled, so that the nature of their contents can be at once seen. A forwarding letter should, in each instance, be sent separately, giving full data with reference to the specimens sent.

Rearing Insects to enable their Life-Histories to be Studied.

General.

In order to study the life-histories of insects, it becomes necessary to examine the various stages of their metamorphosis, and this can only be done by watching them carefully at close quarters. The best stages to collect for this purpose are the eggs or larvæ. These should be put into a box, and a supply of the food-material on which the larvæ feed, put into it. Two points must be remembered: the food, if leaves, etc., should be kept fresh, and the box must be well ventilated. Various things may be used as cages. Tumblers covered with gauze, paste-board boxes pierced with holes and fitted with covers, or large glass jars, are all of them utilisable. The bottom of such vessels

should be covered with damp sand, in which the food-plant of the larvæ may be stuck and kept fresh for several days. Larger and more airy boxes, a foot square, with the sides of gauze, and fitted with a door through which a bottle of water in which to put the food-plant may be introduced, are good cages. Such could be easily made locally.

More than one specimen of an insect may be bred at the same time in any cage, provided they have different habits and appearances, *i.e.*, a wood-boring beetle and a leaf-feeding Lepidopterous larva could be reared in the same cage, since there is no danger of confusing these insects.

Breeding Traps in the Forest.

In addition to breeding insects at home, it is also possible to study the life-history of some insects in the forest itself. A good plan is to fell a tree in different localities, to which it is possible to pay a visit once a month. The bark should be left on. Careful watching will show that the young uppermost branches are soon attacked by small, white beetle larvæ (*Ptinidæ*, *Buprestidæ*, *Scolytidæ*, *Cerambycidæ*), the development of which can be watched during the periodical visits paid to the tree. Later on the larger wood-boring larvæ will be found at work on the trunk and main branches, making flat galleries beneath the bark to commence with, and finally boring down into the wood (*Buprestidæ*, *Cerambycidæ*, *Sessiidæ*, *Cossidæ*, etc.). Some of these larvæ may live for several years boring into the wood, and a good plan would be to cut the tree into sections, slightly removed from one another, and mark down in each one particular class of larvæ, *i.e.*, it would be possible to distinguish the Cerambycid larvæ from the Buprestid, both from the Sessiid and the three from the Cossid, and so on. In each section of the tree one particular class would be watched. In rearing gall insects, the twig containing the galls may be enclosed in a rough bag of muslin. Officers who have a lot of camping to get through will find that by some such plan as the above they will be able to do something towards the study of the life-histories of destructive wood-borers.

Recording Observations.

We now come to the very important point of recording observations made. The greatest care should be taken to see

that the dates of all changes noted with reference to the insect being watched are carefully recorded. Information on the following points would be required:—

I. Species of trees felled or from which specimens were taken. Name of forest and locality, with elevation; and if the tree was felled, date of felling. Also state whether the tree was alive and vigorous when felled or otherwise. Also on what part the insects were feeding —wood, leaf, or fruit.

II. Date of egg-laying whenever observed. Method of laying the eggs, with description of the number, size and markings. A few eggs or egg-capsules should be always preserved.

III. Date of appearance of larva, length of time passed in the larval stage, and nature of food and damage done by it. Also whether it is solitary or gregarious in habit, and whether a day or night feeder. The number of moultings or changes of skin passed through by the larva should be mentioned, with a description of the caterpillar in each stage of its growth. A few larvæ should always be preserved in spirit.

IV. Date of changing of larva into the pupal stage, and length of time passed in this stage. Also description of the pupa. It should be stated whether the pupa is enclosed in a cocoon or not. If it is, the nature of the cocoon should be stated. It should also be noted whether, if the larva hibernates during the winter months, it does so as a larva enclosed in a cocoon, or whether as soon as it has formed the cocoon it changes into the pupal state and hibernates as a pupa. A few pupæ should always be preserved in spirit.

V. Date of appearance of the imago. Description of both the female and male insects. Also a note as to the damage done by them, and the time, method, and position of laying the eggs.

If the insect is reared at home, the dates of obtaining the eggs or larvæ or pupæ, as the case may be, should be given, and the dates of the appearance of the other stages in the metamorphosis.

Dates of periods passed in the various stages, descriptions as far as possible, and nature of damage done, with the locality and

elevation, are exceedingly important when life-histories are being dealt with, and such should always be given.

In addition, the following points should be borne in mind :—

i. In the case of the greater number of our insects it is absolutely necessary that the imago stage should be obtained, otherwise identification is impossible. Beyond being able to place larvæ sent by themselves into their orders, groups, and perhaps families, no further identification is possible, and thus sent alone they are of very little use.

ii. In the furtherance of the study of Economic Entomology, it is of very little use sending insects "found flying about" in the forest or in cultivated land unless some further definite observations have been obtained about them. Economic Entomology means the study of the life-histories of insects with a view to endeavouring to counteract the damage done by their attacks. Thus, in the first instance it is necessary to know that an insect is an aggressor and to be able to give the nature of its attacks, or at any rate to state definitely that it does a particular damage.

As different insects require slightly different treatment, I will now, in conclusion, give a few notes on the rearing of insects of some of the more important orders.

Collection and Preservation of Lepidoptera.

A knowledge of the order *Lepidoptera* is of importance to the forester, since it contains larvæ which defoliate trees on a large scale, and at the same time others which do serious damage by boring into timber. When larvæ are kept in order to enable the subsequent stages in their life-histories to be ascertained, great care should be taken to keep a supply of fresh food always in the box in which they are enclosed. In changing to the pupal stage, some larvæ will spin a cocoon amongst the leaves of the plant, or will attach it to the sides of the box. Others, on the other hand, require earth to pupate in, and this earth should be placed at the bottom of the box, failing which it is probable that no imagoes will be obtained. Other larvæ may require chips of wood, etc., to hide beneath; many Noctuid larvæ, some of which defoliate on a considerable scale, require this, as they often

feed at night only. In searching for the larvæ which are defoliating your trees, this characteristic should be remembered. Any sickly larvæ should be at once removed from the box and destroyed. In all cases larvæ should be carefully described, and at each fresh moult a new description and, if possible, a drawing of it should be made. A little practice will enable the most average draughtsman to turn out a workable sketch of a caterpillar.

The management of wood-boring larvæ will be described under *Coleoptera.*

As soon as the imagoes come out and their wings are fully developed, if eggs are not required from them, they should be killed in the cyanide bottle.

They can then be ticketed and packed away in the triangular paper forms already described.

Collection and Preservation of Coleoptera.

The rearing of wood-boring larvæ will be here considered Amongst such we may mention the larvæ of *Cerambycidæ*, *Curenlionidæ*, *Buprestidæ* (all *Coleoptera*), and of *Sessiidæ*, *Cossidæ*, etc. (the latter two *Lepidoptera*).

Large boxes should be used, so that large pieces of wood containing the larvæ may be placed in them. Care must be taken that only specimens of the same species are confined in the same box. They may be treated as follows:—Take a piece of wood four cubic inches in size, split it in two and make on the inside a cavity just large enough to receive the grub and allow it to move easily in it, then fasten the two halves together with a strong rubber band. Slightly moisten the wood in the box twice a week, and if the larvæ escapes by boring a hole through the wood, replace it in the central cavity by filling the hole with a plug. Tin or glass-sided boxes should be used, as the borer will bore through a wooden or card-board box. The bottom of the box should be covered with sawdust. Certain larvæ, such as Elaterid and some Noctuid ones, require earth in the box, but it should not be put unless required. If earth is put in, it should be thoroughly baked first to destroy all noxious insects, etc., which might prove destructive to your grubs. The larvæ and pupæ should be kept in darkness.

Rearing of Bark and Bast-feeding Beetles.—Such insects, especially *Ptinidæ*, *Scolytidæ*, small *Cerambycidæ*, and *Buprestidæ*,

etc., may be reared by cutting out with the saw or axe pieces of the infested tree with the bark on about 6 inches square and one inch thick. The castings and sawdust, together with the larvæ, should be placed under the bark. Several pieces of bark tied together with the bast sides opposite will sometimes answer the purpose, but the better way is to leave the larvæ in the wood until they are nearly full grown; then, in general, the transformations are completed in about two weeks.

Collection and Preservation of Hemiptera.

The soft-bodied species of aphis or plant-lice (*Coccidæ*, *Aphidæ*, etc.) should be preserved in dilute alcohol or very dilute formalin. When collected from a stem, they should be at once put into this. If it is possible, they should, however, be sent alive *in situ* on the twig or leaf they are infesting to be identified. If the journey is not more than two or three days, this should be always done. The chief essential is to prevent them drying up. The best way of all, if only the insects themselves are being sent, is to enclose them in ordinary quills stopped by plugs of cork or pellets of bees-wax. The substance of the quill is sufficiently porous to prevent mildew on the one hand and a rapid evaporation on the other. In this way small insects may be sent through the post, and in a far better condition than can be secured in any tin boxes, even though they be filled with leaves. If a slip of some succulent leaf be rolled round each quill to retain moisture, a bundle will conveniently pass through the post.

Coccidæ proper may be killed in the cyanide bottle and then dried like herbarium specimens, but without pressure in the case of convex fleshy forms. These dried specimens can be packed in paper slips or card-board boxes.

Hemiptera-heteroptera (true bugs) may be sent either in bottles of spirit or packed in sawdust as dried specimens.

Collection and Preservation of Orthoptera.

Orthoptera can be easily preserved in strong alcohol. If preserved dry, they can be killed in the cyanide bottle without losing their colours, as they do if they remain long in alcohol. In sending dry *Orthoptera* they should be best packed in sawdust, moss, or soft tissue-paper, as their bodies and legs are rather liable to fall off.

Crickets, Grasshoppers, Locusts.—Damage is done by these insects in forest nurseries by biting off young seedlings close to the ground and feeding on the parts so nipped off. The eggs are often laid in holes in the ground, and these may be searched for and the insect bred from them. In the case of crickets, their presence is evidenced by the appearance of circular holes, one to two inches or more in depth, in which they live. They spend their lives in these, moulting several times before arriving at full growth, and sallying forth mostly at night and feeding voraciously on the young seedlings, committing a lot of wanton damage by cutting off innumerable seedlings, only portions of which are consumed. Their life-histories can be easily studied by digging up one or two every week through the months during which they are feeding and developing into the perfect insect. They have of course no pupal stage, as the *Orthoptera* have an incomplete metamorphosis.

Collection and Preservation of Hymenoptera.

All the *Hymenoptera* which are not hairy may be preserved in alcohol. Hairy specimens may be put into the paper triangle forms above-mentioned, or sent in a box full of loose disinfected sawdust. Small *Ichneumon* flies should be sent in small pill-boxes or match-boxes.

Note.—Stress is laid on the sending of larvæ and pupæ *alive* as much as possible.

Another point to be remembered is that collectors often make the mistake of piercing tins with holes to let in air. It is much better to use a larger tin and have no holes.

XVIII. *The Twenty-fifth Annual Excursion—Sweden, 18th July to 3rd August* 1902.

The Society is indebted to the Foreign Office for obtaining from the Swedish Government the programme briefly outlined below; and to Count Wachmeister, Director-General of the Royal Domains, Sweden, for kindly appointing Mr Elis Nilson, of the State Forest Service, as guide and interpreter to the party, and for at the same time extending to the Society a very hearty welcome to Sweden.

The number of gentlemen who took part in the visit to Sweden was almost equal to the average that usually attends home excursions. On the previous occasion when the Society ventured abroad, viz., to North Germany, in 1895, the number of the party slightly exceeded forty; but on this occasion considerably over seventy members were present. The following is a list of the Excursionists :—

The Earl of Mansfield, *President;* R. C. Munro Ferguson, M.P.. *Honorary Secretary;* Sir Archibald Buchan-Hepburn of Smeaton Hepburn, East Lothian; Sir Leonard Lyell of Kinnordy, Kirriemuir; Thomas Ainslie, Penicuik; John Annand, Haystoun, Peebles; John Broom, Bathgate; Wm. Bruce, Edinburgh; Charles Buchanan, Penicuik; Buchanan Campbell, Edinburgh; Wm. C. Carnegie, Sarsden, Oxford; C. H. Clough, Oldcroft, Stanwix, Carlisle; R. W. Cowper, Gortamore, Sittingbourne, Kent; J. Crozier, Durris, Aberdeenshire; W. S. Curr, Ninewar, Prestonkirk; R Douglas, Edinburgh; W. D. Edminson, Berwick-on-Tweed; R. B. Erskine, Edinburgh; Jas. Farquharson, Inverkip; Jas. Forbes, Overtoun, Dumbartonshire; R. Forbes, Kennet Estate Office, Alloa; R. Galloway, *Secretary,* 5 St Andrew Square, Edinburgh; Wm. Gemmill, Greendykes, Macmerry; J. A. Gossip, Inverness; Dr Andrew Graham, Currie; Robert Gray, Fraserburgh; John Hay, Dollars Estate Office, Kilmarnock; W. D. Husband, Edinburgh; Thomas Jack, Hermiston, Midlothian; James Johnstone, Alloway Cottage, Ayr; Henry Jonas, 23 Pall Mall, London; R. C. Jonas, 23 Pall Mall, London; John Kerr, Barney Mains, Haddington; Wm. J. Kippen of Westerton, Balloch; D. P. Laird, Pinkhill, Murrayfield, Edinburgh; G. U. Macdonald, Raith, Kirkcaldy; A. MacGregor, Penicuik; Wm. MacKenzie, Novar, Ross-shire; Wm. Mackinnon, Edinburgh; D. MacNicoll, Derwas, Abergele; R. V.

Mather, Kelso; Alex. Milne, Edinburgh; Captain D. Milne-Home, Caldra, Duns; J. H. Milne-Home, Caldra, Duns; Andrew Morgan, Glamis; David Morgan, Douglasleigh, Carnoustie; Malcolm Morgan, Crieff; Ed. B. Nicolson, Edinburgh; Wm. C. Orkney, Hillside, Montrose; T. W. Paton, Kilmarnock; Geo. Paxton, Kilmarnock; Colonel Porteous of Turfhills, Kinross; W. Ralph, Corstorphine; A. D. Richardson, Edinburgh; Donald Robertson, Dunrobin, Golspie; James Robertson, Panmure; John Robertson, Edinburgh; R. A. Robertson, The University, St Andrews; E. Sang, Kirkcaldy; M. W. Scott, Currie; Thos. Sharpe, Monreith, Wigtownshire; Jas. Simpson, Broughty Ferry; John Smart, Edinburgh; Adam Spiers, Edinburgh; Rev. D. C. Stewart, Currie; Duncan C. Stewart, Castlehill, Inchture; Jas. Stoddart, Bonnyrigg, Midlothian; Fraser Story, The Glen, Innerleithen; Walter C. Stunt, Lorenden, Faversham; F. Urquhart, Inverness; R. B. P. Wallace, Leith; John Watson, Edinburgh; Wm. Jas. Watt, Knowefield, Carlisle; James Welsh, Edinburgh; William Wilson, Auchinleck.

As the two prize essays, printed in the *Transactions,* contain full details of the tour, it is unnecessary to give here more than the following bare outline of it:—

18*th July.*—Embarked on the s.s. "Balder," at Granton, at 12 noon.

20*th July.*—Arrived at Gothenburg. Visited Slottskogs Park and Botanic Gardens. To Jönköping—Stora Hotel.

21*st July.*—Jönköping. Visited the world-famed match factories and the paper-mills of Munksjö, and the Government forests on the island of Visingsö, in Lake Vettern.

22*nd July.*—Sailed up Lake Vettern to Hästholmen; thence by train to Alvastra station, and visited the Government forests of the Omberg. To Norrköping—Standard Hotel.

23*rd July.*—Excursion to Finspong, with saw-mills and extensive forests of fir and spruce.

24*th July.*—Norrköping to Stockholm. Hotels—Belfrage's, Lindqvists, and Hotel de Suede. Visited the Forest Academy, the Natural History Museum, the Bergii Garden and Experimental Grounds, the Skansen Park, the Royal Palace, Riddarholm Church, and other places of interest. Excursions by steamer on Lake Mälaren, to Drottningholm and to Saltjöbaden and the Baltic Archipelago.

27*th July*.—To Österby and Dannemora. Visited forests and mines. To Gefle—Grand Hotel.

28*th July*.—Gefle. Visited the saw-mills, sorting booms, charcoal yards, planing works, and timber yards at Korsnäs.

29*th July*.—Gefle to Falun, the capital of Dalecarlia. Visited copper-mines. Falun to Trollhättan.

30*th July*.—Trollhättan. Visited falls, Rock Canal, and factories. To Gothenburg—Hotel Eggers.

31*st July*.—Excursion by steamer to Marstrand.

1*st August*.—Embarked on the s.s. "Bele," at 12 noon, for Granton.

3*rd August*.—Arrived at Granton about 12 noon.

Before leaving Gothenburg, Lord Mansfield, on behalf of the Excursionists, thanked Mr Nilson for his great kindness and courtesy to them throughout the tour, and presented him with a field-glass by Zeiss, as a memento of the Society's visit. Messrs Nyman, Gothenburg, were also thanked for the excellent hotel and railway arrangements made by them. Telegrams of thanks were dispatched to Count Wachmeister; to the State Railways, Stockholm; to Mr Ekman, Finspong; to Mr Strömberg, Österby; and to Mr Yngström, Falun. The following telegram was also dispatched to the King's Chamberlain, Drott, Marstrand:—

> "Royal Scottish Arboricultural Society present humble duty to His Majesty, and respectfully wish to thank him for agreeable and instructive sojourn in this beautiful country.—Mansfield, President."

On stepping ashore at Granton, the following reply was received by the President:—

> "To Lord Mansfield, steamer 'Bele,' Granton.—I thank you and the Scottish Arboricultural Society for received telegram. Happy to hear your having enjoyed sojourn in Sweden.—Oscar."

XIX. *Forestry Exhibition in the Highland and Agricultural Society's Showyard at Aberdeen, July* 1902.

The auspicious commencement made last year at the Inverness Show encouraged the Royal Scottish Arboricultural Society to organise another Forestry Exhibition this year in connection with the Highland Show at Aberdeen. One of the objects of the Society is to illustrate the specialities in wood-growing of the particular district in which the Exhibition is for the time being held; and they were fortunate in securing this year the services as local secretaries of Mr James Wilson, Fordyce Lecturer in Agriculture at Aberdeen University, and of Mr John Clark, forester to the Earl of Aberdeen, whose tact and enthusiasm were the means of bringing together a compact, varied, and attractive collection. Their aim was to draw together an assortment of specimens of a representative and educative character, and a cordial response was made to the Society's invitation for contributions. Forestry in many of its most important branches was illustrated; and, closely allied as this science is to agriculture, the Forestry Exhibition formed a pleasing and instructive adjunct to the other features of the great show within the enclosure of which it was held. There were in all forty separate exhibits, some of which included as many as twenty different articles, and these were arranged either under cover or in the open, according to their nature.

From Balmoral, Mr Michie, the King's factor, sent a variety of articles, comprising some very fine pine boards, grown on the Balmoral estate. He sent also a great many specimens of carving upon oak and other hard woods by members of the Balmoral Carving Society. In the initiation and progress of that Society the late Queen Victoria and Princess Henry of Battenberg took the keenest interest, and the fine workmanship displayed on the numerous beautiful platters, shields and trays, etc., shown, gave ample proof of the aptness of the pupils. There was likewise an exquisite table-top, made of pitch pine root and bordered by pitch pine wood beautifully polished and varnished. A collection of from fifteen to twenty carved walking-sticks was another feature of the Balmoral contribution.

As was the case last year, the largest number of exhibits came

from Mr Munro Ferguson of Novar and Raith, M.P., who was one of those who had much to do with the inception of the Exhibition. This collection included sections of young trees damaged by animals and insects; specimens of the larvæ of various destructive insects; plants with roots showing the results of various methods of transplanting; working plans and maps of woods; a dressed larch board, a dressed Scots fir board, and several finished birch bobbins.

From the Royal Scottish Arboricultural Society itself came a very interesting contribution, in the shape of part of a collection of 170 sections of the timber of British-grown trees and shrubs, and a collection of 100 micro-photographic slides of plant-tissue, highly magnified. These latter were the gift to the Society of Mr D. F. Mackenzie, Mortonhall, Edinburgh. Mr Charles Wood, of the Fettercairn estate office, a former student in the Agricultural Department of Aberdeen University, sent microscopic slides of British timber in longitudinal, tangential, and cross sections. And specially noteworthy in the photographic display were photo-micrographs of British economic woods and exotic economic woods, chiefly Indian, from Mr R. A. Robertson, of the Botanical Department of the University, St Andrews, who had prepared them by a special method invented by himself. Another equally attractive exhibit came from the Natural History Department of the Aberdeen University, which is presided over by Professor J. Arthur Thomson. This illustrated the life-histories of certain injurious and of certain useful insects, by specimens of the insects, the larvæ, and the eggs: and it showed the nature of the damage which is done to timber and to leaves by the injurious class.

The literature of forestry was represented by a valuable collection of books sent by Mr Alexander Robson, of Messrs W. Smith and Son, seedsmen, Market Street, Aberdeen.

From Lord Aberdeen's seat, Haddo House, Mr John Clark, forester on the estate, and one of the local secretaries of the Exhibition, forwarded numerous specimens of pines and firs; of trees and plants damaged by insects; a photograph showing the results of pruning; a pot of three varieties of seedling beech, the fruit of one parent tree; specimens of "heart-rot" in spruce, etc. In this collection there was also shown a magnificent block of solid wood (*Pinus Douglasii*) from a tree forty-five years old, grown at Haddo House. Mr John Crozier, Durris, contributed, among other interesting exhibits, cones collected on the estate of Durris

from exotic trees; a collection of books on forestry; and of plants naturally sown and transplanted, showing the difference in root-formation. Lady Seafield's forester in Abernethy forwarded several very fine self-sown young pine trees, grown in peat soil.

In the exhibit from Mr John Boyd, forester, Pollok, there were sections of stems of acers and horse-chestnuts affected by fungus; and also plants showing the results of different methods of transplanting.

A curiosity in tree-growth came from Mr H. L. Macdonald of Dunach, Oban, in the shape of the top of a young larch, fifteen years old, showing a peculiar twisting growth with a flattening of leading shoot, followed by the resumption of normal development. This tree was perfectly healthy, and growing at the rate of about two feet a year. Mr Fraser Story's contribution from The Glen, Innerleithen, Peeblesshire, was an exceedingly interesting collection of German forestry implements. In the exhibits from Mr W. Steuart Fothringham of Murthly, attention was arrested by the handsome inlaid table of home-grown woods, comprising sixty varieties. He also sent a cross section of a cedar of Lebanon, about 3 feet 6 inches in diameter, and between seventy and eighty years old; also a cross section of a Californian mountain pine, about 2 feet 6 inches in diameter, and about thirty years old.

An outstanding exhibit was that of Mr L. Gavin, The Schoolhouse, Drumwhindle, Ellon, Aberdeenshire, consisting of specimens of home-grown woods which he uses for object-lessons given in his school. Were his example more widely followed, the objects of the Arboricultural Society would receive very practical assistance.

In addition to Lord Aberdeen, the local proprietors who kindly forwarded specimens were Mr Dyce Nicol of Ballogie, who through his overseer, Mr George Wyllie, contributed two boards of Scots fir; Mr Forbes Leith of Fyvie, through his forester, Mr Simon Campbell, sent six pieces of Scots fir damaged by snowstorm, etc.; and Lieutenant-Colonel F. N. Innes of Learney, whose exhibits were designed to show the advantage of planting trees by pitting as against notching; a section of larch, eighty-five years old, larch damaged by squirrels, and a sycamore damaged by frost, were also in his collection. In the same category was placed the consignment from Sir John R. Gladstone, Bart. of Fasque, Fettercairn, who showed specimens of pitted, as against notched timber,

and specimens of timber grown in close forest as against wood raised in open forest.

Mrs Ellice of Glengarry, Inverness-shire, sent examples of Scots fir, larch, oak, elm, and Weymouth pine. Of much antiquarian interest was the old oak panel carved with the arms of the Earl of Angus, which had been removed from the old church of Glen bervie, and was exhibited by Mr A. B. Nicolson of Glenbervie. In the Exhibition were also seen the model of a Shears fence to be erected above a stone dyke to keep out sheep or deer; specimens of rare shrubs from the Cruickshank Botanic Garden, Old Aberdeen; and specimens of the foliage of conifers grown on the Balcarres estate. Mr James Forgan, forester, Bonskeid, Pitlochry, sent sections of *Wellingtonia gigantea*. Amongst the contents of the stand from Mr James M'Kenzie, forester to the Countess of Seafield, was a larch plank cut from a tree one hundred and fifty years old. Messrs John Denholm & Co., Bo'ness, again exhibited pitwood imported from northern Europe, demonstrating that the foreigner can produce wood which is wanted in Britain, but which we do not cultivate to a sufficient extent.

Turning from the raw material to what may be termed the finished article, one found beautiful specimens of workmanship in the furniture shown by Messrs James Garvie & Sons, Aberdeen; the carriage and cart wheels by Messrs Shinnie and Messrs David Gray & Son; the bobbins, tubs, pails, etc., by Messrs J. & J. L. Brebner; the surf boat and rigging blocks by Messrs Hall, Russell, and Co., shipbuilders; the rustic seats, etc., by Mr D. Kennedy, gardener, Loanhead Terrace, and Mr Alexander Pollock, Tarbolton, Ayrshire; and the cupboard of Douglas fir, made by the exhibitor, Mr Thomas Barrowman, head forester, Mount Melville, St Andrews. Having in this way illustrated the uses to which wood may be put for domestic, navigation, and trade purposes, the organisers of the show gave their visitors an opportunity of seeing how the material can be employed in other directions; and, thanks to the Messrs Tait, Inverurie, the most interesting process of converting wood into paper was graphically shown.

REPORTS BY THE HONORARY SCIENTISTS.

Report by A. W. Borthwick, B.Sc., *Honorary Consulting Cryptogamist.*

Among the specimens sent in during the past year, the following are some of the more important:—

Trametes radiciperda.—This fungus is described as the most dangerous parasite of our conifers. It may attack trees from five to a hundred years old, and occurs on *Pinus, sylvestris* and *Strobus, Picea excelsa, Abies pectinata,* and *Juniperus communis.* The sporaphores are large white bodies which form white incrustations on the roots or at the base of the stem. On careful examination the surface will be seen to be perforated by numerous small holes or pores. The spores are produced in large numbers in these cavities, they will germinate easily in moisture, and can effect an entrance into the living cells through unwounded bark. They are carried underground from one tree to another on the fur of rabbits and mice. Again, where an infected root comes in contact with a healthy one, the mycelium may pass from the one to the other.

The disease is first indicated by an apparently vigorous tree becoming pale green and ultimately dying. Others around it begin to go the same way, whether the first one be cut down or not. The disease thus spreads in a centrifugal direction, causing gaps or blanks in the plantation. If there has been more than one starting-point, then the circles in a few years become confluent.

An examination of the roots reveals the presence of a fine white mycelium below the bark scales; from this mycelium the sporaphores arise, first like little papillæ, but rapidly becoming larger, till ultimately they may measure 30-40 cm. across. The mycelium spreads through the attacked root, and also up to the stem base, whence it can gain access to all the other roots. When this happens, the tree is rapidly killed. The mycelium also spreads some distance up the wood-body of the stem (except in pines). Its presence in the wood causes at first a violet discoloration; later, numerous white spots with black centres

appear, and finally the wood becomes a moist mass of crumbling shreds of a light yellowish-brown colour.

The spread of this disease is effected underground; hence cutting the tree off above ground is of no use—it must be removed, root and all. This is quite practicable in young plantations, and should be done directly the tree shows symptoms of the disease. In old woods this operation is not so easily accomplished, but much good may be done by isolating the diseased area by means of a circular ditch, over which no roots should be allowed to pass. The ditch must, of course, be sufficiently large to entirely include the infected area. The sporaphores should, as far as possible, be collected and burned.

Agaricus melleus.—This fungus has been sent in from several different sources. It is very common in coniferous woods. It may attack trees up to a hundred years old. Young trees which have been killed by it usually have a hardened mass of earth adhering to their roots. The earth is bound together by the resin which exudes copiously from the diseased specimen. If the bark is removed from the roots or stool, the tough white mycelium of the fungus is seen. From this mycelium the well-known caps are formed in autumn.

Sphærella Taxi.—This disease was first described by Dr M. C. Cooke in 1878. At that time it was observed to be spreading from Cornwall through Devonshire to Somersetshire and Dorsetshire, but was not known to have spread farther.

In 1884, Dr W. G. Smith further investigated this fungus, which he describes as follows:—"The leaves of the attacked yew show numerous minute black dots; these are little spherical cavities (*Sphærellæ*) surrounded by a dark cellular investment, and sunk in the tissue of the leaf. In these cavities the asci are produced. These are sausage-shaped sacs, each containing eight spores, which escape at maturity in large numbers. Owing to the hard, firm epidermis of the yew leaves, the germ threads of the spores cannot enter except by the stomata." This, Dr W. G. Smith points out, is no doubt the reason why the fungus is progressing so slowly towards the midlands and the north. The diseased leaves fall to the ground, and there the spores are preserved in a suitable moist and sheltered position The remedy consists in cutting off and burning attacked branches or branchlets as soon as they show the symptoms of disease.

Coccus Fagi.—This insect forms a white woolly covering on the

bark of beeches Where the bark has been punctured, galls arise as little round swellings, which become larger and ultimately burst. The gall-tissue in the cortex becomes brown and dies. *Nectria ditissima* is very frequently found along with this insect. Badly attacked trees may be killed within a few years.

Mr George Leven, Auchencruive, sent some specimens of Douglas fir showing evident signs of disease caused by a fungus; but in the absence of fructifications it was impossible to say definitely what the fungus was. The matter is still under investigation, and a fuller report will be given later.

NOTES AND QUERIES.

Pathological Specimens for the Society's Exhibition at the Highland and Agricultural Show.

The exhibit by the Royal Scottish Arboricultural Society at the Highland and Agricultural Show is now an established annual feature, and forms a not unimportant adjunct to the great show of the sister Society. In view of the fact that of late years there has been a growing interest in all that affects the health and welfare of trees, whether grown for ornamental or for commercial purposes, I would remind Members of the Society that pathological specimens should form an important part of the exhibit.

The health of trees, as influenced by climatic conditions (heat, cold, moisture, snow, hail, frost, lightning, etc.), and also by impurities in air and soil, as well as by parasitic enemies, is treated of in the comparatively recent science of plant pathology. Anything which would tend to a wider dissemination of knowledge of this subject could not fail to be of great value. Material for such a purpose is unfortunately only too plentiful, but it is widely scattered about the country.

A disease common in one locality may be comparatively rare in another; and an exhibit of this kind, including specimens from all parts, would give foresters an opportunity of studying diseases other than those which come under their own immediate observation.

A. W. Borthwick.

The Civil Engineers on British Forestry.[1]

At the opening of the current session of the Institution of Civil Engineers, the President (Mr J. C. Hawkshaw) said that the progress of the last century had been mainly due to the use which had been made of the metal, iron. In their enthusiasm for the great results achieved by this new material, they might overlook what they had owed in the past, and what they would still require in the future, from timber. Engineers here could not do without timber, nor, indeed, without much timber. For the last thirty years they had heard it said that steel would shortly be adopted in place of wood for railway sleepers; nevertheless, although we could make our own steel, but had to import our timber sleepers, this change had not come to pass. France had had experience for years in iron and steel sleepers; yet but few of these were laid in that country, which, in spite of her well-managed forests, had to import sleepers. More metal sleepers were used in Germany, also a timber-importing country, but Germany still used much wood for sleepers. Metal sleepers were used in South Africa, and, together with native timber, in Australia, India, and South America. In Argentina some iron sleepers had recently been replaced by native wood sleepers. The United States and Canada used wood only, and used more wood for sleepers in proportion to their railway mileage than any other country, from 2500 to 3150 being laid to a mile in the former, and 2600 in the latter, as compared with from 1760 to 2145 to a mile in this country. The consumption of timber for sleepers increased yearly, and more were now laid to a mile than formerly, especially in the United States and Canada; but there was a recent tendency to slightly reduce the number in the United States and Canada, and to increase it in this country. The use of creosote prolonged the life, and so somewhat reduced the consumption of sleepers.

We had a less area under forest in proportion to our size than any other country in Europe except Portugal, but our timber imports were more than half the total timber imports of the timber-importing countries of Europe. Of the timber imported into this country in 1899, more than nine-tenths in weight, and nearly four-fifths in value, were coniferous wood, which was grown in the temperate countries of the northern hemisphere, and this was the timber which was most largely consumed in engineering

[1] From an article in the *Standard* of 5th November.

work. As Europe could not supply its own wants, our only other source was Canada, on which the United States was making increasing demands for timber; and Canada itself, with its enormous resources in water-power, would soon be a large consumer of its own forest produce. In this country forestry was neglected. Germany and France had long applied science to the growing of timber, and to them we had to go to learn. Belgium had done likewise. Even Spain, which had suffered more than any country in Europe from the destruction of forests, had a Government Forest Department; Russia, Sweden, and Austria-Hungary looked after their forests; Denmark did much; Norway something, but not enough. The United States had made marked progress during the last ten years, and Great Britain might now be regarded as the most backward of all civilised nations "in recognising the necessity of action with regard to forest resources."

It was to be hoped that the labours of the committee now sitting to inquire into and report upon the question would result in steps being taken to remove this reproach. Dear timber would mean higher rents, and higher wages to meet them. Why should we annually import nearly 100 million cubic feet of timber in pit-props which we could grow ourselves? Prop-wood did not take three or four generations to grow, like sawyers' wood. The railway companies were partly to blame; for they did little to help the buyers of home-grown timber, who had consequently already begun to carry what they bought by steam traction. The railway companies took thousands of tons of unpaying dead weight from all parts of the country back to the collieries each year in the shape of empty coal-waggons, many of which might go back loaded with home-grown pit-props if the companies would seek to encourage such traffic.

Treatment of Canker in Trees.

The *Revue des Eaux et Forêts* for March 1902 makes mention of the following method of eradicating canker from an attacked tree:—Pare off the rough, cankerous portion of the wound so as to expose a smooth surface of living tissues. Then, with a paint-brush, apply hydrochloric acid of the kind and quality used by tinsmiths for soldering. The acid is easy to obtain and costs but little; the process is simple; and a complete cure is said to result from a single application, which involves no risk of injury to the

tree. The writer suggests that the cure might be effected by applying the acid to the canker without previous removal of the rough exterior portion; but he thinks it preferable to remove this latter, in order that the acid may the better penetrate to the root of the evil, and also that the wound may heal over the quicker. He cautions persons handling the acid to exercise care, and to avoid its getting on to their clothes. It would be interesting to try this treatment in a case of larch-canker.

A New Danger for the Larch.

The *Revue des Eaux et Forêts* for March 1902 also contains an account, by M. E. Henry, Professor of Natural History at the French Forest School, of a moth (*Tortrix pinicolana*) which has recently commenced to do extensive damage to larch woods in some parts of France. In 1900 and 1901 it completely devastated the larch forests in the neighbourhood of Barcellonnette and Embrun. The moth, which flies by night, attacks old trees by preference. In colour it is brown, mixed with white on a grey ground; it is about $\frac{3}{8}$ inch long, and has a span of about $\frac{3}{4}$ inch. Its flight occurs during the latter half of August, but moths are sometimes seen as late as the early part of October. The young blackish caterpillars are hatched early in June. The full-grown caterpillar is of a dark greenish colour, darker on the back than on the sides; it is about $\frac{1}{2}$ inch long. When the branches of the trees on which they feed are shaken, they let themselves down by a thread to the ground, where, under the dead needles, especially in dry places, a number of chrysalises may be found, more or less surrounded with needles, which are bound together by threads of silk. Chrysalises are also formed in the crevices of the coarse bark of the tree. The attack has been observed to spread to spruces and Cembran pines growing among larches.

Timber of the Silver Fir and of the Spruce.

Silver Fir.—The timber of this tree is here not accounted as of much value, though its suitability for use in the construction of byres and such like buildings is recognised. The low estimation in which it is held may be easily accounted for by the rough quality of the trees that are usually produced in our

too open woods. Grown under such circumstances, they are ill-shaped, low, branchy, and consequently knotty. Of all our forest trees the silver fir requires the highest density of stock to produce well-shaped, clean-grown stems, with the narrow annual rings which indicate the best technical quality in coniferous timber. M. Boppe, in his *Technologie forestière*, says of this tree that its large size, its exceptional elasticity, and its abundance, cause its timber to be very extensively used in the construction of buildings, as in the wood-work of roofs and the joists of floors, while planks and battens of it serve innumerable purposes.

Spruce.—Of this timber M. Boppe says that it is lighter but softer than that of the silver fir; it is applied to the same uses and is valued more or less than that of the silver fir according to the locality in which it is grown. In low situations, by reason of the rapidity of its growth, it is soft, spongy, and inferior; whereas near the highest limits of the zone it occupies it is of excellent quality, and its price then exceeds that of the silver fir by one-fourth or one-fifth. It is a first-class wood for the construction of buildings. It yields excellent sawyers' timber, but when grown as a too open crop the planks are found to be very knotty, and show numerous plugs of dead wood (loose knots) which easily fall out.

It is, of course, well known that the bulk of the so-called "white wood" imported into this country from northern Europe is the timber of the spruce tree; but "white wood" also includes timber of the silver fir.

Larch on Sakhalin.

Mr C. H. Hawes, who recently visited the island, writes that he was struck by the height of the larch trees (*Larix dahurica*, Turcz.) growing on the lowlands bordering the river Tim, where he found by rough measurements that the stem of one of them was about 145 feet long. The tree appeared to attain its greatest height about a hundred or more miles from the mouth of the river, where the level of the country was neither so low as the tundra of the coast nor so high as the hilly or mountainous region of the interior. It is the principal tree of the north-eastern portion of the island, the region which he explored. On the south-western side it is, however, found in

considerable quantity in the swampy lowlands only. It is a well-established fact that the Sakhalin larch (*L. dahurica*) is a distinctly different species from the Japanese larch (*L. leptolepis*). The Russians on the island pronounce the timber of the Sakhalin larch to yield building material of the best quality, and say that it is not liable to crack and split like the wood of *Abies sakhalinensis* and *Picea ajanensis*, which are found with it.

Mr Hawes made no special observation as to the occurrence or otherwise of canker in the Sakhalin larch. Timber is not exported from the island, at least from its northern portion. He mentions that on the east coast, during the winter, the thermometer often goes down to – 40° R. (58° below the zero point of our thermometers), the snow being from 7 to 9 feet deep, and the sea being frozen to a distance of 3 or 4 miles from the land. The island of Sakhalin lies between the parallels of 46° and 54° N. latitude, 54° being about the latitude of York. It seems probable that this splendid tree might be successfully grown by us. Mr Hawes has kindly promised to endeavour to obtain a sample of the seeds.

Department of Woods and Forests for West Africa.

A Department of Woods and Forests for West Africa is to be established. Northern and Southern Nigeria and the Gold Coast are at present the colonies in the sphere of the Department's work, but as the scheme develops it is intended to include also Gambia and Sierra Leone. Mr Thompson, of the Department of Woods and Forests in Burmah, has been appointed by the Colonial Office to be director of the new Department, and he has recently sailed for the Niger to take up his duties.

The Douglas Fir.

Our National Parks, by John Muir, University Press, Cambridge, 1901, contains the following remarks on the quality of Douglas fir timber, as grown in its natural habitat:—

"In proportion to its weight when dry, Douglas spruce timber is perhaps stronger than that of any other large conifer in the country, and being tough, durable, and elastic, it is admirably suited for shipbuilding, piles, and heavy timbers in general; but

its hardness and liability to warp when it is cut into boards render it unfit for fine work.[1] In the lumber markets of California it is called Oregon Pine. When lumbering is going on in the best Douglas woods, especially about Puget Sound, many of the long, slender boles are saved for spars; and so superior is their quality that they are called for in almost every shipyard in the world."

Damage by Squirrels.

Mr Andrew Chapman, Breckonhill, Lockerbie, writes as follows:—"In September last I noticed considerable damage done by squirrels in one of the woods of the Wamphray estate, belonging to Sir Robert Jardine, Bart. of Castlemilk. The plantation referred to, having suffered severely by a gale, was replanted about fourteen years ago with a mixture of larch, Scotch fir, spruce, and hardwoods. Several of the original trees are still standing, and the young trees are healthy looking and doing fairly well. Many of the young larch, birch, and ash have, however, been damaged by squirrels, several of the larches being peeled all round about 6 feet or so from the top. In some instances a band about 2 feet long has been peeled in the centre of a tree, and in other instances near the top. The birch and ash are damaged in a similar manner, and in one instance I noticed a birch with the stem completely stripped from top to bottom. The forester informed me that he had spoken to the gamekeeper, who soon after shot eight squirrels in that small wood of about 12 acres. Squirrels appeared to be more numerous in this district last summer than they have been for years, but after this hard winter their number may be reduced."

The Problem of the Unemployed.

In connection with the above subject, *The Timber News* writes:—The question of afforestation of some of the spare land that exists pretty largely has, however, come to the front once more. It has, we believe, been discussed very seriously by experts, and the opinion is undoubtedly that it is a great work, an almost

[1] It is not likely to improve in this respect when grown in this country.—Hon. Ed.

limitless work, which, if gone into properly, would eventually give real relief to much labour, skilled and otherwise, and chiefly the latter. We have often discussed the question of arboriculture in these columns, and so has our special correspondent who writes on the home-grown trade. Seen from this purely timber-trade point of view, there are difficulties and problems in the way which at first sight might seem to make the scheme scarcely possible. But the adverse critic should bear in mind that conditions here cannot compare with what we find them in the Baltic countries, and in Asia, or in Canada. It has never been suggested that the red fir should be planted, to be sawn into scantlings for the London auction sales. The plain facts are these. There are extensive areas of waste ground here, there, and everywhere. There is Government land, and there are private estates—pure waste, good for absolutely nothing except afforestation. If then this barren soil were turned into woodland, be it next year, or 20 or 60 years hence, it would certainly be a step in the direction of national economy. The argument frequently heard that it would take a forest 50 years to grow, does not always apply, for these reasons. Firstly, the soil being barren and unused now would probably be no better within the next 50 years; untouched it will remain, and every day that passes constitutes a loss—be it ever so small—to the country. Secondly, the growing time of 50 years only refers to the first period. Once the crop were raised, it would be renewed from year to year, and probably as soon as in the twenties, become a perpetual source of revenue and employment. It has also been said by men who possibly may not know very much of the subject, that the soil here is unsuited for commercial arboriculture; the growth would be too rapid, the texture too loose, the timber too knotty, and so forth. An answer may readily be given. There is no intention of planting forests in the fields and pasture land of England. As to the quality of the timber, it may not be generally known that this improves with the quantity. The garden firs are of the poorest from a timber point of view, the few hundred trees occasionally seen in our ornamental woods and parks are one shade better. But plant hundreds of thousands, and it will be found that the trees will grow straight, the branches will drop off below as they grow in height, and by degrees the texture will become excellent. This can be easily seen in working in Germany, in France, and even in Belgium.

The question then arises, What can be done to further this movement? Something must be done. Why discuss impossible schemes, when there is here a great national work? The question has recently been brought before the Government, but somewhat unsympathetically received. More pressure, therefore, should be brought to bear. Money spent on afforestation would be profitably invested, and coupled with certain reforms recently placed on the statute-book, and some which need putting there, the unemployed and nearly every other canker would be bodily removed from the nation.

REVIEWS OF BOOKS.

Wood: A Manual of the Natural History and Industrial Applications of the Timbers of Commerce. By G. S. Boulger, F.L.S., F.R.H.S., A.S.I., Professor of Botany and Lecturer on Forestry in the City of London College, and formerly in the Royal Agricultural College; Author of *Familiar Trees, The Uses of Plants*, etc. 369 pp. and 82 Illustrations. London: Edward Arnold, 1902.

This work, published at the very moderate price of 7s. 6d., is a welcome and decidedly useful addition to forestry literature. It will be of great service to those who have to deal with commercial timbers, especially those of foreign origin, of which so many are now used in the various trades, but it will also be extremely useful to foresters and students of forestry, as well as to all who take an interest in the subject of wood.

The book consists of two parts. The first treats of wood generally, dealing with its origin, structure, defects, selection, conversion, seasoning, artificial preservation, storage, durability, uses, etc.; a chapter is devoted to our timber supplies, and another to the testing of woods for strength, elasticity, etc. The second and larger part deals with the woods of commerce. These are alphabetically arranged according to their trade or common names, and under each is given the botanical and vernacular names, and

the natural family and native country of the plant from which it is derived, information as to its general appearance, its specific gravity and weight, the principal uses to which it is applied in the industrial arts, and other useful data, and, in the case of the more important kinds, the structural characters by which the wood may be identified.

The book is the production of a botanist, and, as might have been expected, the purely botanical part has received a good deal of attention. The first chapter, dealing with the origin, structure, and development of wood and its uses to the tree, forms an excellent introduction to the other parts of the work, but, it is to be feared, will prove rather too technical for any but those who possess some knowledge of plant anatomy. Some statements in this part, too, seem open to criticism. For example, the author refers to the term "bark" as being a misleading one. "Outside the cambium," he says, "is the *rind*, or, as it is commonly but somewhat misleadingly termed, *bark*, made up of the outer and often corky *cortex*, and the inner, largely fibrous, *phloem* or *bast*." The term "bark," as is well known, is not always used in the same sense, and botanists do not agree as to its limitation. Some use it in the same sense as the forester, including within its scope everything outside the *wood* cambium; others limit the term to the tissues outside the *cork* cambium, or *phellogen*, a layer which is somewhat variable in position. But the term "rind," which the author uses, is one which will appeal to few. There seems to be a tendency amongst botanists to use the term bark in the wider sense in which it is used by the forester, and it would be a decided advantage if the practice became universal, as a great deal of tiresome confusion would thus be got rid of. The second chapter, dealing with the recognition and classification of woods, is an extremely useful one, and the photo-micrographic illustrations with which the work is provided (most of which have already appeared elsewhere) will be found very useful in connection with this part of the subject. The remaining chapters of the first part, dealing with defects, seasoning, etc., of timber, contain a great deal of useful matter, although, perhaps, in a somewhat condensed form.

The second part of the book, which deals with the sources, characters, and uses of the woods of commerce, is the larger, and, in some respects, the more important one. To all who have to deal with converted timbers in any shape or form, whether of

home or foreign growth, it will be invaluable. The list, which, as has already been mentioned, is alphabetically arranged, contains something like 750 different kinds of native and foreign woods, and the descriptions of them are concise and clear. The Latin names, too, have been accentuated, which is an undoubted advantage. The author has, however, fallen into error in a few instances in this part. For example, he states that the name "Plane" is applied to *Acer Pseudo-platanus* in the south of Scotland; but, as is well known, this tree is pretty generally known all over Scotland and the north of England as "Plane." Under "Service" he gives *Pyrus Torminalis* only; but the botanical "Service" is a totally different plant, viz., *Pyrus Sorbus*, and it is not clear that the term should be restricted to the wood of *P. Torminalis* (which does not seem to be known in the timber trade), seeing that in many parts of the country the "White Beam" (*Pyrus Aria*), a much more common tree, is very frequently termed "Service." "Gean" and "Bird Cherry" are absent from the list of names, the former being described under "Cherry," which the author indicates probably includes "Bird Cherry" (*Prunus Padus*), a very doubtful suggestion. Three species of Lime are given, viz., *parvifolia*, *platyphyllos*, and *argentea*, while *vulgaris*, the commonest of all in Britain, receives no place. "Snowy Mespilus," the name by which *Amelanchier canadensis* is best known in Britain, does not appear, but the same plant finds a place under the strictly American name "Shad Bush." The timber known as "African Teak" (*Oldfieldia Africana*) appears both in the list and in the index simply as "African," and a number of blemishes of a similar kind occur throughout this part.

Three Appendices complete the work. The first contains explanations of some of the terms used in connection with converted timber, etc.; but, curiously enough, the term "standard" is omitted from the list. The second gives directions for the microscopic examination of woods, and the third consists of a select bibliography.

Although, as has been indicated, the work is not free from blemish, it is one which may be recommended with confidence as a reliable source of information on matters pertaining to wood, and it should find a place in all libraries specially devoted to the literature of forestry and allied subjects. A. D. R.

Timber: A Comprehensive Study of Wood in all its Aspects, Commercial and Botanical, showing the Different Applications and Uses of Timber in Various Trades, etc. Translated from the French of PAUL CHARPENTIER, Expert Chemical Engineer, Assayer of the French Mint, etc. By JOSEPH KENNELL. 437 pp. and 178 Illustrations. London: Scott, Greenwood, & Co., 19 Ludgate Hill, E.C., 1902.

This work embraces a wider field than Professor Boulger's *Wood*, but it scarcely runs on parallel lines with it. The book consists of six parts. The first deals with the physical and chemical properties of wood, the second with descriptions of the different species of trees, the third with the useful varieties of timber in the different countries of the world, the fourth with forests, the fifth with the preservation of timber, and the sixth with the applications and uses of timber.

The general plan of the book is excellent, and, errors excepted, it contains a great deal of very useful information; but in some respects, notably in the botanical parts, it has suffered severely at the hands of the translator. Besides, the botanical illustrations are very crude, and, in many instances, very much out of date; while in some, such as those representing the leaves of the common alder, the Norway maple, and the grey poplar, the resemblance to the originals is so slight that it would be hopeless to attempt identification by their means. The nomenclature, too, is very much out of joint, and the spelling of both the Latin and English names is inexcusable. The common chestnut is *Fagus castanea*; the American Chestnut (a tree of the same genus) is *Castanea vesca*; *Mercus Cerris* is the "fibrous" or Burgundy or Austrian oak, while Turkey oak, the name by which it is almost universally known in Britain, is not even mentioned. The Swiss Stone Pine occurs as Cimbrian Pine, Cembrian Pine, *Pinus cembro*, *P. cimbra*, and *P. cembra*. *Pinus sylvestris* is Sylvester Pine. The Scotch Pine is *Pinus rubra*, and the description of this very important timber tree is as follows:—"In Scotland large forests are formed of this tree. It grows naturally in the Alps and Pyrenees. It is generally considered as a variety of the sylvester pine, and serves the same purposes."

In the third part of the book, in the chapter dealing with European timber, the forestry of great Britain is disposed of thus:—"In this country, which was formerly nothing more than

an immense forest, it is estimated that only the twenty-fifth portion of its territory is covered by woods, but replantation is being actively carried on, and young forests are in the majority there. Highly esteemed old oaks are still to be found in rather large quantities, which are used in naval constructions, in spite of the remarkable facilities which England finds of supplying itself with exotic timber of superior quality."

The last three chapters are more presentable, but the book has been so badly treated in the translation that most of its real value has been lost, and the sooner the edition is replaced by a more reliable one the better. The price, too, 12s. 6d., compares unfavourably with that of *Wood*, although it would not be by any means a high one for a really well-done translation of the work freed from its blemishes and brought into line with British requirements. A. D. R.

A Manual of Indian Timbers. By J. S. Gamble, M.A., C.I.E., F.R.S., F.Z.S. New and Revised Edition, xxvi + 856 pp., including Index. London: Sampson Low, Marston, & Co., 1902.

This monumental work has been revised, enlarged, and illustrated by its eminent author, than whom no greater authority on the subject exists. The matter is clearly and systematically arranged, and the book should be in the possession of every botanist and student of Indian forestry.

Webster's Foresters' Diary and Pocket Book for 1903. London: William Rider & Son, Limited. Price 2s. 6d.

Most trades and professions have diaries and calendars specially prepared to meet their several requirements, but until now nothing of the sort seems to have been brought out exclusively for the use of foresters. An attempt to fill this gap has been successfully made by Mr A. D. Webster in the book under notice.

Besides a writing space for each day of the year, calendar notes for each month, trade advertisements, and other information of the kind usually to be found in such publications, the book contains in concise form a large amount of information of special interest to the arboriculturist and to the forester, such as

Work notes for each month of the year, Lists of trees for various soils and situations, Prices of contract work, Tables of weights and measures, etc., etc. This latter portion of the book occupies thirty-five pages.

For the assistant forester or young student, jottings, in tabulated form, of occurrences in connection with his daily work should prove interesting and useful for future reference, and for the keeping of such records *Webster's Diary* seems well suited. The recommendations in the monthly work notes are sound, so far as they admit of general application.

The book is neatly got up, bound in limp leather, and can be carried in the pocket without inconvenience. Its price is not prohibitive, and the *Diary* should receive a welcome from foresters and their assistants. J. F. A.

Utilisation of Wood Waste. By ERNEST HUBBARD. Translated from the German by M. J. SACH, F.I.C., F.C.S. xvi + 192 pp., including Index. London: Scott, Greenwood, & Co., 1902. Price 5s.

This is a short manual treating of the many uses to which sawdust and some other forms of wood waste are now being applied. A number of furnaces, specially constructed for the combustion of sawdust as a fuel, are noticed and illustrated on a small scale. The manufacture of oxalic acid is treated of at some length, and a short description of recently-introduced processes is given. The production of artificial wood, and its employment for decorative purposes, according to various methods, forms an interesting chapter. The manufacture of blasting powder from sawdust receives some notice, but the great industry of wood-pulp manufacture for the making of paper and the like is dismissed in a few sentences. A considerable number of minor uses to which sawdust is put receive a passing reference.

TRANSACTIONS

OF THE

ROYAL

SCOTTISH ARBORICULTURAL SOCIETY.

VOL. XVII.—PART II.

ROBERT GALLOWAY, S.S.C.,

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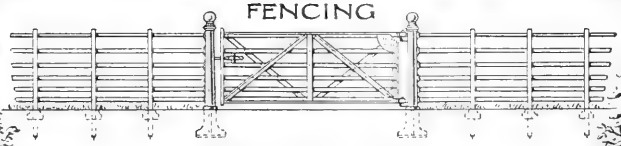

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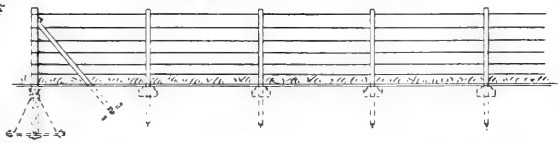

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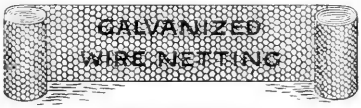

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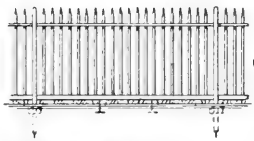

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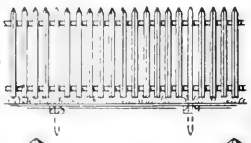

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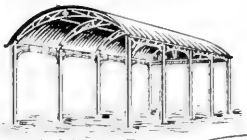

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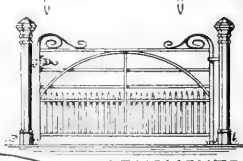

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Special Notices to Members.

THE READING OF PAPERS.

Members are invited to read short papers on any subject connected with Practical Forestry at the Annual Meeting in January, or at the General Meeting to be held at the time of the Excursion. Members who may desire to do this are requested to intimate the title of their subject, in writing, to the Secretary, not later than 1st June or 1st December 1904, and to state the time they require for reading the paper.

THE SOCIETY'S CABINET OF LANTERN SLIDES.

The Council has resolved that the Society's Cabinet of 100 Micro-Photographic Slides—illustrative of the Structure of Timber, and suitable for the purpose of Lectures with Lantern Exhibitions—may be lent to any applicant who is willing to comply with the printed Conditions, copies of which can be obtained from the Secretary.

ILLUSTRATIONS FUND.

The Council begs to draw special attention to this Fund, the object of which is to defray the expense of illustrating the Society's *Transactions*.

THE SOCIETY'S ALBUM.

The Council wishes it to be known that the Society has an Album of Photographs of Members, and that the Secretary will be glad to receive contributions.

NEW MEMBERS.

The Council has printed a Memorandum containing particulars regarding the past and present work of the Society, which, it is hoped, may lead to the introduction of New Members. The Secretary will send copies of this document to any Member who may ask for them, and will forward a copy to any person likely to join the Society whose address may be sent to him by a Member.

The Secretary will receive applications for Membership at any time. See Form of Proposal and Conditions of Membership at end of accompanying Prospectus.

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JAMES CRABBE, Forester, Glamis, Forfarshire.
ROBERT FORBES, Estate Office, Kennet, Alloa.
A. T. GILLANDERS, F.E.S., Forester, Park Cottage, Alnwick, Northumberland.
JOHN W. M'HATTIE, Superintendent of City Parks, City Chambers, Edinburgh.
D. F. MACKENZIE, F.S.I., Estate Office, Mortonhall, Midlothian.
W. H. MASSIE, Nurseryman, 1 Waterloo Place, Edinburgh.

Hon. Secretary.

R. C. MUNRO FERGUSON, M.P., Raith House, Kirkcaldy, Fife.

Hon. Editor.

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Secretary and Treasurer.

ROBERT GALLOWAY, S.S.C., 12 York Buildings, Edinburgh.

Auditor.

JOHN T. WATSON, 16 St Andrew Square, Edinburgh.

Membership.

THE Roll contains the names of about 1000 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, no fewer than 403 Medals and Money Prizes having been presented, exclusive of those awarded in connection with the Exhibitions aftermentioned.

School of Forestry.

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 Forest for Scotland which might serve the above-named objects. Copies of this Scheme were laid before the recent 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.

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.

Excursions.

During the past twenty-five 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, and in 1902 a Tour extending over seventeen days was made in Sweden. 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.

The Society's *Transactions*.

The *Transactions* of the Society are published annually, and 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. Copies of the *Transactions*, which now extend to sixteen volumes, are to be found in the principal Libraries of the United Kingdom, as well as in those of the British Colonies and of America.

Honorary Consulting Scientists.

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

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

Consulting Chemist.—ANDREW PEEBLES AITKEN, M.A., Sc.D., Professor of Chemistry, Royal Veterinary College, Clyde Street, Edinburgh.

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

Consulting Entomologist.—ROBERT STEWART MACDOUGALL, M.A., D.Sc., Professor of Entomology, etc., Royal Veterinary College, Clyde Street, Edinburgh.

Consulting Geologist.—JOHN SMITH FLETT, M.A., B.Sc., M.B., C.M., Geological Survey, 28 Jermyn Street, London, S.W.

Consulting Meteorologist.—ROBERT COCKBURN MOSSMAN, F.R.S.E., F.R.Met.Soc., 10 Blacket Place, Edinburgh.

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.

LOCAL SECRETARIES.

Scotland.

Counties.	
Aberdeen .	JOHN CLARK, Forester, Haddo House, Aberdeen.
	JOHN MICHIE, Factor, Balmoral, Ballater.
Argyle, . .	WALTER ELLIOT, Manager, Ardtornish.
	JOHN D. SUTHERLAND, Estate Agent, Oban.
Ayr, . .	ANDREW D. PAGE, Overseer, Culzean, Maybole.
	A. B. ROBERTSON, Forester, The Dean, Kilmarnock.
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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.
	JOHN HAYES, Dormont Grange, Lockerbie.
	JOHN NEWBIGGING, Nurseryman, Dumfries.
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	EDMUND SANG, Nurseryman, Kirkcaldy.
Forfar, . .	R. CAIRNS, The Gardens, Balruddery, near Dundee.
	JAMES CRABBE, Forester, Glamis.
	JAMES ROBERTSON, Forester, Panmure House, Carnoustie.
Inverness, .	JAMES A. GOSSIP, Nurseryman, Inverness.
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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.
Peebles, . .	* * * * * * * *
Perth, . .	W. HARROWER, Forester, Tomnacroich, Garth, Aberfeldy.
	W. A. MACKENZIE, Factor, Faskally, Pitlochry.
	ALEX. PITCAITHLEY, Jeanie Bank, Old Scone, 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, .	JAMES F. HARDIE, Factor, Skibo Castle, Dornoch.
	DONALD ROBERTSON, Forester, Dunrobin, Golspie.
West Lothian,	JAMES SMITH, Hopetoun Gardens, South Queensferry.
Wigtown, .	JAMES HOGARTH, Forester, Culhorn, Stranraer.
	H. H. WALKER, Monreith Estate Office, Whauphill.

England.

Counties.	
Beds,	JOHN ALEXANDER, 43 Ampthill Street, Bedford.
	FRANCIS MITCHELL, Forester, Woburn.
Berks,	W. STORIE, Whitway House, Newbury.
Bucks,	* * * * * * * *
Cheshire,	WM. ELDER, Cholmondeley Park, near Malpas.
Derby,	* * * * * * * *
Devon,	JAMES BARRIE, Forester, Stevenstone Estate, Torrington.
	WM. STORIE, Forester, Gulworthy, Tavistock.
Gloucester,	GEORGE HANNAH, Over House, Over Almondsbury, Bristol.
Hants,	* * * * * * * *
Herts,	JAMES BARTON, Forester, Hatfield.
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Lincoln,	W. B. HAVELOCK, The Nurseries, Brocklesby Park.
Middlesex,	Professor BOULGER, 11 Onslow Road, Richmond Hill, London, S.W.
	GEORGE CADELL, c/o The Secretary, Surveyor's Institution, 12 Great George Street, Westminster, S.W.
Norfolk,	JAMES RODGER, Forester, Morton Hall, Ringland, Norwich.
Northumberland,	JOHN DAVIDSON, *Secretary*, English Arboricultural Society, Haydon-Bridge-on-Tyne.
Notts,	W. MICHIE, Forester, Welbeck, Worksop.
	WILSON TOMLINSON, Forester, Clumber Park, Worksop.
Salop,	FRANK HULL, Forester, Lillieshall, Newport.
Stafford,	ROBERT T. COLLINS, Forester, Trentham, Stoke-on-Trent.
Suffolk,	ANDREW BOA, junior, Agent, Great Thurlow.
Surrey,	PHILIP PEEBLES, Estate Office, Albury, Guildford.
Warwick,	A. D. CHRISTIE, The Gardens, Ragley Hall, Alcester.
Wilts,	A. C. FORBES, Wood Manager, Longleat, Warminster.
York,	WM. FORBES, Forester, Swinton, Masham.
	ADAM MAIN, Forester, Rose Cottage, Loftus.
	D. TAIT, Estate Bailiff, Owston Park, Doncaster.

Ireland.

Dublin,	JAMES WILSON, B.Sc., Royal College of Science, Dublin.
Galway,	THOMAS ROBERTSON, Forester and Bailiff, Woodlawn.
Kildare,	ROBERT M'KERROW, Manager, Carton, Maynooth.
Kilkenny,	ALEX. M'RAE, Forester, Castlecomer.
King's County,	ARCH. HENDERSON, Forester, Clonad Cottage, Tullamore.
Tipperary,	DAVID G. CROSS, Forester, Kylisk, Nenagh.
Wicklow,	ADAM JOHNSTONE, Forester, Coollattin, Shillelagh.

PHOTOGRAPHIC ARTIST.

A. D. RICHARDSON, Marionville, Sciennes Gardens, Edinburgh.

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, 12 York Buildings, 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, and others, subscribing annually . . . . . Half-a-Guinea.
3. Foresters, Gardeners, Land-Stewards, 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.**

V. Members in arrear shall not receive the *Transactions*. Any Member whose Annual Subscription remains unpaid for three years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till all his arrears are 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, and others, . 5 5 0
3. Foresters, Gardeners, Land-Stewards, 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 *new* Life Members.

XII. Every Proposal for Membership shall be made on the FORM provided for the purpose, which must be signed by two Members of the Society as Proposer and Seconder, and delivered to the Secretary to be laid before the next meeting of the Council. The Proposal shall lie on the table till the following meeting of the Council, when it shall be accepted or otherwise dealt with, as the Council may deem best in the interests of the Society. The Proposer and Seconder shall be responsible for payment of the new Member's first Subscription.

CONTENTS.

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

THE ROYAL SCOTTISH ARBORICULTURAL SOCIETY AT WOBURN, 28TH JULY 1903.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

XX. *The Condition of Forestry in Britain.* By Professor Adam Schwappach, Eberswalde, Germany. Translated by Fraser Story, The Glen, Innerleithen.

After an interval of six years, I again took the opportunity, in September 1902, of visiting a number of Scotland's most famous parks and woods. This I did at the invitation of the Board of Agriculture in London. An official tour of the Committee on Forestry in which I was able to take part, and the kindness of several landed proprietors, made it possible for me to make a further study of the condition of forestry in England and Scotland. From the standpoint of landscape gardening and arboriculture, the beautiful parks of Great Britain are unsurpassed in Europe. Landowners in Britain have not only devoted every attention to the arrangement and treatment of their grounds, but they have for long taken advantage of their connections with foreign lands to gather together, under glass and in the open, plants from every part of the globe. Consequently the country is exceptionally interesting to the dendrologist, and particularly Scotland, where examples of exotic conifers may be seen of an age nowhere else to be found in Europe.

With the greatest delight I wandered again through the charming grounds of Mr Steuart Fothringham at Murthly Castle, where hundreds of Douglas firs, between fifty and sixty years of age, show wonderfully fine growth. At Lyndoch, upon the estate of the Earl of Mansfield, I had the pleasure of seeing Scotland's oldest Douglas fir. It has a height of 95 feet at sixty-eight years of age. A plantation of the same species at Scone Palace, heavily thinned prior to my first visit, has since developed with surprising rapidity. The wood is about 8 acres in extent, and the trees are now forty-eight years old. I found *Tsuga mertensiana* and *Tsuga Pattoniana* in large numbers, and of most excellent growth at

thirty years, upon the estate of Colonel Harris in Perthshire. It would lead me too far were I to deal with, or even make mention of, all the exotics that in these parts grow with vigour and in an arrangement that has added beauty to their naturally fine effect. To see them thus, compensates for many grumbling critics, and lends fresh courage in the pursuit of their cultivation.

In the north, conifers are most in evidence; but in the south of England, under milder weather conditions, species are represented that are quite out of the question for Germany. There, *Wellingtonia gigantea*, *Sequoia sempervirens*, *Cedrus Deodara*, and numerous species of broad-leaved trees that have their home in warmer climes, are found growing freely. I must mention particularly the property of the Earl of Ducie at Tourtworth Court, near Bristol; the collection of broad-leaved trees there brought together may indeed serve as a standard to strive after. As regards the appearance of the rarer species, these grounds contrast favourably even with the renowned Kew Gardens.

The condition of British parks is one picture, that of British woodlands quite another. The afforested area is small—in Great Britain 2,726,116 acres, and in Ireland 309,741 acres; so that the United Kingdom and Ireland, according to statistics taken in 1895, have 3,035,857 acres under trees. Practically the whole of this area is in private hands, for the State forests of England amount to only 66,758 acres. Large, closely-grown forests are entirely wanting even upon those estates which have a considerable acreage under wood. Plantations interspersed in heathland and meadow are certainly seen, but they are generally in small plots of only a few acres extent. Exact statistics as to the extent of the country's woodlands are difficult to collect, because it is frequently hard to tell whether certain areas partake more of the nature of heath, field, or forest.

The southern and central parts of England present, as regards the distribution of their woods, an aspect somewhat similar to Holstein. There is the same division of the fields and pastures by means of hedges and narrow belts of trees. The farther north one goes, the less does one see of agriculture, or at least this becomes more confined to the fertile valleys and coast districts; whereas the higher parts are bare pastures, with an occasional sparse growth of trees. From the forester's point of view, the most unfavourable impression of the country is obtained in that otherwise charming district of the Highlands between Perth and the Caledonian Canal. This broad strip of land is uniformly

hilly. Ben Nevis occurs in it, and the main valleys lie at a height varying between 800 and 1500 feet. Extremely little wood is carried upon this wide tract of land. For hours one travels through it seeing nothing but heather-covered hills and perhaps a few black-faced sheep; no tree, no shrub, no road—waste land in the strictest sense of the word. Farther north, again, the land assumes a less mountainous character; it is more densely populated, and near the East Coast is in part very fertile. South of Carlisle and Newcastle broad-leaved trees, particularly beech and oak, predominate; whereas to the north of this line, Scots pine, alternating with old larch, is more plentiful. In the Perth district, broad-leaved species practically find their northern limit, except on the sheltered lower-lying lands of the east.

Most of the present practically treeless regions of Scotland have been well wooded at one time. In the peat moors there are tree stumps and other fragments of primeval forest. The original woods have obviously been despoiled largely in the feuds between Scottish clans and in the greater wars. Immediately they had become the refuge for a scattered army, the hand of destruction was laid upon them. Undoubtedly this accounts in great part for their disappearance; but another cause, more gradual in its effects, is found in the extension of pasturage and the utilisation of the timber, unfollowed by restocking. It appears to me, further, that peat bogs, which in valleys and depressions are seen to be increasing, have had their influence upon forest vegetation. Before their advance, the area under trees has receded, a fact that I think has not received sufficient attention.

In the Scots pine woods owned by the Countess of Seafield, where there is an area of about 25,000 acres under trees, the very capable forest manager, Mr Grant Thompson, who has been upon the estate for forty-three years, informed me that in consequence of the growth of heath plants, natural regeneration of the pine, on many parts where it was formerly carried out with ease, is now effected with great difficulty, or is wholly impossible. It would seem that this must have occurred to a much greater extent on the ancient virgin forest lands. Under such circumstances, the practice of driving in sheep, immediately before regeneration is about to take place, appears a very proper one. The sheep keep the heather short, and by their treading action, the formation of thick layers of raw humus is checked.

It cannot be said that British woods make a very favourable impression upon the visitor. The stamp of systematic forest

management is absent. Working plans are unknown, or at least are in the hands of but few. Mr Munro Ferguson's woods of Raith and Novar have for some years been placed under a scheme of management. But such regulated work is quite the exception. In this connection I may make mention of a certain estate with over 100,000 acres of woodland, where timber to the value of £1000 is sold annually. The timber represented by this sum is taken quite without regard to the interests of the general management of the forest; apparently fellings are proceeded with simply where timber of the type desired is most accessible.

In countries where forest management is primitive, one usually finds great stocks of old timber; this is not so in Britain, chiefly in consequence of the want of large State woods. A few estates are exceptional in this respect, particularly that of the Duke of Atholl, where there are splendid woods of old larch.

One of Lord Lovat's Scots pine woods was interesting to me as providing an example of "two-storied High forest," in which both the older and younger trees were pines—certainly a rare and curious condition. The really fine timber of the older portion is at least one hundred and fifty years old. It was heavily cut into about fifty years ago, and through natural reproduction a second growth has sprung up which now stands between and among the former crop. About forty very large pines, having an average content of fully 50 cubic feet, are found per acre, and between them the slim poles of the younger pines. The question now is as to the future of the wood; it is more than time that the old pines were felled—some of them are already failing—but one cannot utilise them without sacrificing the younger generation. To fell and remove the mature trees would now quite break up the plantation. Altogether the wood presents an absurd picture, and one that it would be difficult to equal. In the north of Scotland many middle-aged and younger woods are in a sad plight. They are largely composed of Scots pine and larch, partly as woods of one species, partly also in mixture together. Two heavy calamities beset these woods—squirrels and larch disease. The squirrels strip the bark from pine, larch, and spruce, but the pine is the most severely damaged. Woods in the pole stage suffer most; bands of bark are peeled in rings from the trees, which consequently either die, become suppressed, or are broken down by snow. Side branches frequently take the place of a lost leader only to meet with the same fate, so that bushy-headed, malformed trees result. Only those who have seen the extent of the damage

done can possibly conceive how really grievous it is. While in the Countess of Seafield's pine woods, I wished to show those who were with me the system of thinning as it is carried out in Germany; but this was not possible, for nowhere could I find any extent of normally developed young trees.

Some effort of course is made to dispose of the squirrels, and, just as in northern Russia, use is made of dogs specially trained for squirrel hunting. An idea of the extent of the pest may be gathered by my stating that Mr Munro Ferguson's forester, with the assistance of his dogs, shot forty-one squirrels in one morning. A certain sum (commonly threepence) is usually paid for each tail. Upon the Seafield property, the expenditure in this way for squirrel killing during the year 1901 amounted to £80! Combined action, it is felt, must be taken against this dangerous animal, and for this purpose an attempt is being made to form "squirrel clubs."

But bad though squirrels are, the damage done by larch disease is still worse; there is at least some possibility of overcoming the squirrel attack. For the last forty years, larch disease has spread in the most disastrous manner through the British woods. Its presence is universal. It varies only in the degree of severity with which it attacks different localities. The canker extends rapidly or slowly in certain years, as the weather favours or retards its development, but it is never absent. The evil wrought by the disease is felt with all the greater force because the quick growth and valuable timber of the larch have caused that species to be largely planted. Trials with seed from many different parts have been made, but so far without result. *Larix leptolepis* and *Larix sibirica* are also being dealt with experimentally. Up to the present, the Japanese species (at most sixteen years old) has grown well, but what its future will be we have still to learn.

After going through larch woods of forty to sixty years old, that have suffered both from squirrels and disease, one can understand the difficulties of the owner in knowing what to do with his woods, and can more readily appreciate how it is he gives up thought of timber, and turns his plantations into game coverts. One thing is clear, that a change from the too extensive planting of larch is necessary, and that pure woods of that species should be specially avoided.

The excellent growth of North-West American conifers on the policies of many estates should encourage the adoption of some of these as timber crops. I am quite convinced that they should be

in great part the trees of the future. Where there is shelter from wind, the Douglas fir can be planted; in exposed parts, *Picea sitchensis;* upon low-lying ground, *Thuja gigantea;* while several of the *Abies* genus will also succeed well. Upon the shallow, calcareous soils of the south of England, the black or Austrian pine is now being more largely planted.

In Britain, thinnings, especially in the younger woods, are conducted with rash severity. This is done partly to encourage the remaining trees to increased growth, but chiefly out of regard to the interests of game.

The planting material used, and the methods of planting adopted, quite shock a German forester. Apart from the few cases where, as already mentioned, natural regeneration is made use of, the establishment of woods is by planting, not by sowing. Artificial sowing is not possible, owing to the universally strong growth of grass or heather, and the damage done by rabbits. In planting, very large transplants (often four to six years old) are used, and all that Continental foresters demand in regard to root-form is held in high disdain. The transplanting of seedlings is effected in this way: a shallow trench, about a couple of inches deep, is formed; into this the plants are laid closely together (about 2–2½ inches apart) in such a manner that their roots are bent quite to one side. The little trench is filled in with soil, firmed with the foot, and the operation is finished. The consequence of such treatment is, that instead of the roots taking a vertical direction, they grow at right angles to the stem, and the root-collar is buried too deeply. In schooling transplants, the same operation is repeated.

These unnaturally crippled plants are admirably suited to "notching"—the method by which conifers are customarily planted in Britain. With a spade two incisions are made into the soil, either in the form of an L or a T. The corners of the sod are raised somewhat with the spade; the plant, with its horizontally-lying roots, is slid into the opening, and the flap of sod is allowed to fall back. With a tread of the foot the young tree is considered as planted! Certainly an easy and expeditious system!

The results, of course, soon show themselves. In spite of otherwise favourable circumstances,—productive soils, absence of spring drought, and frequent rainfall,—a very considerable number of the plants miscarry. I saw an area in Peeblesshire, for instance, where 60 per cent. of the plants were dead, and a further number had not developed their buds; many more will obviously die in the

ensuing year. Were we to employ such a planting method upon light soils in Germany, probably not 5 per cent. of the plants would remain alive!

In later growth, the effect of this notch-planting is very frequently seen in stems that are bent near the ground, and in the delayed development of the plants. The roots acquire a fairly normal form only after a protracted period. Professor Schlich informed me that after thirty years the results of this cultural practice are still recognisable. The ever-ready excuse for notch-planting is that it is cheap. But this I contend is not the case, because the ultimate result is not attained without further cost. To adopt a surer method, and to use smaller plants, would, without doubt, be an economy.

The most serious enemy of the young plantation is the rabbit. In England and Scotland rabbits have become a national scourge. Generally plantings can be raised only when protected by very costly wire-netting fences. In the north of Scotland, hares, particularly *Lepus variabilis*, cause much damage.

This description will no doubt be sufficient to show that the condition of the wooded area is, according to German views, far from being satisfactory. Still less favourable, however, is the general picture when one considers the great stretches of land as a whole. The northern part of the country has but a limited area under tillage: most of it lies waste, or is only used for grazing, while the woods are poor and ill-arranged. To fully discuss the origin of this state of affairs would quite exceed the limits of this article. It is quite impossible to go into the question of agrarian policy which is so intimately associated with the question—the conditions of the ownership of land, and the returns from farming. I must here confine myself to forest policy.

The reason of the poor development of forestry is attributable first of all to the absence of a large connected area of State forest. In other countries the State has led the way in the transition from primitive forest utilisation to systematised management of woods. Methods of treatment and general guidance towards the better handling of woods were effected in past times by the aid of regulations issued by the State. More recently, intervention has rather gone along the lines of providing technical instruction; but private forest owners learn the broad principles of forest treatment, and the practices which it is best to follow, most effectively from well managed State woods. This is not possible in England. The existing State property is too small and too scattered to be

treated as economic forests should be. Besides, most of the Crown woods are much burdened with communal rights, tenaciously held to by the people. They yield a very low return, and for the purpose of demonstrating the results of forestry work are not at all suitable.

In the country, sylviculture plays an exceedingly small part. The facilities for forestry instruction are very incomplete, and the few landowners who desire to see their woods better managed have neither the necessary knowledge themselves, nor are they in the position to procure capable wood managers.

The strongest factor, however, that is working against forestry is the game interest. It is well known how great the desire for sport in Britain is: I would only remark here that the love of shooting has outgrown the love of the chase. The great object is the filling of the game-bag—so many head of game. On this account, those animals are preferred which may be killed in great numbers in a very short time—pheasants, grouse, and rabbits. For the raising of these, large, close woods are not required, indeed, they are scarcely consistent with the production of game in large numbers. Large tracts of waste land remain without forest out of consideration for the grouse. Red deer in Britain are not present in the same quantity as in Germany, owing to the well wooded state of the latter country. But on the great unpeopled areas of heather moor in Scotland, where occasional poor remnants of former forests exist, deer find the necessary food and quietude. The development of their antlers remains, of course, far behind that of German stags from the forests, but then it is possible in a few weeks to shoot a hundred head!

The extent to which consideration is given to sport was shown by a landowner in the south-west of England. I asked him why, having a great many isolated patches of wood, he did not bring these together by afforestation into one proper forest. His reply was that his neighbours would be too much incensed at the spoiling of the fox hunt which such action would entail.

The landowners are either wealthy enough to make use of their game facilities themselves, and renounce any income from forestry, or they let the shootings at such enormous prices that it appears to them that timber crops could not bring more. This alone would account for the want of interest taken in forestry. The woods should, properly speaking, be called only game-coverts.

It has already been remarked that the young woods are much too heavily thinned. Very frequently this is done simply at the wish

of the gamekeeper, in order to suit the convenience of the "beaters." Nearer the residences, one very often finds all manner of shrubs and small trees in wonderful mixture together. A glance at these is sufficient to show that neither arboricultural nor æsthetic considerations have determined their choice, but that they are there simply to provide shelter for pheasants.

However little, either as forester or political economist, one may agree with this state of affairs, it must be admitted that, from the private owner's standpoint, the system has its advantages. The revenue from game is so considerable, and so sure, that the proprietor often finds it the most profitable on his estate. On the average, 1s. 6d. to 2s. per acre is paid as shooting rent, and sometimes as much as 5s. per acre is obtained. One case is known to me in which the latter sum was paid for rabbit shooting. For each grouse killed ten shillings is usually reckoned. With red deer the sum paid is generally calculated according to the number shot, it varies for each stag from about £20 to £40. Rents of £2000 to £5000 are quite common for single shootings, though certainly the tenancy of a prettily situated shooting-lodge may be included with this.

When one considers that the shooting season averages only two months; and that, in addition to the rent, keepers and beaters must be paid, while the cost of an expensive establishment has to be maintained, it is seen what a costly pleasure this kind of sport is in England. In some parts it has indeed become too expensive for many Englishmen, and rich Americans are stepping in, finding they can shoot more and live with greater comfort in Britain than in their own country.

To undertake afforestation on a large scale, proprietors must not only forego this rent or the highly valued pleasure of shooting, but they must expend much money for the establishment and tending of the woods. In return, they usually reap nothing themselves; their sons receive perhaps only a moderate share, while the sustained yield may only become available to the third generation. Along with this, it must be considered that in England, in contrast to Germany, Austria, and other countries, a knowledge of the profit-bringing capabilities of forestry is wanting. For the most part, the landowner sees only the results of mismanaged woods which return a sum poor in comparison to that yielded by game. Besides which, the certainty of the latter income, and the ease with which it is obtained, must be placed in the balance.

On the other hand, the conditions for forestry in Britain are by no means unfavourable. The prices for timber are from twice to three times as high as in Germany. Larches of about 15 to 30 cubic feet bring at least 10d. per foot, and other better timbers 1s. 3d. to 1s. 6d. per foot in the forest. Good, strong soils are common. In the south the soils are produced from weathered chalk, in the north from greywacke, granite, new red conglomerate, basalt, and morain formations. Any considerable tract of sand is nowhere to be found, the poorest soils being those from gneiss, or where great masses of morain boulders occur. For the growth of timber, the climate can be described as excellent, because precipitations, especially in the form of rain and mist, are frequent, while periods of drought come only very exceptionally. Strong winds are common, and of course unfavourable, particularly in the western districts upon the high peat moors of Scotland. The unsatisfactory condition of the woodland roads tells against the selling price of timber. These, if improved, would not only enhance the value of the timber produced, but would also facilitate the more systematic treatment of the woods.

The vast extent of waste land capable of afforestation is deserving of the first attention. The great area which lies at disposal for this purpose is shown by the following table.[1]

Country.	Total Area.	Area under Wood.		Waste Land.	
	Acres.	Acres.	Per cent. of the Total Area.	Acres.	Per cent. of the Total Area.
England, . . .	32,550,698	1,665,741	5·1	2,305,823	7·1
Wales, . . .	4,776,779	181,610	3·8	1,250,813	26·2
Scotland, . .	19,458,470	878,765	4·5	9,374,512	48·1
Great Britain, .	56,785,947	2,726,116	4·8	12,931,148	
Ireland, . . .	20,333,344	309,741	1·5	*a.* 4,804,428[2] *b.* 12,138,500[3]	83·3
United Kingdom,	77,119,291	3,035,857	3·9	29,874,076	38·7

[1] From the *Agricultural Returns for Great Britain*, 1901 (London, 1902); and *Agricultural Statistics of Ireland*, 1901 (Dublin, 1902).

[2] Moorland, waste land, and water. [3] Grass land.

Attention must be drawn to the fact that what is designated as waste land in Great Britain is considered differently in Ireland. For Great Britain, according to the statistics, waste land is "mountain and heath land," whereas for Ireland, the figures are divided into two distinct categories, namely, waste land proper and pasture land. A portion of the latter corresponds to the mountain and heath land of Britain, and might be afforested, but another portion will be better left to serve its present purpose. Still, nearly one-half of Scotland and Ireland can be designated waste land, and probably 18 million acres suitable for timber growing could be found in the United Kingdom. The country, with about 20 million acres under forest, including the present wooded area, could produce the 600 million cubic feet which, roughly speaking, must now be imported annually from abroad. The annual importation of timber for constructive purposes is at present about 350 million cubic feet in converted form, and this has a value of over £23,000,000. If one reckons that only 60 per cent. of the wood which might be raised in Britain could be used as such timber, even then about 360 million cubic feet would be available. An additional incentive to proceed energetically with planting lies in the fact of the slow but certain decline of the world's timber supply.

Apart from this, there are found both in England and Scotland many bare steep slopes which are being completely denuded of soil owing to their unprotected state. That the damage has not been greater is explained partly by the nature of the precipitations. These seldom take place with much suddenness, and melted snow from higher ground is rarely injurious. On the other hand, the usually moist air, even when circumstances are otherwise unfavourable, gives rise to a covering of moss and weeds which again and again bind together the loosened earth. The beginnings of dangerous formations are everywhere to be found, and it appears to me that later a very great deal of harm may proceed from this cause. Through the want of forests and systematic wood management, the peat bogs are becoming larger, and are rendering a better utilisation of the ground difficult.

If any improvement is to be made in forestry, the interest of the land-owning class must first be awakened. They must be convinced that good sylviculture pays, and that to plant will increase the value of their estates. British proprietors need not think that well-regulated forestry is inconsistent with the keeping of game.

Within certain limits, and in a modified form, the two are indeed well associated one with another. In regard to grouse shootings, much land may be afforested and yet enough may remain for purposes of sport. Pheasants may be raised in great numbers in properly managed woods, as Germany and Austria can sufficiently show. Red deer would enormously benefit from the presence of forest, and if rabbits must be held more in check, so will their damage to tillage crops and pastures be lessened, to the material advantage of agriculture.

To effect an improvement in forestry is not easy, because it rests upon scientific and technical hypotheses; but in Britain it is specially difficult, because of the deep-rooted views of the land-owning class, with whom the forestry problem rests. In this connection, as already remarked, the absence of large State forest property is sadly felt.

Until little more than a year ago, forestry had no official representative within the administration. The Office of Woods and Forests is not of this nature. It conducts the management of State domains in general; to it belong, of course, the Crown woods, but the yearly revenue of about half a million sterling comes from quite different sources—chiefly coal-mines and London property.

Until the Committee was appointed by the late Mr Hanbury to inquire into the present state of matters, British forestry was almost exclusively fostered by two large associations—the Royal Scottish and the English Arboricultural Societies. These names are themselves significant, the word arboriculture being distinct from sylviculture or forestry proper. The published *Transactions* of these Societies show, however, that in spite of their names, they struggle zealously and successfully for the benefit of forestry.

The present facilities for technical education in forestry must be regarded as quite insufficient. The subject is taught in the following places. In the University of Edinburgh[1] there is a lectureship for forestry: the lectures—yearly one hundred hours—are delivered chiefly to students who will later become estate factors or farmers. In Edinburgh also, evening classes in forestry are held at the Botanic Garden for gardeners and foresters. The cost of forestry instruction in Edinburgh is only in part borne by the State, the Highland and Agricultural Society paying a considerable portion of

[1] See "Forestry at the University of Edinburgh," p. 206.—Ed.

it. The teaching in the Glasgow and West of Scotland Agricultural College is practically of no importance, and the Royal Agricultural College, Cirencester, is similarly situated.[1] The lectures delivered in Durham College, Newcastle-on-Tyne, and at the University of Cambridge, are of greater value. The students at these classes are chiefly prospective estate agents, though, in Cambridge, the sons of landowners also take part in them.

Then there is the Royal Indian Engineering College at Coopers Hill, where, under the direction of Dr Schlich, the forest officials for service in India receive their education. Even for this last-named institution, the money allowed by Government is inadequate. To a German this is the more surprising, because, to him, India always suggests golden riches. As far as Britain is concerned, the sylviculturists who have qualified at Coopers Hill are available only at the end of their period of service, or when they return "invalided home." It would seem that these gentlemen are administrators rather than foresters whose inclination is to inquire into the details of cultural work—so important a qualification for British forestry at present.

Apart from the last-mentioned college, there remain in Great Britain, only Edinburgh, Newcastle, and Cambridge for students of the more highly educated class. The forestry knowledge of most of these men, owing to the limited scope of the lectures, and the entirely insufficient practical training, is very deficient. Moreover, students usually attach but little importance to the subject beyond its bearing upon examinations. The greater number of those who have studied at the above colleges become factors or are engaged in agriculture, having too little inducement to follow out the forestry profession. Of the few students who give more attention to forestry, the majority find their way to the colonies, so that the number of sylviculturists with scientific knowledge remaining at home is exceedingly small.

It is the "forester" who in reality has charge of the woods, and he is without systematic training either in the scientific or practical direction. A few only have taken the evening course while working at the Edinburgh Botanic Garden. Foresters are partly drawn from the better forest workers, partly from gardeners, or gamekeepers, or from occupations still more remotely connec ed with sylviculture. Granting, certainly, that a number of these

[1] Since the above was written, a lectureship in Forestry and Estate Management has been created at Cirencester.—Tr.

men possess most excellent qualities through the observation of nature, and by diligence and self-culture, just as in Germany one hundred and fifty years ago, men like Beckmann and Käpler did much good work; still, the foresters in general must be described as inefficient. The small economic importance of woodlands, and the insufficient education of those in charge of them, find expression in the social position of the forester.

The fact that the condition of British forestry can be improved, as much to the benefit of the private owner as for the good of the country in general, is not yet fully realised. Still, a certain section, and particularly those who have studied the subject in Germany and France, candidly acknowledge the situation. An effort to obtain some idea, at least, of the result of good forest management was made by the Royal Scottish Arboricultural Society in 1895, when a party visited North Germany. The effects of that tour have been important and far-reaching. With a like purpose in view, this Society made an excursion to Sweden in 1902, and the English Society visited France. Not resting satisfied with these efforts, these associations have long striven to obtain a State area such as may serve as a model forest, and during the past seven or eight years fresh endeavours have been made to improve education.

Those directing the affairs of the Royal Scottish Arboricultural Society are especially deserving of praise. Standing at the head of this movement are Mr Munro Ferguson, M.P., Dr Somerville, Assistant Secretary to the Board of Agriculture, who studied and took his degree at Munich, and our own countryman, Dr Schlich, formerly Inspector-General to the Government of India The delay in obtaining a State forest has been the more protracted because, as the Minister of Agriculture in 1896 explained to a deputation of the Royal Scottish Arboricultural Society, there was not enough support from private individuals—exactly the class who should have been most directly interested. A suggestion brought before the above Society, to establish a joint stock company, owning a forest area, has not been acted upon.

The movement for the furtherance of sylviculture is now proceeding more briskly however. The late Minister of Agriculture, Mr Hanbury, appointed Dr Somerville as Assistant Secretary to the Board of Agriculture in 1901. That position entails a great variety of work, inclusive of forestry. As already mentioned, the Crown woods are under the control of the Office of Woods and

Forests. It seems to me that these would be better under charge of the Board of Agriculture. The woods are of small importance as they are, but they might be so handled as to provide useful instruction.

On the 26th of February 1902, the late Mr Hanbury appointed a Departmental Committee of Forestry to consider the claims of sylviculture.[1] Of the Committee's recommendations, attention may be drawn to the following. Owing to the absence of State woods of a kind which can serve for demonstration, such should be created. With this in view, suitable estates ought to be purchased and converted into well-regulated forests. The purpose of these model forests is threefold: they should serve technically for—(1) showing how woods may best be treated; (2) proving what returns economically managed forest is able to give; and (3) providing instruction for the working class of foresters.

In addition to these so-called model forests, "instruction woods" (*Lehr-reviere*) in connection with the higher forestry institutions, are extremely useful; but the difficulty of acquiring very large extents of land has led the Committee to advise that "example plots" only be attached to the colleges. These may partake somewhat of the nature of the forest plot at Giessen, but they ought to be larger—100 to 200 acres, so that the several sections may grow under conditions more closely resembling those met with in the forest. It should be possible to utilise the model forests as "instruction woods," not only for experimental purposes, but by making them accessible to students of forestry. This will best be attained by having one area at least within convenient distance from Edinburgh. It is thought to dispense education as follows:—

(*a*) *Higher Grade*—The Coopers Hill establishment should be attached to one of the Universities of Oxford or Cambridge. Better teaching facilities ought to be given to Edinburgh, and both the Universities of Oxford and Cambridge should have lectureships in Forestry.

(*b*) *Lower Grade*—in connection with the model forests, after the manner of the German and Austrian forest schools. Those being trained would take part in all kinds of forest work, while the scientific side would be looked after and lectures delivered by the director and his assistant.

[1] Professor Schwappach details the recommendations of the Forestry Committee, but as these have already appeared in Part 1 of Volume XVII. of the *Transactions*, this part of the article has been omitted.—Tr.

(*c*) At all agricultural schools forestry should become an obligatory subject of study.

(*d*) In the better wooded districts, courses of a few weeks' duration should be held. These may resemble those given to landowners, forest managers, and others in Switzerland and Germany.

It is evident that before the above recommendations can be given effect to, much time will necessarily elapse. During this period matters must remain unimproved. On this account the suggestion which I made in a memorial laid before the Committee, that "forest advisers" might be appointed, has been favourably received. From these men, proprietors would receive skilled advice upon the management of their woods and in the practice of forestry. It is a system that has worked excellently in connection with several Prussian Chambers of Agriculture and in the United States.

Looking to the present condition of British forestry, it appears to me to be absolutely necessary that those who are called to take up the management of the model forests, teachers, and advisory experts, must first have made themselves acquainted with forestry on the Continent, especially Germany. Their training there should be thorough and practical, similar to that gone through by Dr Schlich's students.

For the rest, one can only express entire agreement with the recommendations of the Committee. Should their proposals be carried out, as I hope they soon will be, the most favourable results will undoubtedly ensue.

XXI. *An Address delivered at the Inauguration of the New Chair of Forestry and Estate Management at the Royal Agricultural College, Cirencester.* By Dr Schlich, C.I.E., Ph.D., F.R.S.

The Council of the Royal Agricultural College has done me the honour of appointing me Honorary Professor of Forestry at the College. It is an honour which I highly appreciate for several reasons. Apart from the acknowledgment of my humble efforts in the cause of extended afforestation and amelioration of existing methods of managing woodlands in this country, I value the appointment, especially because it shows that the authorities of the College fully recognise the importance of forestry. After all, forestry means the employment of land for a specific purpose, and it forms, therefore, part of agriculture in its wider sense. Indeed, it represents an essential part in the management of almost any estate in this country. The Council have, therefore, acted wisely in taking

A New Departure

by appointing a special Professor of Estates Management and Forestry. I had the pleasure this last summer of seeing a good deal of your new professor, Mr F. M'Clellan, and I feel sure he will give a good account of himself. There is yet another matter of great importance to which I must refer. The Principal has alluded to the fact that this College is situated close to Lord Bathurst's estate, a great portion of which is under wood. I cannot claim an intimate acquintance with these woods, but Mr Elwes was good enough to drive me through them a couple of years ago, and I can assure you that I was most favourably impressed with their condition, and the careful management which that condition indicates. Lord Bathurst, I understand, has been kind enough to place his woods at your disposal for educational purposes, and I think the College owes to his lordship a debt of gratitude for his liberality and public spirit. Let us hope that proprietors in other parts of the country will follow Lord Bathurst's admirable example. Thus, the College appears to be well equipped to impart that knowledge of forestry which in these days is considered of great importance in the development of the resources of the land, and through it to land-owners and land agents, as well as to the labouring classes, because

increased afforestation of waste lands provides extra work in the shape of managing the woods, and in the development of industries. As regards the latter point, let me remind you of the beech woods in the Chiltern Hills, whose existence caused the development of an extensive chair industry, which uses the produce of these forests as its raw material. Tens of thousands of people are employed in that industry, which would never have seen the light of day without those forests. There is every likelihood that similar industries will spring up in other parts of the country if you create the necessary woodlands. On the whole, then, I think the students of this College are to be congratulated on enjoying benefits which are as yet denied to students at other similar institutions. What I have said so far, naturally brings me to the question whether extended and improved forestry is of such importance to this country generally, as to justify any special measures to be taken towards furthering it. To answer that question is a complicated matter: hence, within the short time at my disposal, I can only touch on a few of the more important points.

Requirement of Forest Produce in this Country.

The production of timber in this country may be estimated at perhaps two million tons a year, and that quantity has probably not varied very much during the last forty years. On the other hand, these islands imported in 1864 about $3\frac{1}{3}$ million tons of timber, and in 1899 10 millions, making an average annual increase of about 190,000 tons. Here, then, is an important fact. Of the timber imported in 1899 about 87 per cent. was pine and fir, and only 13 per cent. so-called hardwoods. Of the latter, 3 per cent. were oak, and the other 10 per cent. teak, mahogany, furniture woods, house and door frames. Some of these cannot be grown in this country. The centre of gravity of these importations rests, however, in the coniferous woods, and these, or efficient substitutes for them, can be produced in these islands. As regards prices, it may be said that they fell from 1870 onwards to about 1888, owing to the great development of the means of transport by sea; from 1888 to 1894 they were steady, but then a reaction set in, so that the years 1894 to 1899 showed a gradual rise in prices equal to about 18 per cent. Then came the war in South Africa, which caused a temporary check, but during the last twelve months the effects of it have practically disappeared. In my opinion, we shall never again

see the low prices of ten to fifteen years ago, because the more accessible forests in the exporting countries have been heavily worked, if not exhausted, so that the timber for export has, year by year, to be carried over longer distances before it reaches the sea.

Sources of Timber Supply.

Before I proceed to deal with forestry in this country, let me say a few words about the sources whence this timber comes. In 1899 we received from Canada under 2 million tons, from other British possessions rather more than $\frac{1}{4}$ million tons, total for British possessions about $2\frac{1}{4}$ million tons; from foreign countries $7\frac{3}{4}$ million tons, total 10 million tons. The latter came from the following countries—Russia, about $2\frac{1}{4}$ million tons; Sweden, about $2\frac{1}{4}$ million tons; Norway, about $\frac{3}{4}$ million tons; Germany, rather less than $\frac{1}{2}$ million tons; France, $\frac{3}{4}$ million tons; United States of America, 1 million tons. But we are not the only importing country in Europe; on the contrary, most of them import timber. For example, Germany's net imports are $4\frac{1}{2}$ million tons a year; France, $1\frac{1}{4}$ million tons; Belgium, over 1 million tons; Denmark, nearly $\frac{1}{2}$ million tons; Italy, nearly $\frac{1}{2}$ million tons; Spain, nearly $\frac{1}{5}$ million tons; Holland, $\frac{1}{5}$ million tons; Switzerland, $\frac{1}{6}$ million tons; and Portugal, Bulgaria, Greece, and Servia, smaller quantities. The exporting countries in Europe are Russia with 6 million tons, Sweden $4\frac{1}{2}$ million tons, Austria-Hungary $3\frac{1}{4}$ million tons, Norway 1 million tons, and Roumania 60,000 tons. If you draw the balance of imports and exports for the whole of Europe, you find that there is an annual deficit of about $2\frac{3}{4}$ million tons a year, which are supplied by Canada, the United States of America, and smaller quantities from other countries.

Are Future Supplies Safe?

My reply is, "by no means." To begin with, the timber which we get from Germany is really only a re-export, because that country has a net import of $4\frac{1}{2}$ million tons a year. It has been known for some time past that Norway is working her forests with a deficit (by cutting more than grows annually). Sweden was hitherto considered as solvent in this respect, but a Parliamentary paper just issued gives a different account. Sir W. Barrington writes from Stockholm to the Marquis of Lansdowne, on the 18th March 1903: "Recent calculations estimate the annual consumption of

timber at some 1060 million cubic feet, which is said to be about 106 million in excess of normal reproduction." Here, then, is another of our most important sources of supply also working with a deficit. As to Austria-Hungary, very little timber comes to this country, because half their export goes to Germany and the bulk of the other half to various other countries, especially France. There remains, apart from a diminishing supply from Sweden and Norway, Russia. That country has enormous areas under forests, but it has still greater areas without it. Its population is rapidly increasing. Differing views are taken of Russia as to her capabilities of maintaining her export of timber. Some experts say that her resources are inexhaustible, others doubt it. My own opinion, having weighed the evidence on both sides, is that Russia is a somewhat doubtful factor. At any rate, there can be no doubt that the demand is increasing year by year, and that other European countries must reduce their exports. Then as to North America: the United States are no longer a real exporting country, because they import already more from Canada than they export. Thus we are reduced to Canada for making good the deficiency in Europe. That country is supposed to have about 266 million acres of timber lands, and she could, no doubt, supply the rest of the world with the necessary coniferous timber, if her forests were managed in a rational manner, instead of killing the goose that lays the golden eggs. There are also the peculiar conditions of the timber trade, and the great destruction wrought by forest fires, to be taken into account. In summing up this part of the subject, it may therefore be said, (1) that we require enormous and ever-increasing quantities of timber, (2) that prices in the future are likely to be higher than in the past, (3) that supplies from outside rest on a very unsafe basis, (4) that the increase of the afforested area in this country, especially by utilising the waste lands, is sure to lead to an increased demand for labour.

Steps to be Taken in this Country.

It is clear, then, that we must look about and see what we can do for ourselves in these islands. A detailed examination shows that we have plenty of land available for extended afforestation. There are altogether some 25 million acres, or 30 per cent., of the land in Great Britain and Ireland, which is either lying waste altogether or used for rough grazing, apart from their value as

shooting grounds. It is, no doubt, difficult to estimate the actual returns yielded by these lands, but I feel sure that I am within the mark when I say it is less than one shilling an acre all round. Some of the lands may yield up to half-a-crown, but enormous areas yield considerably below a shilling, even down to threepence an acre. We may safely say, then, that there is no lack of land obtainable at reasonable and even low rates. As regards the climate, there is practically nothing better to be desired, as far as the production of timber is concerned, however unpleasant it may be in other respects. We have, generally speaking, mild winters and cool summers. Of rain we have plenty, often too much, while snow and ice are not nearly so frequent as in other northern European countries. Unfortunately of gales and strong winds we have more than a fair share, but with proper management their injurious effect upon forest growth can be considerably reduced. On the whole our climate, at any rate up to the centre of Scotland, though it may not be equal to that of a great portion of France, compares very favourably with that of Germany, and there is absolutely no reason, in this respect, why we should not grow as good timber here as is done in Germany. Certainly, our climate is considerably more favourable than that of Norway, Sweden, and North Russia, whence we import some 6 million tons of timber a year. If home-grown timber has hitherto been considered inferior to timber imported from those three countries, it is due, not to the climate, but to the manner in which it has been grown. Conifers have been too heavily thinned while young, so that they yielded knotty timber with broad annual rings. Only let us grow our timber in the manner followed in France and Germany, the countries which share the honour of having developed the science and art of forestry, and we shall produce the same quality of Scotch pine (the red deal of the Baltic) and Norway spruce (the white deal of the Baltic) as that now imported into this country. It is the non-observance in this country of good sylviculture which is at fault, and not the climate. As regards hardwoods, and especially oak, it is asserted by leading timber merchants, that the quality of British-grown timber is actually superior to that imported from the Continent, but that the latter comes to us in better shaped, cleaner pieces, which again indicates faulty sylviculture in this country. On the whole, there is no doubt in my mind that we can produce just as good timber in this country as that now imported from other European countries, provided we put our shoulders to the wheel, and teach

our land agents and foresters correct sylvicultural methods. At the same time, we must not expect immediate results in all cases. In only too many instances the land has suffered in yield-capacity owing to continued exposure, and the subsequent dissipation of all organic matter. In such cases there will be some difficulty in the beginning, but if once more a suitable forest crop has been established on the areas, the producing powers of the land will increase in the same degree as organic matter accumulates in the soil. The loss of increment in the beginning is a penalty which we shall have to pay for neglect in the past.

Financial Aspect of British Forestry.

The next question you are likely to ask me is, "Will it pay to put land under forest in this country?" In answering that question we meet with great difficulty. Most naturally you would say, "Let us inquire what the results of forestry have been so far." That inquiry would lead to disappointing results, because, in the first place, it is almost impossible to obtain, in this country, data which would conclusively prove the case, either one way or the other; and, secondly, we can only estimate what the effect would be if rational sylvicultural methods were applied to the industry, accompanied by a more systematic management. As regards the first point, I must point out that those data which are available are almost invariably vitiated by the fact that many items are included under expenses which have little or nothing to do with forestry by itself. For instance, you find heavy payments for fences which ought to be charged against shooting rents or enjoyment of the chase, or even against the cultivation of adjoining land, to keep the cattle out of the woods. In other cases, fancy roads are kept up for the benefit of the proprietor. As regards the second point, I have no hesitation in saying that the returns might in many, if not in most cases, be doubled by following the rules of rational sylviculture and by systematic management. (Here Dr Schlich gave an illustration from the experience of Saxony, and quoted the figures which will be found on p. 221 of this Part.)

Objects of Management.

The management of forests depends on the objects which it is proposed to realise. It rests with the proprietor, in so far as his

choice is not limited by the laws of the country, to determine in each case what these objects shall be, and it then becomes the duty of the forester to see that they are realised to the fullest extent, and in the most economic manner. Here you have the fundamental principle in a nutshell. In these islands nearly the whole of the woodlands belong to private proprietors. They desire, in the majority of cases, to have the woods so arranged that they either lend themselves to landscape beauty, or to the rearing of game, or to the production of a particular kind of produce required in the management of estates. Either one or more, or sometimes all these objects, have to be kept in view. Where this is the case, the economic working is sometimes altogether out of the question, or, at any rate, considerably interfered with. And yet, even in such cases the objects of the proprietor may be realised, and the woods can be made to yield, if not a full, at any rate a fair return, while the proprietor must put down any deficiency in the return against his pleasure, or against shooting rents, or the benefits derived by the rest of the estate.

Economic Forestry.

Where, however, the manager is not hampered in this way, and where economic forestry is aimed at, as it would generally be in the case of extended afforestation of waste lands, the question of finance would stand in the foreground. The forester must decide what to plant, how to plant, and how to treat his woods, so as to realise the highest possible net returns. The answers to all these questions involve practically a treatise on sylviculture and forest management, which your Professor will no doubt propound to you. On this occasion I can only offer a few general remarks. The financial results may be said to depend chiefly on (1) the soil you have to deal with, (2) the average annual production of the several species, (3) the value per cubic foot of timber, (4) the cost of planting and subsequent treatment, (5) the degree to which the trees are exposed to injury, and last, but not least, the rate of interest on the money invested in forestry.

Rate of Interest.

It has been said in public by an eminent botanist, "that no British landowner will invest money in forestry unless he is assured

of 4 per cent. on his money." But, I say, is this reasonable? What other investment of equal security gives 4 per cent. in these days? Does agriculture proper give 4 per cent.? Why should forestry be expected to give a higher per cent. than agriculture? Let us consider the case of consols for a moment: they give nominally 2½ per cent., but look at the ups and downs which they undergo. A few years ago they stood at 112, now they are quoted at 88, a fall which represents 10 years' interest. Such fluctuations do not occur in forestry. Once that industry has been established on a safe basis it yields a steady income, and the capital is safe from anything like the fluctuations to which consols are subject. In my opinion, forestry, conducted on proper lines, offers an investment at least as safe as consols, and it seems to me unreasonable to expect more than 2½ per cent. from it. There are millions of acres in these islands fit for planting, which are valued at such a low rate that they can be made, if put under forest, to yield steadily 2½ per cent. and more. At the same time, I must lay stress on the fact that all forest operations must be conducted in a truly economic manner. Extravagance has no place in forestry, or in agriculture either.

Soil.

In coming to the question of soil, I desire to impress upon you this fundamental rule: "Never attempt to plant a species which is not thoroughly suited to the locality, that is to say, soil and climate." Every disregard of this rule is likely to lead to financial loss. It is quite astonishing how often this rule is sinned against. Sometimes the planter has not a sufficient understanding of what is the species most likely to thrive best in a given case. This shortcoming must be met by proper instruction, such as you will, henceforth, no doubt receive at this College. In other cases the planter has developed a fancy for a certain species, and he proceeds to plant it under all circumstances. This is a most disastrous failing, which the forester must combat with all his might. The subject must be approached with an open mind, and all personal fancies must be absolutely put on one side. No doubt the selection of the right species is a very difficult task, and the subject must be studied in detail. As a general proposition, it may be said that "heavy soils are better adapted for broad-leaved species, and lighter soils for conifers." This rule is, however, not without exception. Spruce, for instance, does very well on heavy soil. There is a medium class of soil, which

I shall call loam, which practically suits any of our forest trees; in the same degree as you proceed to heavier soils, the conifers retire, and *vice versa*. Again, some species, to do really well, require a fertile soil, like sycamore, ash, oak, and elm; others are somewhat less exacting, like chestnut, beech, and silver fir; next come Norway maple, lime, alder, larch, and spruce; less exacting again, willows, poplars, birch, Weymouth pine, Scotch and Austrian pine. There are, of course, many other points to be considered, and the forester must make his choice accordingly.

Average Annual Production.

We have as yet in this country very few data which throw light on the possible average production of the various species. The matter is complicated by the fact that certain species grow fast from the very start, while others grow slow at first, but make up for it by growing faster later on. Both in Germany and in France the collection of statistics on the question under consideration has, during the last twenty or thirty years, been most actively prosecuted, so that a great mass of information is now available, although it is not yet complete. We have now tables giving detailed information of the progress of woods of beech, Scotch pine, spruce, and silver fir; provisional tables for oak, larch, and some other trees. The best available data show that on a locality of average yield-capacity in the use of each species, and under proper sylvicultural treatment, larch and ash give the greatest average production under a rotation of about 70 years; Scotch pine under a rotation of about 80 years; spruce, 90 years; beech and silver fir, 120 years; and oak, 130 years. On fertile soil the culmination occurs earlier, and on inferior soils later. If worked under that rotation, we can count on an average production in the way of timber as follows: Ash, about 40 cubic feet per annum; oak, 46 cubic feet; beech, 57; Scotch pine, 70; larch, 73; spruce, 84; and silver fir, about 111 cubic feet per annum. Placing the value per cubic foot for oak and ash all round at 1s. 5d., beech 11d., larch 11d., Scotch pine and silver fir 8d., and spruce 7d., larch gives the highest annual money production and spruce the lowest. But it must be remembered that the mean annual production culminates at different periods, that of oak being as much as 130 years, whilst that of spruce is 90 years.

The Cost of Planting.

Economy in planting is of great importance, because compound interest on the original outlay must be allowed for a long period of time. Generally speaking, the cost of planting is greater in the case of broad-leaved trees, such as oak, ash, and sycamore, and smallest in the case of conifers, such as larch, Scotch pine, and spruce. The exotic Douglas fir makes an exception, because its seed is as yet expensive. For argument's sake we may place the cost of planting an acre with spruce at £3, 10s.; Scotch pine, £4; larch, £4, 10s.; beech and silver fir, £5; oak and ash, £6. Charging compound interest at the rate of $2\frac{1}{2}$ per cent., we find that the cost of planting amounts at the time of cutting over the wood, in the case of larch (at 70 years) to £25; Scotch pine (80 years), £29; spruce (90 years), £32; ash (70 years), £34; silver fir (120 years), £97; beech (120 years), £97; oak (130 years), £149.

Value of Soil for Forestry.

I cannot take you through all the intricacies of the calculations, but I may say that, based upon the above considerations, and additional data which I cannot now place before you, I have calculated the amount which a proprietor may pay for land if he wishes to plant certain trees and get $2\frac{1}{2}$ per cent. on the invested capital. I have then, to keep on the safe side, deducted 25 per cent. from the amount thus obtained, and I find that he may pay for his land the following sums per acre: for planting oak £9, 11s.; beech, £9, 17s.; Scotch pine, £14, 5s.; spruce, £15, 1s.; silver fir, £16, 6s.; ash, £24; larch, £34, 2s. That is to say, if he obtains the land at a lower rate, he gets more than $2\frac{1}{2}$ per cent. on his investment; if he pays more, he gets less than $2\frac{1}{2}$ per cent. You will observe that larch pays best by far, ash comes next, while oak stands last.

External Dangers.

Here the hardwoods have a decided advantage as regards insects, fungi, fire, gales, etc. Spruce and Scotch pine are especially exposed to insect attacks, also to fungus attacks, but the most serious thing of all is the liability of larch to be attacked by the canker produced by *Peziza Willkommii*. Indeed, this fungus has now spread to such an extent in these islands that few

places will be found where it does not occur. The appearance of this fungus makes the planting of larch in future highly problematic. Great efforts have been made to get at the bottom of this disease, but the results are, up to date, not satisfactory. The *Peziza* is a wound parasite; that is to say, the tree must have been injured in some way, to break the bark and let some sap flow out, to enable the spores of the fungus to germinate. Different opinions are held as to how the injury has been caused. Causes have been given as damage by frost, the attacks of the aphis *Chermes laricis*, hail, wind, and what not. Dr Massie, of the Royal Gardens at Kew, has lately published an article on the subject in the Board of Agriculture's Journal.[1] That article does not contain much which was not known before, but it contains one view which I do not consider correct. Dr Massie maintains that the disease is chiefly due to the damage done by the aphis, inasmuch as the canker generally commences somewhere around a branch, and the aphis mother settles in the angle of the branch with the main stem. This is very ingenious, and I have no doubt that the attacks of the aphis may cause the damage. But, on the other hand, the canker appears where there is not an aphis within miles around. I have just condemned and cleared away a larch wood seventeen years old because it was ruined by canker, and I have never seen an aphis within five miles of the wood, although I have watched it for the last eleven years. My personal opinion is that we have not yet got to the bottom of the matter, but that probably snow, ice, and wind have more to do with it than the aphis. If heavy snow or rime settles on the tender branches they are pressed down, and probably small rents are caused where the branch joins the main stem. Sap flows out, and gives the spores the means of germinating. It is not improbable that strong wind causes the damage. Unfortunately the result is that the pure larch woods must be given up. The only way to proceed is to plant a sprinkling of larch into other woods. In that case it has a better chance of escaping the disease, and if not it can be cut out in the thinning without ruining the rest of the wood.

Indigenous Trees versus Exotics.

To sum up, in my opinion the best plan in economic forestry in this country is: Plant ash, sycamore, and oak on lands which

[1] Reprinted in last year's *Transactions*, pp. 25-36.

are thoroughly suited to them; and conifers, such as Scotch pine, spruce, Corsican pine, and perhaps others on the rest, in either case with a sprinkling of larch. On wet lands, probably, poplar pays best. There can be no doubt that it is desirable to make experiments with such exotics as are likely to suit our climate and soil, but we must be careful not to be carried away by enthusiastic recommendations. It stands to reason that the indigenous species have stood the test of climate, soil, and other conditions, and we know what we may expect of them. Planting exotics, except on an experimental scale, is always a risky matter, until actual experience has shown decided results; and that takes, unfortunately, a long time. There is no knowing what diseases exotic trees may develop, and I think the case of the larch is a case in point. Still, the larch has done us good service, at any rate for a time, and there are other exotic species which may do the same. Amongst the latter, the three most promising are the Douglas fir, the Weymouth pine, and the Corsican pine. The last-mentioned produces a straighter stem than *Pinus sylvestris*, and suffers less from rabbits. The Weymouth pine gives heavy crops of timber; it is the species which yields the Canadian white pine. Above all, however, the Douglas fir deserves attention. There are two varieties of it, the Atlantic or Vancouver variety, and the Colorado variety. The former is a marvellously fast grower, but it is not quite so hardy as the other. The Vancouver variety is to be recommended for the south and west of England and Ireland; the Colorado, or slower growing variety, for the north of England and for Scotland. The Douglas fir gives a yield that beats the larch in its palmiest days, and I may mention a wood of it on the estate of Lord Ducie which made a most favourable impression upon me. There are, no doubt, other exotic trees which deserve attention, but, as I have said already, we should be careful to avoid planting them on any considerable scale until actual experience has shown that they are superior to our indigenous trees, for, as the old proverb puts it, "A bird in the hand is worth two in the bush."

In Conclusion,

Dr Schlich said forestry was an industry based upon science. It could not be studied in the class-room only, but there must be instruction and observation in the forest. The treatment of woods differed with every change of conditions, and it was

necessary to observe the development of their woods from the time the seed was laid down till the wood was finally cut over. Above all, continued action and treatment were essential. The want of these had been one of the principal causes why the industry of forestry had not been more developed in this country. However, there seemed to be a little forward movement going on now. Lord Onslow's predecessor appointed a committee some eighteen months ago which had led to the provision, in the first instance, of instruction for those interested in the forest industry, such as proprietors, land agents, and woodmen. That would be developed at that College, and he hoped similar measures would be taken by other agricultural colleges in the country, and also by our leading universities. Steps had also been taken by the Commissioners of Woods for the instruction of woodmen and forestmen on a small scale in the Forest of Dean, where the men received instruction on two days and worked the other four. He wished the students before him all success in the prosecution of their studies in that new branch of work, and he thanked them for the way they had listened to his humble endeavour.

XXII. *The Management of Fire Protection Lines in Scots Fir Forests.* By Dr Kienitz. Note by A. C. Forbes.

In several articles in the *Zeitschrift für Forst und Jagdwesen* which appeared in 1901-2, Dr Kienitz, Forstmeister in charge of the Chorin forest (visited by the Royal Scottish Arboricultural Society in 1895), dealt with the question of managing those strips of land in Prussian fir forests which run parallel to the railway lines, and which are maintained and managed to prevent fires breaking out, through engine sparks, in the forest behind. At the outset, Dr Kienitz called attention to the fact that at least half a dozen systems of managing these lines often exist within as many miles, and that it is impossible to lay down rules regarding them which could be followed with advantage in all cases. About 2 miles of railway line run through the Chorin forest; and careful attention to the subject convinced the Doctor that the maintenance of the adjoining fire lines was far too costly a process, and that equally good results might be obtained by cheaper methods.

The police regulations for the maintenance of these lines date back to 1856, according to which the ground on either side of the line, for a distance of 8 to 16 yards, was to be broken up and kept clear by the railway authorities. This ground could either be utilised for growing green vegetables or potatoes, or could be planted with hardwood, underwood, young conifers, or fruit trees. The coniferous crops behind had to be thinned out and pruned up for a farther distance of 8 to 16 yards, in such a way that the companies could clear the ground of grass, moss, heather, etc., and break it up in the desired manner.

The principle of securing the safety of the adjoining forest by keeping the surface of the ground of the first line cleared of all surface growth only, while utilising it for a forest crop, was not fully recognised; and considerable areas of ground were and are left bare which might well have been put to use, while the expense of keeping down the surface growth has still to be incurred. In other cases, again, lines may be seen on which an attempt has been made to grow hardwoods, which have succeeded only on the fresher and less exposed ground. On the drier and poorer soils, such attempts have not only been attended with great expense, but also with indifferent results. On such spots it is generally considered necessary to maintain within the forest a second line of defence, which is intersected by ditches in such a way that a ground fire would be checked.

Dr Kienitz then reviews the various orders and regulations which have been issued from time to time on the subject of these lines. In the first place, and before the days of excessive traffic, the authorities allowed the forest to come close up to the line, or rather to the edge of the embankment or cutting, as the case might have been. After the occurrence of fires in various parts, the order was issued to break up the ground at a given distance from the line, and the forest guards were instructed to patrol the sides of the line in dry weather, and at such times as trains were due to pass through. The next method adopted was the digging of banks and ditches about 1 chain from the line and parallel to it. At intervals of 30 yards other ditches ran at right angles from these to the slope of the permanent way, so that a fire breaking out between them might be easily controlled. It was not until 1864, twenty-two years after the opening of the line, that a strip of ground 50 feet wide was cleared of forest on either side of the bare or cropped area, and this strip was rented by the railway authorities, who undertook to keep a ditch 6 feet broad and 4 feet deep clear of surface growth along the boundary. The effect of this broad, bare strip was, however, not sufficient to prevent fires, and in 1868 about 100 acres of Scots fir, about twenty-five years of age, were burnt.

Since that time sufficient attention has been paid to the protection lines to prevent serious damage being done. When the railway line was taken over by the Government in 1880, a more elaborate system was organised to ensure the safety of the adjoining forests, and, according to present arrangements, the following method is adopted. Each year the ditches which intersect the bare strips are completely cleared of all growth before the 15th of March, while the ground between them is cleared of all dead vegetable matter which would feed a surface fire. Coniferous woods which are at all liable to ignite, and stand on the second line, are thinned, cleaned, and pruned to a degree which hinders the occurrence of crown or branch fires. After the felling of the crop on the second strip, the ground is to be replanted with hardwoods; or if the soil does not allow this, the felling is to be delayed until the main crop behind has outgrown the most dangerous stage for fire injury. Since 1887, the Railway Department has been in favour of letting the cleared strip for the growth of crops; but as this is only practicable on the better class of ground, the poorer soil has been planted with

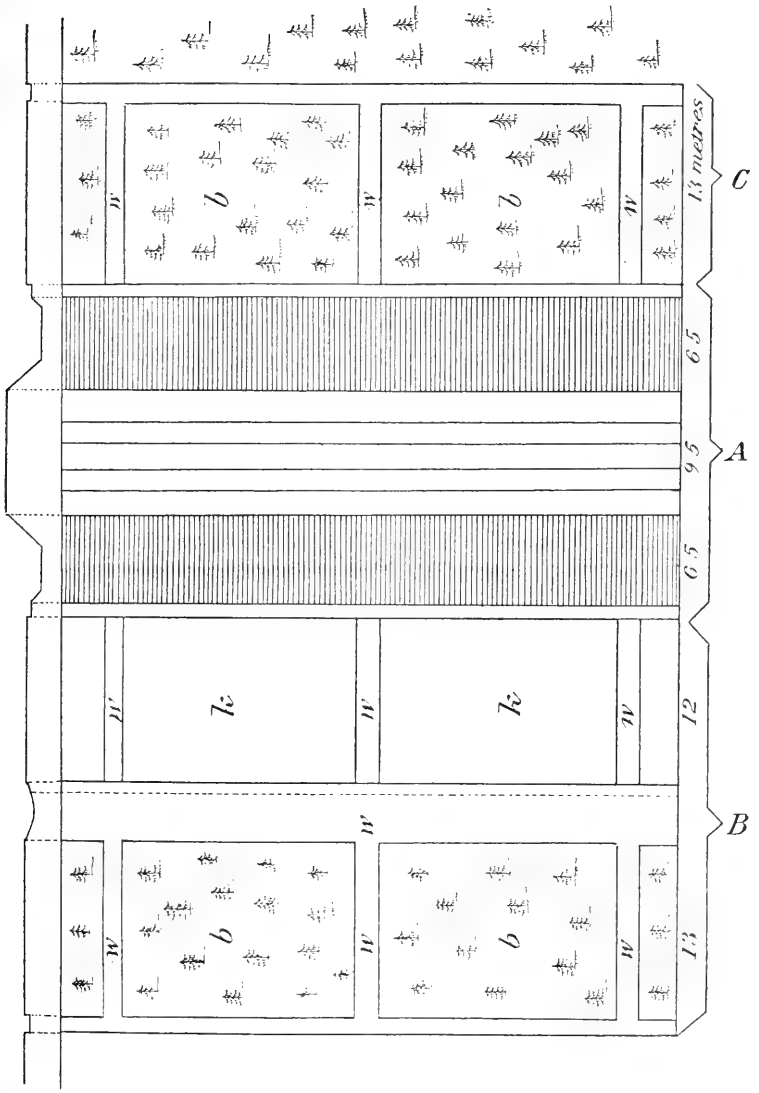
hardwoods and worked on short rotations. The planting has been carried out more or less generally, but where the ground is poor, and the danger from fire greatest, it has proved a failure; the young hardwoods have been killed by surface fires, or, where the soil is cleared to an extent which prevents this, they have been smothered by drifting sand. Behind this second strip again, banks and ditches are cut to check surface fires.

The above method of protecting the forest is explained in the following plan, which is the usual method in the Chorin forest.

This method is effectual enough, as is proved by the fact that no forest fire has occurred from engine sparks, although innumerable fires have broken out in the protection lines. But the pecuniary sacrifice entailed in their maintenance is very great. Apart from the strips of ground leased by the Railway Department, and which have a nominal breadth of 25 yards, but which are actually often wider, there are the strips behind which have to be stocked by the Forest Department with an unprofitable crop of hardwoods. But another disadvantage of the present system lies in the fact that the height attained by this hardwood crop is rarely sufficient to intercept all the sparks, many of which are carried into the forest beyond, where the fires resulting from them are stopped by the cross ditches. Under the present system, again, the Forest Department has not only to bear the cost of planting this unprofitable crop, but is also saddled with the expense of cutting trenches in the section of forest behind, and of the pruning and thinning of the trees, without any compensation. The Railway Department, on the other hand, has to keep clear the ditches and the ground on the first bare section, and has also to pay compensation for actual damage done by fires in the tree crop behind.

It is to the interest of both Departments, therefore, that the desired object should be attained in the least expensive manner, and should, at the same time, render the protection lines thoroughly effective by preventing fires beyond their zone of influence. The essential conditions for the accomplishment of this purpose are—(1) the absence of all combustible material on the surface of the protection lines, or the existence of ditches broad enough to prevent fires spreading beyond them; and (2) the existence of a crop of trees on the lines capable of preventing sparks from flying beyond them.

So far as the first condition is concerned, it has long been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known that nothing checks a surface fire better than bare sand or soil. Surface vegetation which is sown or planted for the purpose, does not answer at all times or at all seasons of the year. The cultivation of annual crops, such as lupines or potatoes, will prevent a surface fire, but a perennial plant does not exist in Europe which will cover dry ground with noncombustible stems and leaves, such as those possessed by a Mexican *Opuntia*, and yet leave no gaps between it. Researches made in the Chorin forest with different perennial plants, with a view to prevent surface fires, have proved the difficulty of finding one which fulfils the desired conditions. Lupines and *Lathyrus sylvestris* do not succeed on poor ground. Gorse will grow into bushes, but the dry twigs burn like matchwood. *Caragana frutescens* burns with the grass which grows up amongst it. Nothing remains but to grow annual crops, or to break up the surface of the ground.

So far as the second condition is concerned, it is generally considered that the tree crop best adapted for intercepting sparks should consist of hardwoods, as these suffer less from fire than conifers. But a great deal of the ground in question will not grow hardwoods. Only a few hardwoods will grow on the moderately fertile soil, on the poorest they fail altogether. Larch, oak, poplar, robinia, and birch are the most easily satisfied, but on ground most in need of protection the planting of these lines with hardwoods merely remains a pious wish, and where planting has been done, only a crippled growth remains as evidence of the work. But apart from this, these bare lines or stunted crops do not fulfil the object aimed at. Sparks have been known to fly 40 yards over them, and to cause fires in the forest beyond. A broad, completely barren strip, which does not lead to any satisfactory result, but for which rent has to be paid, and labour to be expended in keeping it clean, is an expensive property, and is not a desirable acquisition. The only tree which will grow on these strips and keep green throughout the year is Scots fir. It is not such a good fire resister as some trees, yet it is the best for keeping green the whole year through. It is only destroyed by fire when the flames spring up from below, not by sparks falling into the crowns, as these are caught and extinguished before they do any injury. Hardwoods not only require better ground, but during March and April, the most dangerous months of the year, they are bare of foliage, and do not

act as efficient spark catchers. All forest fires begin as surface fires, and when the crowns of the trees are close to the ground, the flames spread to them without difficulty. But when the crowns are high, and beyond the reach of the flames, they remain practically uninjured, and it then only becomes a question as to how much heat the stems are able to bear. The power of resisting heat is acquired by the Scots fir very early; stems of an inch or two in diameter acquiring a bark thick enough to char outwardly without damaging the vitality of the tree, while birch of the same size is much more sensitive, and oak, beech, hornbeam, etc., on account of their thin periderm, are quickly destroyed. A Scots fir plantation, therefore, can be made secure against fire provided that precautions are taken to prevent the fire from reaching the crown, and that the heat is not sufficient to injure the stem. The height to which the flames will rise, and the heat of the fire, depend upon—(1) the quantity and condition of the combustible material on the surface, (2) the density of the crop, and (3) the area over which the fire extends. These three factors can be regulated to some extent by the forester; but the violence of the wind and the dryness of the air are conditions over which he has no control, though they have a considerable influence upon the fierceness of a fire. As a general rule, the drier grounds, on which fires most frequently occur, have only a scanty surface covering of moss, lichens, stunted grass, and herbs, between which the dry needles of firs or leaves of hardwoods lie. To prevent surface fires with this kind of covering, it is sufficient if the trees are pruned up for the first 3 feet from the surface, and the fallen branches or other combustible material raked up, provided that the trees are not too dense, nor the area too large. But with heather or thick turf, the trees must be pruned for at least double this height. The thick bark of young Scots fir proves sufficient protection only when every tree stands free, otherwise the flames will rise between two stems to a dangerous height. Care must be taken that each tree stands singly, or at least a yard from its neighbour, but, at the same time, too wide distances must be avoided, as these would allow sparks to fly through the belt. Scots fir of fifteen to twenty years of age is generally safe against surface fires which have not embraced wide areas, and they are, at the same time, able to hinder sparks from reaching ground behind them.

With surface fires covering a wide area, the heated air enables

the flames to reach a height which would be out of the question in the case of small fires. The area of the protection lines, therefore, must not exceed a certain size, but must be divided by a ditch or path from the rest of the wood, so as to restrict the surface fires to dimensions which render crown fires impossible. How broad a protective strip should be has not been definitely determined. According to Dr Kienitz's observations, the correct breadth lies between 40 and 50 feet, provided that this area is stocked with Scots fir of about 20 to 50 feet in height, without large gaps, and that the branches of the trees are pruned up as much as possible. It has been noticed that bare lines in the Chorin forest have been naturally seeded with Scots fir in many places, and that these natural groups prove effective spark interceptors, while they are not injured by surface fires when pruned up and thinned out to the proper extent.

Dr Kienitz lays down the following rules for the management of fire lines in Scots fir woods; he considers that they are based on more economical principles than those hitherto followed. When a new line is laid through a forest, it is desirable that the Railway Department should purchase all land adjoining the line which is required for storing material, the erection of telegraph lines, etc., and that also which must be kept clear of wood for the proper working of the signals. The Department should then maintain clear tracks of a yard in breadth along the boundary of this land, so that fires breaking out on it may not extend beyond it. Parallel to these tracks, and from 40 to 50 feet inside the standing wood, the ground should be intersected by cross tracks kept clear of all surface growth; these would prevent fires breaking out between them from spreading farther. The trees standing on the area so intersected should be pruned up at least 5 feet high by the Forest Department, but at the cost of the Railway Administration, and all dead branches should be taken off annually. The wood should be thinned out to a distance of 3 feet from tree to tree, and care taken that all blanks are filled up. The surface of the ground should be cleared of all inflammable material, such as dry grass, heath, etc.; but the light covering of very poor soils might be left for the benefit of the crop. In plantations under eight years of age, the ground between the trees should be broken up until they have reached a height of 8 feet, when they can be pruned up as described above. In case sparks are found to fly over and through this

line, a second line behind the first must be prepared and maintained in the same way, until the latter becomes more effective. As old timber forms a more imperfect protection against sparks than a young crop, and as the former is more likely to prove dangerous to telegraph lines or endanger the permanent way itself if overturned by wind, the trees on the protection line should be worked on a short rotation. When the crop is felled, however, a temporary strip behind must be provided with cross tracks until the ground in front is again stocked with trees of the required height. After the felling, the ground should be replanted with ball-plants at 4 feet apart, and the ground between should be broken up for several years. After the trees have reached a height equal to that of the engine funnels, they may be considered an effectual protection, and the further breaking up of the ground may cease: in order to hasten this stage, the effect of artificial manures on the young trees may be tried on poor ground.

By carefully carrying out the above rules, the maintenance of bare and unprofitable strips of ground becomes unnecessary, and it may also be possible to utilise the bared tracks as footpaths or roads. When the traffic is insufficient to keep down surface growth, a grubber or horse-hoe must be run over them occasionally for this purpose; the cost of doing this need not be more than 16s. to 20s. for a length of $2\frac{1}{2}$ miles or so, and in thinly inhabited districts, with long lines of railway, it is an invaluable method of safeguarding the adjoining forest.

In a note appended to the reprint of the above article, Dr Kienitz calls attention to the suitability of these protection lines for the growing of telegraph poles for the Post Office. These poles must be clean, straight, and with little taper, and are usually obtained in Germany by taking out dominant trees in middle-aged forest, which ought properly to stand until the end of the rotation. Dr Kienitz thinks it might be arranged to grow a large proportion of such poles on these fire lines, and thus to supply the requirements of the postal authorities, and protect the forests from fire in one and the same operation, as the low rotation naturally lends itself to the task.

Possibly many of our large Scots fir plantations in Great Britain through which railway lines run, and which often suffer from fire in dry summers, might be protected in the same or in a modified form of the same manner as the German forests.

XXIII. *Forestry at the University of Edinburgh.*

By Colonel F. Bailey.

The teaching of Forestry at the University of Edinburgh was begun in 1889, and the Class has been conducted annually without a break until the present time. In 1891-92, owing to a change of lecturer, the course was a short one, and no fee having been levied, the Class was attended by 40 persons, 12 only of whom presented themselves for examination. Taking these 12 as the *bona fide* students of that year, and omitting the other 28, the total attendance up to and including 1902-3 has been 112, and the yearly average has been 8. The average of the last three years has been 10, which is also the number in the current year, 1903-4.

Students may join the Forestry Class without preliminary examination. If they do not intend to graduate in Agriculture, they are permitted to pay a University Entrance Fee of 5s. only, in lieu of the ordinary Matriculation Fee of £1, 1s. The smaller fee does not, however, entitle them to a Class Certificate, nor does it confer on them any other University privilege. The Class Fee is £3, 3s.

The Class meets during the Winter Session of the University, the lectures commencing about the middle of October and concluding towards the end of March, with a Christmas vacation of about a fortnight.

The prescribed number of meetings of the Class is 100, the time available for each lecture being one hour. In 1902-3 the work of the Class was arranged as follows, viz.:—

Lectures.

Subject.	*No.*
Introductory,	1
The Principles of Sylviculture (Text-book, Dr Schlich's Vol. I.),	16
The Formation and Tending of Woods (Text-book, Dr Schlich's Vol. II.),	23
Protection of Woods against Injuries,	20
Structure, Physical Properties, and Defects of Timber,	7
Utilisation of Forest Produce,	11
Systematic Forest Management,	7
Uses and Effects of Forests,	3
Total No. of Lectures,	88
Class Examinations,	3
Excursions,	9
Total Meetings,	100

The excursions, which occupied fourteen hours in actual work, were made to woods, nurseries, timber-yards and works in neighbourhood of Edinburgh.

The Degree in Agriculture, with Forestry taken as part of the Curriculum.[1]

I. *Preliminary Examination.*

The following Preliminary Examination must be passed, at not more than two sittings, before the candidate presents himself for any part of the First Science Examination, but not necessarily before he enters on his curriculum :—

1. English.
2. One of the following : Latin, Greek, French, or German.
3. Mathematics.
4. One of the following : Latin, Greek, French, German (if not already taken), Italian, or such other language as the Senatus may approve, Dynamics (Elementary Statics and Kinetics of Solids, Liquids, and Gases).

The Fee for this examination is 10s. 6d.

II. *Courses of Instruction.*

Candidates must, in the course of three academical years (*i.e.*, three Winter Sessions, or two Winter Sessions and three Summer Sessions), attend eleven courses of instruction, viz. :—

1. Mathematics or Biology (*i.e.*, Zoology and Botany).
2. Natural Philosophy.
3. Chemistry (including Practical Chemistry).
4. Agriculture and Rural Economy.
5. Agricultural Chemistry.
6. Geology.
7. Veterinary Hygiene.
8. Agricultural Entomology.
9. Economic Science as applied to Agriculture.
10. Forestry.[1]
11. Engineering Field Work.

Some of the above are full courses and some are half courses. At least five full courses or their equivalent (counting two half

[1] The Regulations provide that Experimental Physics or Engineering may be substituted for Forestry. Full details regarding the Degree in Agriculture will be found in the *Regulations for Graduation in Science*, obtainable from Mr James Thin, 55 South Bridge, Edinburgh. Price 2d.

courses as one full course) must be taken at the University of Edinburgh, and these must include the course in Agriculture and Rural Economy. The remainder of the courses may be taken at any institution recognised for the purpose by the University Court. Residence and practical work at a farm are required to such an extent, and under such regulations, as may from time to time be prescribed. At present the period of such residence must not be less than twelve months.

III. *Examinations.*

(A) *First Science Examination.*—There is a First Science Examination, for which the three following courses in the University qualify, viz.:—

1. *Mathematics* (*Full Course*).
   Winter Session, 100 Lectures. Fee, £3, 3s.

or, alternatively—

Biology (*Zoology and Botany*) as follows:—(*Each a Half Course, together a Full Course*).

(*a*) *Zoology* (*Elementary*).
Winter or Summer Session, 50 Lectures.
Fee, £4, 4s.

Practical Zoology (*Elementary*).
Winter or Summer Session, 50 Meetings.
Fee, £2, 2s.
(with 10s. for Laboratory Expenses).

(*b*) *Botany.*
Summer Session, 50 Lectures. Fee, £4, 4s.

Practical Botany.
Summer Session, 50 Meetings. Fee, £2, 2s.
(with Garden Fee of 5s.)

2. *Natural Philosophy* (*Elementary Dynamics and Elementary Physics*)—*Full Course.*
   Winter Session, 100 Lectures. Fee, £3, 3s.
3. *Chemistry* (*Full Course*).
   Winter Session, 100 hours. Fee, £4, 4s.

Practical Chemistry.
Winter or Summer Session, 50 Meetings. Fee, £2, 2s.

The Fee for the First Science Examination is £3, 3s.
(or £1, 1s. for each subject).

(B) *Final Science Examination,* for which the following University courses qualify:—

4. *Agriculture and Rural Economy* (*Full Course*).
   Winter Session, 100 Lectures and 10 Field Demonstrations. Fee, £4, 4s.
5. *Agricultural Chemistry* (*Full Course*).
   Winter Session, Lectures and Practical Work, about 100 hours. Fee, £3, 3s.
6. *Geology* (*Half Course*).
   Summer Session, 25 to 30 Lectures, 10 Demonstrations in Laboratory, and 8 Field Demonstrations. Fee, £3, 3s.
7. *Veterinary Hygiene* (*Half Course*).
   Winter Session, 15 Lectures and 1 or 2 Demonstrations at Veterinary College. Fee, £1, 1s.
8. *Agricultural Entomology* (*Half Course*).
   Winter Session, about 20 hours. Fee,[1] £2, 2s.
9. *Economic Science as applied to Agriculture* (*Half Course*).
   Winter Session, 50 Lectures. Fee, £2, 2s.
10. *Forestry* (*Full Course*).[2]
    Winter Session, 100 Lectures. Fee, £3, 3s.
11. *Engineering Field Work* (*Half Course*).
    Summer Session, 75 hours. Fee, £3, 3s.

The Fee for the Final Science Examination is £3, 3s.
The Matriculation Fee of £1, 1s. is paid annually.

An agricultural student desirous of qualifying also as a forester should, at the Preliminary Examination, take up both German and French, or at least one of those languages; and he should unquestionably take the University course of Biology in preference to that of Mathematics. The fees for the above three years' curriculum, including matriculation and examination fees, amount to less than £52; but the class fees of all qualified students are payable by the Carnegie Trust.[3]

[1] Free to present and past students of the class of Agriculture and Rural Economy.

[2] The Regulations provide that Experimental Physics or Engineering may be substituted for Forestry.

[3] Three qualifications are at present demanded of students applying for payment of Class Fees by the Carnegie Trust. The Applicant (1) must be over sixteen years of age; (2) must be of Scottish birth or extraction, or must have given two years' attendance after the age of fourteen at a school or institution under inspection of the Scotch Education Department; and (3) must be qualified by Preliminary Examination under the ordinances of the Scottish Universities' Commission, and the regulations of the Joint Board of Examiners, to attend the classes for which payment of fees has been claimed.

It is interesting to compare the above curriculum of study with that laid down for the British students who were formerly admitted as candidates for the Indian Forest Service to the French Forest School at Nancy. The figures indicate in both cases the number of hours occupied in class work under the Professors.[1]

	In Edinburgh.	At Nancy.[1]
Forestry proper,	90	156
Botany,	100	117
Zoology,	100	
Geology,	35	117
Agricultural Entomology,	20	
Economic Science,	50	39
Natural Philosophy,	100	See Footnote[2] (v.).
Chemistry,	150	
Agriculture,	100	39
Agricultural Chemistry,	100	
Veterinary Hygiene,	17	...
Engineering Field Work,	75	132
	937	600
Engineering Drawing,	...	388
French Law,	...	156
Totals,	937	1144

[1] The time compulsorily spent by the Nancy students, in their class-rooms, working without the supervision and assistance of the Professors, is not included. It certainly did not exceed that which is devoted by the majority of the University students to private study in their own rooms.

[2] Before entering the Forest School at Nancy, candidates were required to pass an examination in the following subjects, viz.:—

(i.) English Writing from Dictation, and English Composition.
(ii.) Arithmetic in all its branches.
(iii.) Algebra, up to and including the Binomial Theorem.
(iv.) Elementary (Five Books of Euclid) and Plane Trigonometry.
(v.) Elements of Mechanics, Physics, and Chemistry.
(vi.) Surveying, Land Measuring, Plan Drawing, and the Use and Adjustment of Instruments.
(vii.) A competent knowledge of French.

A preference was given to candidates who, in addition to the above, showed proficiency in translating from French, in the elements of Botany, Geology and Mineralogy, and in Freehand Drawing.

Work on excursions during the progress of the courses of lectures occupy the Edinburgh students about 120 hours, as compared with 100 hours similarly spent by the Nancy men; but the latter had the further great advantage of a summer course, occupied as follows (the figures indicating days):—

	Out of Doors.	In Study.	Total.
Sylvicultural Excursions, . .	19	7	26
Exercises in Working Plans, .	15	9	24
Botanical Excursions, . .	3	1	4
Geological Excursions, . .	2	1	3
Surveying, ...	32	18	50
Total days, . .	71	36	107

It will be seen that if the time spent during the Winter Session at Nancy on French Law and the not very useful course of Engineering Drawing be neglected, the work done in Edinburgh compares very favourably both as to quantity and quality with that done at Nancy, even though it be admitted that at the latter school the course in Botany, and some other courses, were specialised in a way that may at present be impossible here.

During the past eight years twenty students have taken the Agricultural Degree, with Forestry as one of their subjects. Of the six men who did so during the year 1902-3, all but one took up Biology in preference to Mathematics.

It may reasonably be hoped that, should the Government give effect to the recommendations of the late Forestry Committee, and provide a suitable and accessible practical training ground in Scotland,[1] on which students could reside for a length of time sufficient to enable them to acquire a sound knowledge of practical forest work, or should some other satisfactory arrangement be made for their practical instruction, the University will confer a Degree in Forestry distinct from that in Agriculture. The curriculum of study for the proposed Degree would, after certain necessary modifications, remain, at first at any rate, much the same as that now prescribed for the Degree in Agriculture, with a compulsory term of residence and work in the State Demonstration Forest or elsewhere, such as would correspond with the term of residence on a

[1] See paragraphs 17-23, 26 and 36 (*a*) of the Report of the Forestry Committee of 1902.

farm exacted from students for the latter Degree. Men who could earn such a Degree would not compare unfavourably with those who passed through the French Forest School in former days. Most of these latter have attained high positions in the Indian Forest Service, and have been instrumental in building up the splendid system under which the vast State forests of India, covering nearly 120,000 square miles, have not only been rescued from destruction, but are year by year growing more valuable, and yield a rapidly rising annual surplus revenue.

XXIV. *Our Forestry Problem.*[1] By Dr Schlich, C.I.E., Ph.D., F.R.S., Professor of Forestry at Coopers Hill College.

A year ago the President of the Board of Agriculture appointed a Committee to inquire into and report upon the present position and future prospects of forestry and the planting and management of woodlands in Great Britain, and to consider whether any measures might with advantage be taken, either by the provision of further educational facilities or otherwise, for their promotion and encouragement. Ireland was excluded from the reference in accordance with the expressed wish of the Irish Agricultural Department. One of the assistant-secretaries to that department was, however, nominated a member of the Committee, so that the authorities in Ireland might be in full possession of the views of the Committee for further action in that country.

The Committee has now submitted its report and made various recommendations, which are under the consideration of the President of the Board of Agriculture. In the meantime every serious citizen should be made aware of the problem, and should awake to the necessity of early action being taken in the matter.

The questions which present themselves are chiefly the following :—

(1) Why is the forestry problem of importance to Great Britain and Ireland?
(2) What will be the result, not long hence, if nothing is done?
(3) What is the present state of affairs?
(4) What are the practical objects which the people and Parliament ought to set before them for immediate execution?

Importance of the Forestry Problem.

For the purpose of demonstrating this, it will be necessary to indicate shortly the quantity of timber required by the country. In a paper I read before the Society of Arts on February 27, 1901,[2] I gave detailed information regarding the outlook of the world's timber supply. This information I shall not repeat here, but limit myself to giving a few of the main points. In the first

[1] Reprinted from the *World's Work*, by permission of the Editor.
[2] See Part 3 of Volume XVI. of the *Transactions*, p. 355.

place, it must be stated that although the average forest area per head of population in Europe amounts to two acres, the imports of timber show already an excess over the exports amounting to 2,620,000 tons a year. That deficiency comes chiefly from Canada and the United States of America, and smaller quantities from Australia, India (nearly all teak timber), the countries round the Gulf of Mexico, the west coast of Africa, and a few other places.

It is well known that the supplies from outside Europe at the present rate cannot be relied on beyond a limited number of years, since the United States, as time goes on, will require all the timber which Canada can export, under the system hitherto followed in the latter country, where reckless cutting and disastrous forest fires are still the order of the day. Russia, with Finland, Sweden, Norway, and Austria-Hungary, which have so far supplied the rest of Europe, will not be able to maintain the exports of the past, owing partly to the gradual exhaustion of their surplus stocks, and partly to their increasing home requirements, due to the growth of their population and the development of industries. On the other hand, the requirements of the chief importing countries (excepting France) are rapidly increasing. The imports of the United Kingdom have grown from 3,400,000 tons in 1864 to 10,000,000 tons in 1899, or at the average rate of 189,000 tons a year. The imports of the latter year were valued at £25,000,000. The average annual value increment of the imports during the years 1890-94 amounted to £382,000, and during the period 1895-99 to £771,000. There has been somewhat of a check during the South African war, but signs are already discernible that the imports will resume their gradual rise.

Looking now at Germany, which takes the second place amongst European importing countries, we find that her net imports of timber up to 1864 amounted on an average to 13,000 tons a year. In 1899 they had risen to 4,600,000 tons, or an average annual increase of 131,000 tons. The value of the imports in 1899 came to £14,820,000.

The Belgian net imports of timber amount now to 1,020,000 tons, valued at more than £4,000,000. They have increased during the last thirty-five years on an average at the rate of 22,000 tons a year.

The net imports of France have remained practically stationary during the same period; they amounted to about 1,230,000 tons

a year, or little more than the quantity now imported into the small kingdom of Belgium.

Of the total area of Great Britain and Ireland, 4 per cent. are under forest.
Of the total area of Germany, 26 per cent. are under forest.
Of the total area of Belgium, 17 per cent. are under forest.
Of the total area of France, 18 per cent. are under forest.

Pondering over all these figures, one is almost inclined to say that the requirements of timber are an index to the industrial development of a country.

Other European countries which import timber are Denmark, Italy, Spain, Holland, Switzerland (rapidly on the increase), Portugal, Bulgaria, Greece, and Servia; Roumania exports moderate quantites.

The price per ton of timber next demands attention. It fell from 1870 onwards until about the year 1888 in consequence of the enormous development of the means of transport, especially by water. From 1888 to 1894 prices remained stationary, but since then a slow but steady rise has taken place, amounting to about 18 per cent. during the five years 1894-99. Fluctuations in the price will of course occur, but I have no doubt whatever, that on the whole it will continue to rise, in the same degree as supplies have to be brought from localities farther and farther removed from the world's great highway—the ocean. This holds good especially in the case of Russia, the most important source of supply in Europe. Matters have now come to such a pass in that country that the Government has taken measures to ensure a permanent supply for home consumption by restricting and regulating cuttings. The head of the Prussian forest department informed me a year ago, that a remarkable change has of late taken place in the western provinces of Russia. German timber merchants, who go there to buy up and work out forests, used to send all the timber to Germany; now they transport already considerable quantities into the interior of Russia, because there they obtain better prices than in Germany. To sum up, it may be said that the quantity of timber required in Europe is rapidly increasing, so that the deficiency in the supply must advance correspondingly, making it more and more problematic, whence the material, especially the coniferous timber, is to come in the future.

Effects of a Shortage in the Timber Supply on the United Kingdom.

It is all very well to say that we can pay for the timber we need, but that will not meet the case. When the supplies from outside fall off, the rise in prices may become prohibitive, and the effects of an insufficiency of material would be disastrous. Of the 10,000,000 tons a year imported lately into this country, 8,700,000 tons were coniferous timbers, which form the very staff of life of our building trade and mining operations. A deficiency of supply in this material would be a real calamity for the population of these islands. Let us not deceive ourselves by imagining that in such an emergency iron and steel can be substituted for timber. That this is a fallacy has been proved by past experience. While the population of the United Kingdom has increased by about 20 per cent. during the last twenty years, the imports of timber have increased during the same period by about 45 per cent., in other words, every inhabitant uses now considerably more timber than twenty years ago. At the same time, nobody can say that extraordinary efforts have not been made of late years to substitute iron and steel for timber. As a matter of fact, the latter is an absolute necessity to civilised peoples. Engineers have not even succeeded in superseding the wooden railway sleepers by steel sleepers. Mr Hawkshaw, in his presidential address to the Institute of Civil Engineers the other day, dwelt particularly on this subject, saying: "Engineers could not do without timber, nor, indeed, without much timber. For the last thirty years they had heard it said in that room that steel would shortly be adopted in place of wood for sleepers; but although we could make our own steel, but had to import our timber sleepers, this has not come to pass," etc. The same experience has been gained in France and in the United States of America, the home of the great iron and steel trusts. As to the effect of a shortage of the timber supply on the mining industry, it would be too terrible to contemplate, as it would practically bring mining to a standstill, and throw hundreds of thousands of workmen out of employment, and the same may be said of the building trade.

The Present State of Affairs in this Country.

The United Kingdom of Great Britain and Ireland has an area of 78,000,000 acres (in round figures), of which about 3,000,000

acres are classed as under wood, equal to not quite 4 per cent. of the area. This makes about $\frac{1}{14}$ of an acre of woodland per head of population—an area capable of yielding only a fraction of the timber required by the nation. Hence, we find that the imports amount to at least five times the amount produced in the country. An examination of the agricultural returns of Great Britain and of those of Ireland show that there are extensive areas of waste land, which yield either no return or a very small one. Again, there are other areas entered as mountain land, used as rough grazing. These lands may be apportioned as follows:—

	Waste land, including inland water.	Mountain and heath land.	Total area in acres.
England, . .	4,050,000	1,985,000	6,035,000
Wales, . .	690,000	1,055,000	1,745,000
Scotland, . .	4,250,000	9,410,000	13,660,000
Isle of Man and Channel Islands,	45,000	18,000	63,000
Ireland, . .	5,235,000	...	5,235,000
Total, . .	14,270,000	12,468,000	26,738,000

I am not in a position at this moment to say what the area of inland water may amount to, but for argument's sake let us assume that there are of

Actual waste land, ...	12,000,000 acres.
Mountain and heath land, ...	12,000,000 ,,
Or a total of	24,000,000 ,,

This area is extensive enough to set people considering whether that land could not be used in a more profitable manner than at present. The question is, however, not so simple as it would appear at first sight, because nearly the whole of this land is private property, and most of it is utilised as shooting-grounds. The latter, however, after all is said, do not, even in Scotland, yield more than 1s. 6d. an acre all round, while the rest give much smaller returns, down to perhaps 3d. an acre, and in many cases not even that.

How to Obtain a Permanent Supply of Timber in this Country.

It is obvious that this country cannot interfere in the management of the woodlands of foreign countries. Again, under the

enlightened principle followed by Britain, that her great colonies shall be self-governing, any interference with their internal management is out of the question. Amongst the latter, Canada and Australia take the chief places as regards the supply of timber. Although forest conservancy in Australia is anything but enlightened, we can count for a good many years to come on a considerable quantity of hardwoods. These, however, will only serve for certain limited purposes, while 87 per cent. of our imports are coniferous timbers, the supply of which requires our chief attention. Canada could furnish them, if the Governments of that country would put their shoulders to the wheel. Without going into details, I may say that the lumber and milling interests of Canada are so powerful, that it seems almost hopeless to expect a decided change of policy in the management of her forests. In the meantime the resources of the latter are rapidly decreasing.

Under these circumstances, let us consider what can be done at home. With the exception of about 67,000 acres of Crown forest, all British woodlands are in the hands of private proprietors, or one or two municipalities. Most of the woodlands are maintained for landscape beauty, shooting purposes or shelter, so that their yield cannot be considerably increased. Again, the 24,000,000 acres of land, of which I spoke above, are private property. Of that area a large portion is fit for afforestation, and the question arises whether this can be achieved, and if so, in what manner?

In a paper read before the Society of Arts in November 1899, it was boldly proposed that Parliament should allot £1,000,000 a year during the next hundred years, so as to acquire and afforest 6,000,000 acres of land, which would yield all the ordinary timber required in the United Kingdom. It was argued, that only the State was in a position to do justice to the scheme for any length of time, as has been done in other European countries The position of Britain is, in this respect, somewhat different from that of other continental states. In the latter, the areas now forming the State forests were, with small exceptions, always State or Crown property, and it required only the gradual introduction of systematic and scientific management to render them highly remunerative. In Great Britain the lands are, as already stated, private property, and it would not be easy in England, or even in Scotland, to acquire large areas, because

owners would not care to sell. In Ireland the difficulties would probably be much smaller. To expect Parliament to vote £1,000,000 a year, and for a hundred years, is, of course, utopian, but I fail to see why the State should not do something on a smaller scale. A more modest sum might be set aside for the purpose, and either the Commissioners of Woods, or the Agricultural Department, or both, instructed to acquire any suitable surplus lands whenever opportunities offer. In this way the area of the State (or Crown) forests might gradually be increased in England, Wales, and Scotland.

In Ireland operations on a somewhat larger scale might be attempted. A new Irish Land Bill is about to be laid before Parliament, and provision might be made in it for the acquisition by the State of all waste lands which it is not necessary to include in the farms to be acquired by the tenants. In this way a considerable area might be obtained at a very low price. It has been estimated that, of the 5 235,000 acres of waste lands in Ireland, not less than 3,000,000 are fit for afforestation. Most of these lands can be bought for from ten shillings to one pound an acre. Assuming that only half the area so bought is really fit for successful afforestation, the purchase price per acre of real forest land would be between one and two pounds per acre. At that rate the financial success of afforestation would be ensured. In Ireland, then, the State can, and in my opinion should, interfere by the direct acquisition of State forests. Such a measure would be a great help in the settlement of the Irish land question. The labour connected with the preparation and planting of the land, the subsequent management and working of the forests, and the development of industries which draw their raw materials from the forests, would provide just that class of additional work for the small Irish farmer, especially in the poorer districts, which will assist him in earning the necessary money to pay off the instalments which will gradually convert him into the proprietor of his farm.

In England, Wales, and Scotland the acquisition of State forests will probably be a very slow process. Here we must work in a somewhat different way. We must count on extended afforestation by the landed proprietors, but the State should do what it can to help. The chief desideratum is to provide the means of acquiring a sound knowledge of systematic forestry as elaborated by scientific and practical investigation. First and

foremost, the sons of the big landowners and young men who are preparing for the highest class of estate managers, must be given the opportunity of acquiring such knowledge. Hence the establishment of a course of forestry teaching should be arranged at Oxford, Cambridge, Edinburgh, and Dublin. Ultimately regular forest faculties may be organised at these universities, or a joint faculty for forestry and agriculture, but at the outset we may be satisfied with the appointment of a lecturer on forestry at each of these centres of learning.

For practical instruction an area of 100 to 200 acres should be acquired at or near each university, where sowing and planting, etc., could be taught, and where illustrative experiments could be made. But something more is wanted, and this has been fully explained in the Forestry Committee's report. There should be at least one larger area in each, England, Scotland, and Ireland, of from 2000 to 10,000 acres, under a competent manager, where systematic economic forestry is carried out on a large scale. These State demonstration forests will serve a double purpose; they will afford the means of introducing university students to systematic and rational management, such as is likely to be adopted on the estates with which they will afterwards be connected. These areas must be managed as commercial undertakings, so as to produce the best financial results. In the second place, young men of the working classes can be received at these forests as working apprentices, giving them an opportunity of acquiring a sound knowledge of the business, thus fitting them for the posts of woodman, forester, or bailiff on the various estates of the country. Finally, arrangements may be made at agricultural colleges for instruction in forestry for the benefit of men who, while unable to pass through a university course, prepare for the management of landed estates.

As to the funds required for extended afforestation, these will no doubt be forthcoming in the case of many landed proprietors, as soon as we have succeeded in convincing them that economically conducted forestry will pay a fair interest on the invested capital. In other cases, however, this will not be so. The Forestry Committee in their report have dealt with the question of State loans at low interest, and suggested that the matter might stand over for the present. I should, however, like to draw attention to the system of Co-operative Credit Organisations, upon which

Mr Montgomery published, in 1902, an interesting bulletin.[1] Such Credit Organisations should be local, where members can obtain advances at a moderate rate of interest, either for a short period or on the principle of a sinking-fund. Organisations of this class have, I understand, already been started in Ireland and elsewhere, but a further and considerable extension would doubtless prove of the greatest assistance to landed proprietors.

The financial aspect of the problem is, of course, of the highest importance, but at the same time it is most difficult to deal with, owing to the absence of suitable data. The Forestry Committee have taken a considerable amount of evidence on the point, and arrived at the conclusion that excellent results, even with indifferent management, have often been obtained from plantations formed on land of little or no value for any other purpose. Nobody expects that waste lands, which have for a long period of time been exposed to deteriorating influences, will at once spring into full production on being planted, and this is specially pointed out in the evidence; but there can be no doubt that most of our waste lands were once under forests, and, if the thing is done in the right way, can again be successfully afforested in spite of initial difficulties.

In order to show how proper management will lead to increasing financial prosperity, I propose placing before the readers of the *World's Work* a few data from the history of the Saxon State Forest. Saxony is a highly industrial country, and in this respect comparable with Great Britain. We have reliable statistical data about these forests since the year 1817, from which it appears that the area in 1817 amounted to 367,499 acres and in 1893 to 428,542 acres, giving an increase of 61,043 acres, equal to 17 per cent. These lands include good, bad, and indifferent soils, and the greater part are situated in mountainous districts up to an elevation of nearly 3000 feet above sea-level. The yield in wood per acre amounted in 1817 to 61 cubic feet; in 1893 it had risen to 92 cubic feet, or an increase of 31 cubic feet, equal to 50 per cent. We do not know what the average stock of wood standing on each acre was in 1817, but in 1844 it came to 2173 cubic feet; in 1893 it had risen to 2658 cubic feet, representing an increase in fifty years of 505 cubic feet, equal to 23 per cent.

[1] "Co-operative Agricultural Credit in Germany and Switzerland," Report by H. de F. Montgomery, D. L., Member of the Agricultural Board of Ireland, 1902. See Note on page 331.

This shows that, in spite of the greatly increased yield, the forests are now much more valuable than fifty years ago. The net returns (after deducting *all* expenses) show the following results *per acre and year:*

During the period	1817-26 . .	4·0 shillings.
,, ,,	1827-36 . .	4·2 ,,
,, ,,	1837-46 . .	4·7 ,,
,, ,,	1847-53 . .	6·5 ,,
,, ,,	1854-63 . .	10·0 ,,
,, ,,	1864-73 . .	14·8 ,,
,, ,,	1874-83 . .	17·5 ,,
,, ,,	1884-93 . .	18·4 ,,
They rose further in	1900 to . .	22·5 ,,

I may add that the average receipts per cubic foot of wood were 2·1d. in 1817 and 4·5d. in 1900, a rise equal to 114 per cent., while the above figures show that the net receipts per acre have during the same period risen by 462 per cent.

Surely here is an incontrovertible proof of what scientific and systematic management of woodlands can achieve!

There are many other important points connected with this subject which I should have liked to discuss, but want of space prevents my doing so. Enough has, I hope, been said to demonstrate the extreme importance of the problem, and the simple steps imperatively called for to solve it.

XXV. *Afforestation of Waterworks Catchment Areas.*[1] By Joseph Parry, M.Inst.C.E., Engineer-in-Chief of Liverpool Waterworks.

Throughout Europe and America there is gratifying evidence of a new and increasing interest in forestry. Various causes have in the past contributed to the neglect of this important industry. In England the neglect, especially in so far as State action is concerned, has been especially marked since the substitution of iron for wood in shipbuilding. As long as there was a demand for timber for the use of the navy, the planting of trees was felt to be an object of national importance, and active measures were adopted and Acts of Parliament passed to ensure a sufficient supply of suitable oak. Then when the enormous demand came for timber for railway and other engineering works, the natural resources of foreign countries—the growths of many ages—were so easily and cheaply brought here by sea carriage, that little or no inducement was offered to grow timber at home. Planting for profit, therefore, practically ceased, and the planting for ornamental and sporting purposes by landed proprietors was, and is, of comparatively small market value.

The total acreage of land returned as woods and plantation in Great Britain is only 2,726,116 acres, being less than 4 per cent. of the total area of the country. According to Mr Nisbet, most of this consists of "old copsewoods, in which most of the standard trees are oaks dating from the time when the maritime power of England depended upon our oak supplies." Of the acreage given above, there are 66,758 acres of Crown forests, under the control of the Woods and Forests Department. It is notorious that these Crown forests have been sadly neglected and mismanaged, but a decided improvement has of late years taken place in the administration of the Department. With regard to the only Crown forest of which I have any intimate personal knowledge, namely, Delamere, in Cheshire, I agree with the description of it given by the Arboricultural Society, that it is a model of what a forest ought not to be.

The total imports of timber into Great Britain and Ireland last year were 9,896,688 tons, valued at £27,652,393.

[1] Read before the British Association at Southport, 1903.

Nearly three-fifths of this came from Canada, Russia, and Sweden. The bulk of the wood was coniferous, which can be grown in any temperate climate. The number of loads of pit-props imported in 1901 was 1,897,810, and the number of sleepers required annually for renewals along our railway lines is estimated at 3,750,000. The quantity of home-grown timber used in Great Britain and Ireland is estimated at 2,000,000 tons, so that the home production is only about one-sixth of the total consumption. The demand for timber shows a steady increase, and as new uses for it are constantly being discovered, the demand will no doubt continue to increase even more rapidly in the future than in the past. For example, the importation of pulp of wood for paper-making is a comparatively new development, and last year the quantity imported (not included in the above figures) amounted to 525,799 tons, valued at £2,398,215.

The price of timber is also increasing at a rate that cannot fail soon to be seriously felt. Ten years ago (1892) our imports were 7,842,382 tons, valued at £18,470,969, being an average of £2·35 per ton, and, as already stated, last year the total was 9,896,688 tons, or an average of £2·78 per ton. Whilst there is this steadily increasing consumption to be provided for, foreign sources of supply are falling off. The total imports into European countries show a considerable excess over exports. In Canada and the United States of America huge forests have been cut down in a most wasteful manner by the lumbermen and settlers. The havoc done has at last attracted the attention of the Governments, and steps are being taken to ensure better control in the future.

The Government of the United States has commenced experimental planting in the San Gabriel, San Bernardino, and San Jacinto forest reserves in Southern California, which are estimated by the United States Geological Survey to contain 1,447,000 acres of brush land, upon which all valuable timber has been destroyed by fire. Since the reserves were established, the danger from fire has been so reduced, by a vigorous patrol system, that a large proportion of the brush land is now safe enough to warrant planting. Two or three years experimental work has developed economical and rather rapid methods of planting, and during the past season the planting has been extended over several hundred acres by a field party of the Bureau of Forestry.

In April 1902, the Niobrara and Dismal River forest reserves, containing altogether 208,902 acres, were established for the purpose of making a systematic trial at afforestation. The Department of the Interior has invited the Department of Agriculture to undertake the work, which is now fairly begun.

The following extracts from a recent report of the United States Department of Agriculture show, further, how vigorously the subject is being dealt with in that country:—

"The States of New York, Pennsylvania, and Connecticut have recently acquired extensive areas of non-agricultural land, and are now engaged in the work of foresting them. The State of New York especially is undertaking work of great magnitude. Within the Adirondack Preserve are about 60,000 acres of burnt-over waste land which it is planned to reforest. A beginning was made last year by the planting of 750 acres, and it is proposed hereafter to plant at the rate of 1000 acres per year until the waste land is covered. Nurseries for the growing of seedlings are now being established.

"The State of Michigan last year set aside a tract of 60,000 acres of cut-over pine land for an attempt at systematic forestry.

"The Kansas State Board of Agriculture reports 142,984 acres of planted forest in 1900. Nebraska claims over 200,000 acres."

While these active measures are being taken in America, and large sums of money are being spent in protecting and restocking old forests, in planting new areas, and in training expert foresters, the British Government is still hesitating and inactive.

Last year the late President of the Board of Agriculture appointed a Departmental Committee to inquire into and report as to the present position and future prospects of forestry, and to consider whether any measures might be taken for their promotion and encouragement. That Committee has issued its report, which contains many valuable recommendations, but there are no signs yet of effect being given to those recommendations.

One of the recommendations is, "That the attention of corporations and municipalities be drawn to the desirability of planting with trees the catchment areas of their water-supply," and it is to the important field thus suggested for the promotion of Forestry that I desire to call special attention in this paper. There are no available statistics from which I can give the exact areas of the watersheds from which supplies are collected for waterworks purposes, but in preparing evidence for the Forestry Committee, I estimated the total area to be about 576,000 acres, irrespective of

the watersheds contributing to rivers from which supplies are taken by pumping. The gathering-grounds included in the 576,000 acres from which water is collected into catchment reservoirs are generally situated in thinly populated upland districts, but, notwithstanding the sparseness of the population in most of these areas, great difficulty is experienced in satisfying the demands of modern hygienic science with respect to the degree of purity to be maintained. The undesirability of allowing water for domestic consumption to be polluted by human sewage has never been seriously disputed, but as long as impurities were determined and measured only by chemical analyses, the presence of matters detrimental to health could seldom be quite conclusively proved. The science of bacteriology has changed all this, and if the standards of purity now exacted by the medical profession, based upon the determinations of bacteriologists, are to be observed, much more rigorous methods must be adopted than have hitherto been considered necessary to protect the streams and rivers from contamination by pathogenic organisms. Efforts made to prevent fouling, by putting into operation the provisions of the Public Health Acts, the Rivers Pollution Act, and the by-laws of conservators, have proved ineffective, and the results obtained have been unsatisfactory. And in consequence of the inadequacy and failure of these statutory provisions and by-laws, the authorities of many large towns, such as Manchester, Liverpool, and Birmingham, and of many smaller towns, have been led to the conclusion that the purity of their water-supplies can only be effectually secured by themselves becoming the owners of the watersheds. Acting on these convictions, they have applied to Parliament for powers to acquire the watersheds by agreement or by compulsion; and Parliament, having been satisfied as to the soundness and wisdom of the conclusions arrived at, has readily granted the necessary powers. The cases that have come to my own knowledge in which compulsory powers for acquiring watersheds have been obtained, amount to a total of 102,615 acres. It is probable that the precedents set by these towns will be largely followed in the near future, and here the important question arises, How are the areas thus acquired to be utilised? It is evident that, in order to reduce to a minimum the risks of polluting the water in a manner likely to produce disease, the first object must be to limit the resident population to the lowest number reasonably practicable. This cannot be accomplished if agricultural operations are allowed to

be carried on in the ordinary way, for no really satisfactory methods can be devised for the disposal and treatment of the sewage of resident populations of farmers and farm-labourers with their families, and the pollutions from shippons and farmyards, so as to permit of the effluents being discharged into the water-courses. Sheep grazing is, from a waterworks point of view, the least objectionable of farming pursuits, especially where, as in some cases known to me, the proportions of live stock are calculated according to the number of acres to a sheep, and not according to the number of sheep to an acre. Grouse moors are still less objectionable, especially where the growth of peat is kept under proper control, and suitable channels are cut for the water.

In considering the desirability of afforesting the gathering-grounds of waterworks, it must not be assumed that the proposition is to cover the entire area with trees. Each watershed must be separately studied, and must be to some extent differently treated. Questions of aspect, temperature, depth of soil, wind, rain, and frost, and other features must be taken into account in determining where and what to plant. It is probable that the proportion of any gathering-ground that can be planted with advantage will be found to vary from 25 to 75 per cent. of the total. These are points upon which it is necessary to obtain competent expert evidence at the outset, so as to avoid imprudent expenditure and to guard against failure. A working plan should be prepared and systematically carried out, careful records being kept of all expenditures and receipts.

Forestry has been so much neglected in this country that there are very few people to be found who are qualified to advise upon planting for profit on a large scale, and it is particularly important to distinguish between planting as usually practised by landowners, and systematic scientific planting as practised under State control and direction in several European countries. In this connection I was much interested in reading the evidence given before the Committee on Forestry by the Earl of Selborne. I quote two or three extracts:—

"I only took to forestry about ten years ago, and I became very keen on it. I very soon became convinced that nobody in my neighbourhood or on the estate knew anything whatever about it, and it gradually dawned upon me that that applied not only to my father's property, but all the surrounding properties."

Again,

"Everything was absolutely haphazard. The thing is now systematised, and runs perfectly smoothly. I know what it will cost me every year. I can make exact estimates of expenditure, and I am even now able, from the natural capabilities of the place, to practically make the returns balance the expenditure, but of course what I am really trying to do is to build up a property which will be valuable to my son and my grandson."

. . . . . .

Then he was asked,

"You believe that the question of forestry is one of considerable importance to landowners?"

Answer:—

"I think it is of immense importance. I do not think English landowners have the slightest conception of the money they are throwing away, or that this country realises the amount of undeveloped property there is in forestry in this country."

Afforestation must not be regarded merely as a method of utilising land which would otherwise remain unproductive. It can claim much more than this. Indeed, for a large proportion of these waterworks' areas, timber-growing may justly claim to be the most profitable use to which the land could be applied.

As to the effect of trees upon the yield and quality of the water collected, it cannot be otherwise than beneficial. I do not know of any exact gaugings of the flow from forest areas as compared with the same or similar areas free from trees, but there can be no doubt that, having regard to the diminished evaporation and other influences, a larger percentage of rain will reach the reservoirs from forest areas than from the same areas without trees. The quality of the water will also be better, owing to the soil on the slopes of the hills being held together by the roots of the trees, and the destructive effects of the heavy rains in carrying down huge masses of clay and soil being prevented. These matters have been very fully investigated in the United States of America. The Year-Book of the Department of Agriculture for 1902 contains a report upon forest planting, in which the following statement is made:—

"A forest furnishes the best possible cover for the watersheds of storage reservoirs. For this reason fully as much as for the financial one, several

water companies are planting extensively in the Eastern States. Among the most important of these are the Metropolitan Water and Sewerage Board of Massachusetts, which is planting on the watershed of its immense reservoir at Clinton, Mass., and the water department of the City of Woonsocket, R.I. In both cases the planting is being done in co-operation with the Bureau of Forestry. The water companies supplying the cities of New Haven and Hartford, Conn., are also planting large tracts about their reservoirs under plans prepared by the Director of the Yale Forest School, and the City of Middletown, Conn., is similarly planting under directions from the State Forester."

Again, on page 143 of the same report it is stated :—

"In the case of the mountain slopes upon which planting is being done, the importance of a forest cover in conserving the water-supply for the cities of Los Angeles and Pasadena and contiguous country is considered so great that the Los Angeles County Forest and Water Association and the Pasadena Board of Trade have contributed liberally toward the work. The planting gives promise of excellent results."

The following is an extract from the Report of the Secretary of Agriculture on the Forests and Rivers of the Appalachian Region :—

"The perpetuation of the streams and the maintenance of their regular flow, so as to prevent floods and maintain their water-powers, are among the prime objects of forest perservation in the southern Appalachians. Nothing illustrates the need of this more fully than the fact that on the neighbouring streams, lying wholly within the Piedmont plateau, where the forests have been cleared from areas aggregating from 60 to 80 per cent. of the whole, floods are frequent and excessive. During the seasons of protracted drought some of the smaller streams almost disappear, and the use of water-power along their course is either abandoned or largely supplemented by steam-power.

"To-day the larger valuable water-powers in the South Atlantic region are mainly limited to the streams which have their sources among the Southern Appalachian Mountains ; and the waters of these streams show a striking uniformity of flow as compared with the streams lying wholly within the adjacent lowland country, where forest clearing has been excessive. While the rainfall is somewhat greater in the mountain region, it is a question of the regularity rather than the volume of flow, and this depends upon the water storage. The soil in the one region is as deep as in the others, and the slopes being gentler in the low country, other things being equal, the water would soak into it the more easily. In the mountain region itself the flow of the streams along which proportionately large clearings have been made, has become decidedly more irregular, and the flood damages have greatly exceeded those along other streams where the forests have not been disturbed. The problem resolves itself into one of a forest cover for the soil."

I have also received from the Chief Engineer to the Metropolitan Water and Sewerage Board of the State of Massachusetts, chemical analyses which fully bear out the statements made by the Secretary of Agriculture as to the excellence of the water derived from forest areas.

The Corporation of Liverpool made a new departure in this matter some six years ago, when they obtained the advice of Mr W. R. Fisher, Assistant Professor of Forestry at the Royal Engineering College, Coopers Hill, in regard to the management of plantations on their Vyrnwy Watershed in North Wales. The total area of these Vyrnwy plantations, old and new, is at present over 600 acres. Nurseries have been established which will enable the planting to be carried on more rapidly in the future. There are to-day in these nurseries nearly 200,000 young trees which are to be planted out during the coming season. If this rate of planting can be maintained, and it is likely to be continued for some years to come, it will be seen that the area of plantations which I have given will soon be largely augmented, the number of trees required to cover one acre being about 2700. Lake Vyrnwy is nearly five miles in length, and the larger plantations are near to the upper end, the nurseries being situated near to the lower end. All the workmen employed reside below the Dam, and therefore off the Watershed, with the exception of the Forester with one assistant, and their residence within the area of the gathering-ground is accidental and temporary. In order that the men may reach their work quickly and fresh, an oil-launch has been provided, in which, when they are employed at the upper end of the lake, they are carried to and from their work, so that little time is lost or energy expended in travelling. This has proved a very useful and inexpensive mode of transit, the launch being useful for several other purposes. There is at the present time a saw-mill belonging to the Corporation driven by steam-power, which is used for sawing timber for general works and estate purposes, and machinery has lately been ordered to utilise the power of the compensation water from the Lake for generating electricity, so that in future the saw-mill will be operated by an electric motor deriving its power from a dynamo driven by a water turbine. This brings me to another important feature connected with the afforestation of watersheds, namely, that on these gathering-grounds, water-power is generally available, or capable of being made available, without great expense, by which

the successful working of forests from a financial point of view can be greatly assisted. Saw-mills and wood-working machinery, driven directly by water-power or by electric motors, may contribute to the profitable utilisation of trees in several ways, and particularly by reducing timber to marketable sizes, and by providing mechanical power to produce various kinds of wooden implements and articles of commerce, also by providing power for making wood-pulp. With regard to the question of cost, the actual average expenditure incurred by the Corporation during the last five years has been £261 per annum. This year, including the extended planting operations already arranged for, the expenditure will be higher. After observing the results of recent operations around Lake Vyrnwy, and examining the details of expenditure, I feel satisfied that for the class of lands to which I particularly refer, afforestation on the catchment areas of waterworks can be carried out not only with great advantage to the country, but also with profit to the owners of the works.

XXVI. *John, Duke of Atholl, his Larch Plantations* (1774–1830), *and the Larch Disease.* By JOHN BOOTH, Gross-Lichterfelde, near Berlin.

In the *Transactions of the Royal Scottish Arboricultural Society* for 1901 (Part 3 of Volume XVI.), I find on page 515 that on the 7th of August, under the presidency of Mr Munro Ferguson, the Excursion dinner was followed by a lively discussion on some questions of great interest to arboriculturists. Among these questions the Larch disease occupied a prominent position. I cannot say that I agree with all that has been said on this subject, but I have waited till the *Transactions* of 1902 were published, hoping that somebody would take the matter up. I was rather disappointed, and so I think it my duty to write these lines.

Having been a member of this Society since 1876, I have derived from it in all these years so much valuable information regarding the growth and the progress of newly-introduced foreign timber trees, and in my several visits to Scotland have had such kind assistance from men like John M'Gregor, Wm. M'Corquodale, Malcolm Dunn—all dead now,—that I embrace with pleasure this opportunity of returning my thanks to the Society, by directing attention to a publication which seems to be quite forgotten.

The general laws of naturalisation, *i.e.*, bringing a plant from its native country into another, are almost the same all over the vegetable kingdom. In introducing the Douglas Fir from North America or the Larch from the Alps, we need the same care not to place them in situations or plant them in soils which are opposed to their nature. Certainly there might be more difficulty about the one than the other. The Douglas Fir, which is distributed over an area of more than 50,000 square miles, is not confined to mountainous regions, and grows very freely in many soils and situations. The Douglas Fir will therefore undergo this change much easier than the Larch, which, being an alpine tree, can only be grown in high regions, and only in such localities can offer successful resistance to the attacks of disease. So I have felt for many years the most lively interest in collecting all available information on the Larch, with regard to the introduction of foreign timber trees. When I look over the papers which have been published during the last quarter of the nineteenth

century, it seems difficult to find any certain point of view, because the most competent men hold opposite views on nearly all the elementary questions regarding the Larch and the Larch disease. I begin with the first noteworthy publication, which I remember having read with delight thirty years ago.

As this publication[1] is rarely mentioned, it seems to me that it is almost forgotten, and considering the value of its contents, which have been approved by practical results during a century, I now appreciate it still more, and I venture to say that it is quite an extraordinary one. Although written more than a hundred years ago, and published in 1832, it has kept its freshness and originality and the stamp of the author. It deals not only with the arboricultural side of the question, but with the politico-economic as well; for we can learn from it how to turn wide ranges of waste, barren, and uninhabitable land into a productive, healthy country, with an active population.

John, Duke of Atholl, who succeeded to the title as fourth duke in 1774, must have been a most extraordinary man to engage himself in such a far-sighted enterprise. The whole history of Forestry does not reveal a similar case of a large proprietor having taken such an interest in afforestation as did John, Duke of Atholl, with a surprising perseverance, during fifty years from 1774. His Parliamentary and other representative duties, entailed on him by his high social position, very likely made it necessary for him to reside a great part of the year in London, while the scene of his planting operations was about five hundred miles off—a distance which, one hundred and twenty-five years ago, took much more time to cover by stage-coach than it does nowadays in the "Flying Scotchman." We may imagine, therefore, that the Duke had many public duties to perform; but on reading his day-books they give the impression that he was an enthusiastic forester, whose lifelong problem had been: planting the Larch, and treating every question concerning the Larch.

We do not find in those times many men of highest rank who began to plant the bare mountain ranges with forests, and took part in introducing a new species into our forests of indigenous trees, after having been convinced "that the results of experience

[1] *Account of the Larch Plantations on the Estates of Atholl and Dunkeld,* by the late John, Duke of Atholl. Drawn up from papers and documents communicated by his Grace's Trustees to the Highland Society of Scotland, 1832. William Blackwood, Edinburgh.

in Scotland accord exactly with the expectations of reason"; and we find very few who had the courage to invest a very large capital in such an undertaking—a rare thing even in present times.

The Larch had been introduced from the Tyrol into the Atholl forests by Duke James in 1738. Before his death in 1764 he had the wood examined, and even in this rather young state the result proved very satisfactory, for the wood of the then only twenty years old trees was found to be much superior in quality to the wood of all the indigenous coniferous trees of the same age; so his heir continued the trials, and planted till his death in 1774 about 11,000 Larches.

The "plantin' Duke" followed in 1774. He saw the great advantages of planting the Larch, coming as it did from the continental Alps, and having the peculiar property of thriving in the most elevated positions, and at the same time of producing most excellent timber on inferior soils. "Immense extents of mountain ranges may thus be applied to useful purposes, which otherwise would have been quite unavailable," says the Duke; and he continues, "Scots Fir thrives at an elevation below 900 feet, but the Larch ascends to 1600 feet above the sea, and it may ascend higher. This is an important fact in a national point of view. Much of that mountain land of Great Britain which is at present worthless may grow timber to supply her navy and merchant shipping without at all interfering with the land which produces her cereal crops, or even her fine pasture land in a lower situation." I think these few words of the Duke explain the whole Larch question. It is very strange that we find the Larches at Dunkeld often mentioned, but scarcely ever anything about the Duke's experiences as recorded in his day-book. If we had taken advantage of these experiences there would have been no Larch question, as nearly all our difficulties are the natural consequence of ill-treatment of this noble tree with alpine nature; and, as the Duke says, "the failure must be ascribed, not to the nature of the materials, but to the misapplication of the tests employed."

When Duke John succeeded his father in 1774 he began with completing the plantation of 225 acres which his father had left unfinished. It took some years to do this, owing to the difficulty of obtaining larch plants. They were dear at that time, costing 6d. a piece, but the price went down to 35s. per thousand as more plants were raised. The demand increased as planting Larch

began to attract more attention. As to how this grand planting affair gradually developed during the next half century, I must refer the reader to the original *Account*, and must content myself with stating here that the Duke in this period planted about 14 millions Larch (13 millions unmixed and about 1 million mixed) on 8017 Scotch acres. At the same time the reader will find in the *Account* a profound knowledge of the whole planting business, and many proved experiences, which raise this paper on Larch plantations to the first rank as a most exhaustive monograph dealing with all possible circumstances.

[After alluding to an article by De Candolle of Geneva on the "Native Larch Forests of Switzerland," which appeared in the *Quarterly Journal of Agriculture* for 1835, and to the chapter on the "Larch Disease" in Professor Hartig's book on *Diseases of Trees*, the English Arboricultural Society's Report on the same subject, the Reports of the Society's Excursion to Dunkeld in 1884, and to Strathspey in 1894, and to Mr Elis Nilson's letter of December 1899, all of which have already appeared in the *Transactions*, the author goes on to say:]

The above mentioned highly satisfactory results of the Atholl and other Larch woods, planted very likely in right situations, were passed over in silence in the discussion to which I referred at the beginning of this article; mention was only made in general terms "of isolated cases in alpine situations, where Larch did well, but in nine cases out of ten the disease was so prevalent that it was unprofitable to plant Larch." . . .

Thereupon I ask, Are all the mountainous regions in Scotland, like those of Atholl, already covered with Larch? If that is so, it would certainly be of no more use to plant Larch, as it properly belongs only to mountainous regions.

On page 521 we find another totally incorrect statement: "It was not till 1839 that they had any record of disease having appeared in the Atholl plantations. Before the introduction of the disease the Larch grew well on any soil." This assertion is in contradiction to the Duke's day-book, where we read that the disease was known to him.

"Previous to the year 1795," he writes, "a blight . . . affected the Larch, and of those in low situations, many died . . . trees above 30 feet in height, and trees in high situations escaped this affection . . ." (then follows a minute description of this disease).

And as to the remark that "it grew well on any soil," I can

only say that the Duke at great length gave strict directions where to plant Larch, and what soils had to be avoided. When such erroneous statements are made without being corrected, there can be no wonder that people have little faith in planting Larch.

But how do the glowing reports of the different Excursions agree with this mournful discussion on the 7th of August 1901. The Duke's successful experiments during half a century appear to me to be ignored by the present generation. We ought to pay a little attention to his writings, especially as the results of his prolonged practical planting operations in the naturalisation of this alpine tree accord with the opinions of scientific authorities and of many practical men. I think this fact adds much to the credit of the Duke's careful and correct observations made during a long period.

All the false doctrines and prejudices which exist to-day about the Larch are refuted in the Duke's *Account*, and they all find in it a suitable answer in a most convincing manner, everything being based upon practical results. No better proof can be given of the Duke's keenness of observation than his remarks regarding the Larch disease.

However ignorant he must have been of the nature of this disease,—Hartig's scientific researches were made long after his death,—still he knew the only "remedy" for it was to treat *the Larch as an alpine tree!*

In one respect the Duke was wrong. He planted the Larch to grow timber for the ships of the navy. His calculations are of the highest interest, although in one point they proved erroneous. He estimated the timber to be most valuable for shipbuilding, —he could not anticipate our age of steel and iron,—but nevertheless his financial calculation of the value of the Larch timber has proved just. The superiority of Larch wood was manifest in the Duke's time, and is so still, being dearer and much more valuable than the wood of the Scots Fir; and the late Duke was right in noting in his day-book: "I have no hesitation in saying that the price, when the wood is thoroughly known, will long continue superior to the best foreign fir timber, and little inferior to the oak."

As to the value of Larch wood compared with that of the Douglas Fir and other conifers, I will give here, at the end of this article, very interesting evidence.

A Douglas Fir, grown in my father's plantations from seed which the Royal Horticultural Society in London had distributed in 1828, after the first voyage of Douglas, was felled in 1878,—fifty years old. I sent samples of the wood to Robert Hartig to get a correct statement as to the quality of timber grown in Germany. I added a specimen of Douglas Fir sent to me by the late Mr M'Corquodale from the trees of Lord Mansfield at Scone Palace. Professor Hartig having examined the anatomical structure and value of the specimens, reported as follows:—"It is easy to see that the wood of Douglas Fir, grown in Germany and in Scotland, surpasses by far the *Pinus sylvestris*, and is almost equal to the Larch wood grown in the mountains. The value of the wood is indicated in the following numbers:

Larix europæa,	I.
Abies Douglasii,	II.
Pinus sylvestris,	III.
Abies excelsa,	IV.
Picea pectinata,	V."

In concluding this article, I most respectfully suggest that the Council of the Royal Scottish Arboricultural Society should reprint the Duke's *Account* for the members of the Society.

In my opinion, the only remedy for the Larch disease is to follow exactly the methods of the great "plantin' Duke": select the situations only on high mountainous regions, and not stick the Larch any more like a fencing-post, regardless of its nature, into low-lying lands, nor into muggy situations.

XXVII. *Our Imported Coniferous Timbers.*

By A. D. Richardson, Edinburgh.

The United Kingdom is the largest timber-importing country of the world, and our timber supplies are drawn from every quarter of the globe. Nine-tenths by weight of the timber we import is coniferous, and the great bulk of this is pine and fir of foreign growth, most of which comes to us in the converted state. Our annual timber bill amounts at present to over £25,000,000, and there is a steady upward tendency. The value of our timber imports for the quinquennial period 1895-99 amounted to over £22,000,000 per annum on the average, and for 1899 alone it stood at over £25,500,000. Of the latter sum, about £20,500,000 was for coniferous timber, hewn, sawn, and manufactured, and of this timber, Norway, Sweden, and Russia together contributed over £11,750,000 worth, and the rest of the European countries to the value of nearly £2,000,000. Canada and Newfoundland supplied us with over £4,500,000 worth, and the United States with over £2,000,000 worth, the remainder coming from various other parts of the world. In 1899, therefore, we paid to foreign countries not far short of £16,000,000, and to our colonies over £4,500,000, for coniferous timber; and of that paid to foreign countries, over three-fourths was for pine and fir timber, of which a large proportion could be profitably produced within the confines of our own shores.

Coming to a closer analysis of our imported coniferous timbers, we find that they consist in the main of the produce of but a few species of trees. These are the Scots pine and common spruce of Europe, and the red, white, and pitch pines, and black and white spruces of North America. Other coniferous timbers which we import are the silver fir and maritime pine of Europe, the Oregon pine and Californian redwood, and the Kauri pine of New Zealand; and to these may be added the American pencil "cedars," and a few others of little or no commercial importance.

Undoubtedly the most important coniferous timber we import is that of the Scots pine, or, as it is frequently called, Scots or Scotch fir (*Pinus sylvestris*). This tree is also known as wild pine and northern pine, and its timber comes into the home market under a puzzling variety of trade names. It yields all the kinds of timber designated as "red" or "yellow," which come from the Baltic countries, and the local varieties of its timber are imported

under special trade names. The imported timber of the Scots pine is generally known in the home trade as Baltic red-wood, but it is also called Baltic red fir, red pine, and red or yellow "deal." Its varieties are designated according to the locality from which they come, or to their port of shipment, as White Sea, Swedish, Danzig, Riga, St Petersburg, Gefle, etc., red or yellow deals, battens, or boards, and these are graded into first, second, third, and so on qualities, and are stamped or branded accordingly by the exporters. The best qualities of red-wood which we import are those which come from the Baltic and White Sea ports. The timber which comes from the regions about Danzig and Riga is the strongest and most durable, and is specially well adapted for structural work of all kinds, for railway sleepers, and for all purposes where exposure to weather, damp, etc., are factors which have to be taken into account. A fine quality of this kind of timber was formerly imported from Memel, but this supply has now almost ceased. The red-woods shipped from the southern and eastern ports of the Baltic are the largest, hardest, and most resinous of our imported Scots pine timbers; but the finest qualities of this timber for joinery are those imported from St Petersburg and Archangel. These are drawn from the northern parts of Russia, chiefly from the White Sea region, and they are much finer in texture, and less resinous, than those of the south. A fine quality of this timber also comes from Sweden. This is grown on the eastern slopes of the Scandinavian highlands, and is shipped from the ports on the east coast of the country.

The coniferous timber of European origin which ranks next in importance to that of the Scots pine, amongst those we import, is that of the common or Norway spruce (*Picea excelsa*). This timber, like that of the Scots pine, is largely used in house-building and constructive work generally, and under the trade names of white-wood, white fir, and white "deal," immense quantities of it are imported into Britain from the Baltic and Norwegian ports; and besides the converted timber, great numbers of undersized stems of this tree are imported for scaffold poles, pit-props, and various other purposes. Like that of the Scots pine, the timber of the spruce varies in character with locality, and the qualities of the various local varieties are graded and branded in a similar fashion to those of the red-woods.

The most important coniferous timber which we import

from the New World is that known in the home trade as yellow pine. This is derived from the American white pine (*Pinus Strobus*), a tree better known to planters in this country as Weymouth pine. The timber of this tree is called white pine in America, and of the coniferous timber which we import from Canada it forms by far the largest proportion. It is much used for internal finishing in house-building, and on account of its fine grain and close texture, its non-liability to warp, and its large dimensions, it can be used for many purposes for which the Baltic timbers are quite unsuited. In fact, in general joinery and cabinetmaking no other coniferous timber occupies so important a place.

The heaviest and strongest of the coniferous timbers we import is pitch pine, a timber very similar in character to some of the strong, hard, resinous varieties of the Scots pine of some parts of Europe. It is mostly imported in the hewn state, and it is used for a considerable variety of purposes, but chiefly in engineering works, carriage building, etc., and in house-building for beams, open roofing, stairs, etc. Pitch pine is a timber regarding the nomenclature of which a good deal of ambiguity exists, and even in a standard work like Laslett's *Timber and Timber Trees*, the author falls into error regarding the identity of the species from which the timber of commerce is derived. In North America the tree which is called pitch pine is *Pinus rigida*, a tree which yields a coarse kind of timber which is never exported, but the pitch pine of commerce is the produce of *Pinus palustris*, the long-leaved pine of the Southern States, where it is also known by the names of yellow pine, red pine, turpentine tree, and some others. In the home market this timber is known as Georgia pitch pine, from the fact that most of it is shipped from the ports of that State, and it has taken to a large extent the place of the heavy Scots pine timbers of the Memel and Riga trade.

The least important of the pine timbers which we import from North America is that of the red pine (*Pinus resinosa*). This tree may be said to be the representative of the European Scots pine in the New World, and its timber is used for practically the same purposes as the timber of that tree. In Canada this tree is called Norway pine, and it is the yellow pine of the Nova Scotians. It is not native to Europe, and the name

Norway pine has no doubt been applied to it under a mistaken belief that it was the same species as that which occurs so plentifully in Norway. The timber of *Pinus resinosa* is imported into Britain under the trade name of American or Canadian red pine, but the imports of this timber seem to be on the decline, and at present it finds its principal market in the western parts of the country.

The spruce timber which we import from North America is really the produce of two distinct species—viz., the white or "single" spruce (*Picea alba*), and the black or double "spruce" (*Picea nigra*); but the timbers of these two trees are not separated commercially, and both are imported under the trade name of American or Canadian spruce. These two species take the place in America which the Norway spruce does in Europe, and their timbers are imported for practically the same purposes as those for which Baltic white-wood is employed; but the market for American spruce, like that for American red pine, is confined chiefly to the western parts of the country.

Oregon pine, or, as it is sometimes called in the timber trade, Columbia red-wood, is derived from a tree which is quite familiar to us in Britain. This is the Douglas fir (*Pseudotsuga Douglasii*), a tree which has been largely planted in this country, and which gives promise of becoming a valuable timber tree here. The timber of this tree is as yet imported in comparatively small quantities, but it bids fair to take the place of Baltic red-wood for some purposes.

When the timber of the Californian red-wood (*Sequoia sempervirens*) made its appearance in the home market some years ago, it caused not a little sensation, but the hopes which were then held out of its becoming important commercially, have not been realised. It is still imported, but only to a limited extent, and its use is practically restricted to internal finishing in high-class buildings, and to some kinds of cabinetmaking. It is, however, a wood of great beauty, and planks of it can be procured of very large size; and it is said to be very durable when placed in contact with the ground.

Under the popular name of "cedar" a number of timbers are known, but very few of these have any connection with the true cedars (*Cedrus*). The timber which is imported as pencil cedar is really the produce of two species of juniper—viz., *Juniperus virginiana*, the Virginian red cedar, and *Juniperus bermudiana*,

the Bermuda cedar. This timber is now almost wholly used in the manufacture of lead pencils, and as the supply of Bermuda cedar has become well-nigh exhausted, the bulk of what we now import is the produce of the Virginian tree. Formerly this timber was much sought after by cabinetmakers for the construction of the internal parts of wardrobes, cabinets, etc., its pungent odour furnishing efficient protection against insect attack, but its use for this kind of work has now practically ceased.

The timber of the European silver fir (*Abies pectinata*) is imported under the trade name of "Swiss pine," and it is chiefly used in the manufacture of musical instruments, for which purpose, on account of its excellent sonorous properties, it is well adapted.

The only other European coniferous timber which we import to any extent, is that of the maritime or cluster pine (*Pinus pinaster*), and practically the whole of this is in the form of pit-wood. The most of this timber comes from the west coast of France, where large forests of the maritime pine have been formed on the sand-dunes, and it finds its chief market here in the Welsh colliery districts, where it does not come much into competition with the Baltic produce.

The timber of the Kauri pine of New Zealand, like that of the Oregon pine and Californian red-wood, is one of the more recent introductions. The timber is excellent, and has been used to some extent in shipbuilding and for various other purposes, but heavy freights operate prejudicially against its importation. In its native country, however, the Kauri pine (*Agathis*, or *Dammara*, *australis*) is an important timber tree, and large quantities of its timber are exported to the neighbouring Australian towns—in fact, it plays much the same part in that quarter of the globe which the pines and firs do in Europe and America.

XXVIII. *Notes on Forestry in Finland.*[1] By John F. Annand, Haystoun Estate, Peebles.

The area of Finland equals the whole of the United Kingdom, with the addition of Holland and Belgium (about 144,220 square miles). Of this vast area over one-half is forest land, and of the remaining half only a small proportion is cultivated plough land, but much consists of lakes and marshes.

It is a country of great beauty, and although poor from an agricultural point of view, it possesses the enormous advantage of being able to produce in the finest quality the timber trees most commonly used for architectural and building purposes.

Geologically the country belongs to the Scandinavian Peninsula, and not to the great plain of Eastern and Northern Europe. It is made up mainly of granite, gneiss, and glacial formations. The surface-soil is largely composed of glacial debris, partly changed by sea action after glaciation—gravel, brash, pebbles, sand, etc., with a substratum of granite or gneiss rocks, and rocky outcrops are frequent. On the other hand, there are also large plains, formed in the post-glacial period, when part of the country was covered by the sea. The soils on these plains consist largely of clay, and are comparatively fertile, and more suitable for the cultivation of field crops than of forest trees. The gravel and rubble overlying the granite form excellent lodgment for the vertical-rooted pine, which also thrives in the drier oases in the sandy marshes; while the fir (spruce) does best in the cool, mossy, and wet ground. The rainfall is everywhere abundant, or at least sufficient for tree growth, and the forests extend far northward.

Finland cannot be called a mountainous country, as only a small part in the extreme north belongs to the Scandinavian mountain chain. A good deal of country, however, rises to 1000 feet or more above sea-level, and it is at this elevation that we find the densest and most valuable forests; but, in fact, the whole country is studded over with forests of varying size and density.

Indigenous Timber Trees found in the Forests.

In point of commercial value the common Scots Pine or Redwood (*Pinus sylvestris*) easily holds first place. Grown, as it

[1] Compiled chiefly from *Finland*, by N. C. Frederiksen, formerly Professor of Political Economy in the University of Copenhagen.

usually is in Finland, in dense masses, the tree is tall, straight, and free from knots, and forms a fine, full-wooded bole. The Norway Spruce Fir or White-wood of commerce (*Picea excelsa*) is next to the pine in point of timber value. Bulk for bulk it is worth somewhat less than the pine, but the extensive modern requirement of spruce for paper-pulp can be met by trees of comparatively small dimensions. In Finland the spruce demands a better soil than the pine, and in particular wants more moisture, and it suffers also severely from gales. A mixture of spruce and pine is common in the natural forests, and, says Mon. Frederiksen, "It is in the north in the woods thus arranged that we often meet with the long, healthy pines, as straight as the most perfect columns, and such as are rarely seen in Central Europe."

Amongst deciduous trees the Birch predominates, being found everywhere throughout Finland, and the Dwarf Birch (*Betula nana*) farthest north of all. The Common Alder (*Alnus glutinosa*) grows largely in the swamps of South Finland, while *Alnus incana* is common in the north, being often more strongly represented in burnt-over forest land than birch. The Aspen Poplar (*Populus tremula*) is found almost as far north as the birch, but rarely in dense growth or pure forest. Other evidently indigenous deciduous trees, found chiefly in South Finland, are Ash, Elm, Maple (*Acer platanoides*), Lime, Oak, Hazel, Mountain Ash, and Service trees, Hawthorn, and Apple.

Larch has been introduced with some success, and experiments are now being made with *Pinus strobus*, *P. cembra*, *Abies pectinata*, *A. balsamea*, and Douglas fir from the Pacific coast.

Wasteful Methods and Destructive Agencies.

Only a small part of the timber cut in the forests is exported, and of the great mass used at home much is wasted. Not so very long ago it was, in some districts, thought good policy to burn the old pine woods simply in order that they might be changed to pasture lands or into plantations of the inferior deciduous trees which could later be used in the old "Svedja" method of agriculture. This very wasteful system consisted in burning over the forest lands in order to obtain a few harvests and some pasture land afterwards. In a large part of the country this method has entirely changed the character of the forests, and instead of the dense pine and fir woods, we find thinly stocked woods of birch, with some aspen, alder, and spruce. The Legis-

lature has attempted to check this wasteful practice, but the restrictions imposed by law are not always regarded.

Equally antiquated and wasteful is the method of manufacture of tar—an industry dating from the sixteenth century. The healthy and vigorous trees of forty to eighty years of age are partially stripped of their bark for several successive seasons, and are then felled, cut up into pieces, and charred in pits or kilns, from which the tar is collected. Large tracts of forest have thus been destroyed. Although tar-burners are now content to use less extravagant material, such as stumps, roots, saw-mill waste, and forest thinnings, the old wasteful methods are still in vogue to a large extent.

Formerly forest fires were frequent, and large tracts of dense pine and fir forests have thus been destroyed. Terribly destructive gales also swept over much valuable timber during the years 1866, 1873, 1890, 1897. Excessive grazing with cattle, horses, and, in some cases, even with sheep, has been, and still is, very detrimental.

Export of Timber, Etc.

The chief products of the forests now go through the saw-mills. In 1889 planks, battens, boards, staves, etc., were exported to a total value of 82,000,000 marks. In 1899 the exportation of hewn spars or beams, of laths and lathwood, of round spars, bowsprits, yards, masts, etc., represented a value of about $5\frac{1}{2}$ million marks. Pit-props and wood for pulp-mills and paper factories were exported to the value of $5\frac{1}{2}$ million marks. To this list should be added firewood ($3\frac{1}{2}$ million marks), and bobbin squares of birch ($3\frac{1}{2}$ millions), bobbins and articles of turnery (3 millions), poles, rafters, knees for keels, beams (2 millions). The value of the whole bulk of wood exported, hewn or manufactured in the saw-mills, amounted in 1899 to the large sum of 101 million marks. To this may be added the export of pulp, pasteboard, and paper, over 18 million marks, or nearly £6,000,000 sterling in all.

State Forest Administration.

Not till 1850 was it decided to establish a proper forest administration, and it was ten or twelve years later before anything practical was done. Following on advice given by Baron Edmund Von Berg, of the Forest School of Tharand, in Saxony,

administration districts were formed; but some are unworkable, or, at any rate, insufficiently controlled, owing to their enormous extent. There are four districts of over $3\frac{3}{4}$ million acres, twelve of over 250,000 acres, twenty-five of 60,000 acres, and nine of smaller extent. Forest guards are numerous compared to the foresters at the head of districts, but the guards are uneducated men with small salaries. Up to the present, little has been done further than preserving the forests and selling the heavy timber for the benefit of the Treasury. Formerly this Crown property had been used by everybody pretty much as they pleased.

In 1863 a School of Forestry was established at Evois. The School has been extended lately, and a course of instruction has been suggested at the University of Helsingfors, it being generally admitted that advanced studies are more profitably carried on at a university than in isolated schools. A course of instruction has been instituted for forest guards, and it is proposed to establish stations for experimental forestry, as has already been done for agriculture. Every year small grants of money are distributed through the agricultural societies for the promotion of forest cultivation, which can hardly yet be said to exist. The State foresters are allowed to assist private persons in drawing up schemes of management and with other work connected with forest cultivation.

In 1860 it was estimated that in the Government forests there were 10 million trees large enough (12 inches diameter and over at 20 feet high) to furnish big logs, and 5 million trees suitable for railway sleepers. Later, more exact measurements were made, giving $26\frac{1}{2}$ million first-class and 30 million second-class trees, and if the woods are included where the trees are not numbered, but where their bulk is approximately calculated, the total number in each class is $34\frac{1}{2}$ and 45 millions. As the State forests extend to about 35 million acres, this only gives about 1 first-class and $1\frac{1}{4}$ second-class tree to the acre, and even if calculated for the dry ground alone, which extends to 14 million acres, it only gives about $2\frac{1}{2}$ and $3\frac{1}{4}$ trees per acre. Still there are large districts where 19 large trees per acre are to be had.

The present condition of the Crown forests will be better appreciated if we remember how they were formerly treated. Over large areas of the domains the trees have been cut down to obtain resin or tar; elsewhere the forests have been burned over for the sake of two or three crops of grain and a little subsequent

pasture. Even now there is a constant succession of forest fires; the area destroyed in this way during 1891-95 amounted to an average of 40,000 acres per annum.

The foregoing remarks regarding waste in the Government domains apply equally to the forests owned by communes and private individuals.

Prospective Output of Timber, Etc.

The Finns are now, however, fully alive to the importance of a better conservation of their forest wealth, and the beginning which has been made in forest administration is sure to be followed up in the near future by more vigorous measures for the proper working both of State and private forest properties. The use of artificial seeding and planting is now beginning to be understood, and the great capacity of the country for the production of timber is beginning to be utilised.

When all has been said, however, it is to be feared we have no grounds for hoping that there can be a continuity of supply as regards timber of first-class size and quality, at any rate, not for export; but the supplies of smaller and immature timber for pit-wood, paper-pulp, and such like, are still very plentiful. It has to be kept in mind, however, that new industries requiring enormous quantities of timber, such as pulp-making for paper and pasteboard, match-making, turnery, etc., are more and more being extended and developed in the country, and in time the Finns are bound to use up the bulk of the surplus timber, even of smaller and medium sizes.

Many will be surprised to learn that in some provinces of the country there are complaints of lack of timber. This does not refer to some districts on the coast, where, as in Iceland, the houses are built of turf because there is so little timber. It is from districts where the peasant proprietors hold often as much as five thousand acres of forest land each that complaints of scarcity come, with the result that in some cases the Government have granted to each man as much as from 1200 to 2500 acres of Crown forest. This state of matters prevails in many districts in the province of Uleäborg in the north, which contains about the half of the whole area of Finland. In many cases the peasants have met the generous treatment of the Government by an immediate sale of all the heavy timber on their newly acquired

land; and in certain parishes with large forest areas, the peasants, on account of their reckless timber cutting, have now little to sell except osier bark. The destruction of the forests in the Lapmark in particular is very much to be regretted, because regeneration by natural means is extremely slow and difficult.

In South Finland, in a moderately rich soil, a pine takes 82 years to attain a diameter of 20 centimetres at a height of 7 metres (about $7\frac{3}{4}$ inches at 23 feet high). In Central Finland it takes 105 years, and in the north, below the Lapmark, it takes 130 years to reach the same size. The average height of a predominant forest tree, 100 years old, is in those regions 82 feet, 68 feet, and 59 feet respectively. In the very best and deepest soils the height in the same time may reach 108 feet, 87 feet, and 62 feet; while in the poor, shallow soils, only 58 feet, 49 feet, and 30 feet are to be looked for. In the far north, on the other side of the watershed, in the Lake Enare District, it takes over three hundred years for a pine tree to attain a diameter of 10 inches at 20 feet high. The figures for spruce in the various parts of the country are similar to those for the pine, only, other things being equal, the spruce attains to maturity two or three decades earlier. These figures seem clearly to prove that, after a general clearance of virgin forest growth, such as we now frequently meet with in various parts of Sweden and Norway, the extremely slow rate of production will seriously militate against a continuity of supplies being maintained in Finland, unless a much more rigid system of conservation than at present is adopted.

That this is a matter of very great importance to us will readily be understood when we call to mind the fact that of the £6,000,000 worth of forest produce annually exported from Finland, nearly £2,000,000 worth is sent to our own ports. Swedish saw-mill owners also import from Finland $1\frac{1}{4}$ million marks' worth of heavy timber every year, and a large proportion of this timber is said to be re-exported from Sweden to this country in the form of boards, planks, and battens. That the Swedish saw-mill owners are finding it necessary to import a portion of their heavy timber is another proof of the growing scarcity of first-class coniferous timber in Northern Europe.

XXIX. *The Forest Resources of Australia available for British Commerce.*[1] By E. T. Scammell, F.R.G.S., formerly Commercial Representative for the West Australian Government.

One of the most important duties requiring the early attention of the Federal Government of Australia is that of dealing with the forest resources of the Commonwealth. At present the forest laws and regulations in force, according to the opinion of the Victorian Royal Commission on Forestry, 1901, are "weak, unsystematic, and inefficient." This has been acknowledged at different times by the various Governments of the Australian States, and desultory efforts to introduce some scheme of State regulation have been made, but no scientific and comprehensive plan, on the lines laid down by France, Germany, or British India, has apparently been seriously considered, or, at any rate, attempted. Referring to the need of forest conservation and management in Greater Britain, Professor Schlich says: "Surely the time has come, or rather, it came some time ago, for a more vigorous forest policy on sensible lines throughout the Empire. Let us strive to introduce systematic forest management, more particularly into Canada and Australasia. The question is no doubt beset by great difficulties, but where there is a will there is also a way. Above all, let the self-governing Colonies consider the magnificent example which has been set them by India, where the preservation of the State forests has now been put on a safe basis, for the everlasting benefit of the people of the country and the Indian exchequer. Humboldt says that 'men in all climates'—by the indiscriminate felling of trees—'prepare at once two calamities for future generations—a want of wood and a scarcity of water.' In order to avoid these calamities, which will as surely fall upon the New World as the old, unless prevented by wise and timely action, it is incumbent upon British Colonial Governments to give the question of forest control and development their most careful and enlightened consideration."

I am glad to know that the labours of the Victorian Commission have resulted in a strong recommendation being made, to the effect that the action of the Government of India should be followed by the Legislatures of Australia. It is satisfactory also to note that the Western Australian Government have lately appointed a commission for the purpose of obtaining information,

[1] Read before the British Association at Southport, 1903.

and of recommending measures for dealing with the forests of that State, while New South Wales and Queensland are considering proposals having similar objects in view. The way, therefore, is being prepared for concerted action on the part of the Federal Government, by co-ordinating, as far as may be possible, the efforts that are being made by the various States of the Commonwealth, and by advising the adoption of measures which, while applicable to the separate States, shall be suitable to the country at large.

The Forest Areas of Australia.

The magnitude and importance of the interests involved may be judged by the fact that the forest areas of Australia comprise 107,037,000 acres of marketable timber, or nearly half the areas of the forest lands of Europe, excluding Russia. Of this area Queensland possesses 40 million acres, New South Wales 20 million, Victoria 12 million, South Australia 4 million, Western Australia 20 million, and Tasmania 11 million acres. To this should be added a considerable area in Queensland (over 100 million acres) and in Western Australia (over 70 million acres) covered with inferior timber, which has a local value for building and for general purposes.

Many, if not most, of the important forests of Australia are fairly accessible from the sea, as the best grown and most valuable timbers are mainly coastal. This especially applies to the belts of jarrah and karri in Western Australia, which occupy clearly-marked and distinct areas on the hill ranges of the south-west, which skirt the coast for some hundreds of miles; and also to Tasmania, whose forests of blue gum and stringy bark grow down to the shores of that forest-clad island. In Victoria the southern forests, which correspond very largely to those of Tasmania, are not far from the sea, while in the northern part of the State, where the timber is akin to that of New South Wales and Queensland, considerable areas border on the river Murray. The sub-alpine regions of Victoria, however, where some of the finest timber of that State is found, are at present practically inaccessible. In New South Wales and Queensland a number of the largest and most valuable belts of forest land lie between the dividing range and the sea; but in both these States there are large areas too far from the coast to render them serviceable as immediate sources of supply.

The Commercial Timbers of Australia.

The timbers of the Commonwealth are of many varieties, and some of them of high commercial value. The chief of these, as shown in the great work of the late Professor Baron von Mueller, are the eucalypts, which are indigenous to Australia, and are found in all parts of the country. Of this valuable timber alone there are over one hundred and fifty species. Besides the eucalypts, there are many kinds of casuarinas (the Australian oak), some conifers (the Moreton Bay pine), the cypress pine, the brown pine or colonial deal, and others, many acacias (the Australian wattle), banksias, and numerous other varieties.

At present, however, the range of Australian woods available for British commerce is limited. Western Australia and Tasmania are the only States that have seriously dealt with the question of exporting timber, or of using their forest resources as a valuable commercial asset. New South Wales is beginning to enter the field, and Queensland should be able to utilise her timbers for the supply of outside markets. But before these States can hope to compete with Western Australia or Tasmania, or in any way to command the attention of timber users in this country, they must issue, under authority, a definite and reliable statement of the timbers available for export. General statements on the subject—of which the Government books are full—are of no practical use, nor are the tests, proving the strength and general value of the timbers, such as those issued by the Queensland and New South Wales Governments, unless accompanied by reliable data as to the timber actually available. For example, two of the most useful eucalypts of Australia—ironbark and tallow wood—to which special attention has recently been called by the New South Wales Government, are said to be so restricted as to render an export trade of any magnitude impossible. There are, however, other varieties of timber in New South Wales and Queensland, of which there should be an ample supply. In the case of Victoria and South Australia, notwithstanding the proposed efforts to conserve and increase the forest resources of these States, there is little probability of any export trade in timber being possible for many years to come. Our attention, therefore, for the purpose of this paper, must be confined, practically, to Western Australia and Tasmania.

Western Australia.

The leading timbers of this State are the well-known jarrah (*Eucalyptus marginata*) and karri (*Eucalyptus diversicolor*), which occupy a computed area of 8,000,000 and 1,200,000 acres respectively in the south-western district. The average size of matured jarrah trees is from 90 to 120 feet in height, and from 3 to 5 feet in diameter. The stems are straight and clean, and rise 50 to 60 feet without a branch. Karri is a still finer tree, its height averaging 200 feet, diameter 4 to 6 feet, and its stem rises branchless from 120 to 150 feet. The colour of the matured woods is red, and it is difficult, even for experts, to tell from the material itself the difference between them. The usual test is by burning, when jarrah is found to leave (ordinarily) a black clinker, and karri a white ash. Both timbers are largely used for harbours and dock purposes, railway sleepers and waggons, and street paving. For structural works karri is preferred, as it possesses greater lateral strength than jarrah. But for general uses jarrah is (locally) in much greater demand, and is esteemed the better wood. These timbers, when sound, possess, in common with some other Australian woods, great immunity from the attacks of marine and land insects, and are comparatively non-inflammable. The former characteristic renders them suitable for sea-work of every kind and for use in damp ground, while the latter renders them useful as a fire-resisting material, on account of which, I understand, an order has recently been placed for karri sleepers for the Baker Street to Waterloo tube railway by the Underground Electric Railways Company of London, Ltd. The durability of karri and jarrah is universally recognised. Samples of timber which had been in use for piers and railways and for underground work for many years (such as those shown at recent exhibitions in Paris, Glasgow, and London) prove that they compare favourably with the best hardwoods of the world. The usefulness of these woods for street paving in this country is also well known.

Of the other timbers of this State available for export, tuart (*Eucalyptus gomphocephala*) occupies the first place. This timber, in strength and toughness, is one of the best, if not the best, of all Australian woods. But the limited area it occupies renders a large export trade in it impracticable. Red gum (*Eucalyptus calophylla*) is a strong and useful wood, and has a very wide range. It requires, however, to be carefully

selected, as it is often marred by numerous veins. These, however, exude a gum which possesses important medicinal properties, and is used locally for tanning. The term "red gum" is common to many Australian eucalypts, particularly to the *Eucalyptus rostrata* of Victoria and the *Eucalyptus resinifera* of New South Wales. Wandoo (*Eucalyptus redunca*) is a wood that needs to be better known. It covers a considerable area, and it is computed that there are from 6 to 7 million loads of marketable timber available for use or export. It is well suited for railway and wheelwright work. York gum (*Eucalyptus loxophleba*), another widely-distributed timber, is a strong, tough wood, suited for general purposes. The same also may be said of the yate gum (*Eucalyptus cornuta*) and other eucalypts of this nature, of which this State and Australia generally possess a great variety. The *Acacia saligna* (a species of wattle) supplies a valuable tannic acid—mimosa tannin—of which the bark contains about 30 per cent. The well-known raspberry jam (*Acacia acuminata*) is a beautiful wood, suitable for cabinet work. Another acacia, the badjong (*Acacia microbotrya*), is used for barrel staves and soft-wood joinery. There are many other timbers in this State—casuarinas, banksias, and conifers—suitable for building, furniture, and fancy work, which are available for export.

Tasmania.

The most important and best known tree of the Tasmanian forests is the blue gum (*Eucalyptus globulus*). Its name is derived from the colour of the young growth. In size it compares with jarrah and karri. The colour of the matured wood is golden yellow to purplish brown or buff. It is in considerable demand for harbour works. Good piles, like those supplied for the national harbour works at Dover, can be obtained up to 100 ft. in length. with only a moderate taper. It has been tried for street paving in London, though with only moderate success. If sound and well selected, blue gum is one of the most important and valuable trees of Australia, and, according to recent reports by the Government of Tasmania, is available in any quantities. On account of its rapid growth, and the pungent and odorous exhalations from its leaves, it has been widely planted in Southern Europe, particularly in malarial districts, with most beneficial results. In South Africa, India, and particularly in the Southern and Western States of America, extensive plantations of blue gum have been

made. In a report on *Eucalypts Cultivated in the United States*, issued by the U.S. Department of Agriculture, 1902, this tree is described as the best all-round eucalypt. As an illustration of its use for harbour purposes, the report states that a contractor, who was constructing a pier at Oceanside (California), required a few piles of Oregon timber to complete his contract. As these were not, for the moment, to be had, he obtained from a neighbouring plantation some piles of blue gum. When it became necessary, some years later, to repair the pier, these were found to be the only sound piles in the structure. "The demand for these piles," the report states, "is now greater than the groves of eucalyptus can supply."

Stringy bark (*Eucalyptus obliqua*) is a more widely distributed tree than blue gum. It attains an immense size. The timber varies considerably, according to the situation and soil in which it grows. It is used for similar purposes to blue gum, but it is more subject to gum veins, and has, therefore, to be carefully selected It should be serviceable for street paving, but its tendency to warp and shrink renders careful seasoning and preparation necessary.

Among the other timbers of Tasmania which are available for export, blackwood (*Acacia melanoxylon*) and myrtle (*Fagus Cunninghamii*) are the best known and most in demand. Blackwood is extensively used for furniture, panelling for railway carriages, wainscotting, and interior fittings. It resembles cedar in appearance. Alcock & Son, of Melbourne, use it for billiard tables, and Collard & Collard, of London, for pianos. It has lately been supplied to the Admiralty for gun carriages, having passed the necessary test in the Government arsenals. Myrtle has been favourably reported upon by Messrs Ransome, saw-mill and mechanical engineers, of Chelsea, for its strength and high finish. Fine examples of its use, with blackwood, for dados and wall linings may be seen in London.

In addition to these there are the Huon pine (*Dacrydium Franklinii*), an exceedingly fine timber, light and strong, which should constitute a useful and valuable commercial asset for local and export purposes.

New South Wales and Queensland.

I do not propose to give any detailed description of the timbers of these States, since, as already indicated, sufficient particulars

are not to hand to justify any confident expectations of a continuous supply for commercial purposes. The only timbers from New South Wales that are being exported to any extent are blackbutt (*Eucalyptus pilularis*), which is being used for sleepers and railway waggons, and tallow wood (*Eucalyptus microcorys*), which is being sent to South Africa for use as sleepers. Blackbutt is in colour a lightish yellow or brown. It grows to a height of from 50 to 150 feet, with a diameter of from 2 to 4 feet. Like other Australian hardwoods, it is liable to warp, and requires careful seasoning. There is a difficulty at present in securing large sizes for exportation, for which there is an increasing demand. Tallow wood is of a clear yellow or light reddish colour when newly cut, but changes afterwards to a pale brown. Its average height is from 100 to 120 feet, and its diameter 6 to 8 feet. Its common name is due to the greasy nature of the wood. It is largely used in Sydney for street paving, and, with blackbutt and box (*Tristania conferta*), is being tried for that purpose in Westminster.

Conclusion.

My object in bringing forward at these meetings a practical subject of this nature is to aid, as far as one is able, the efforts that are being put forth by scientific, as well as commercial, men to promote the interests of our Colonies, the development and progress of which cannot fail to be of deep concern to this Association. It will, I am sure, be readily granted that the more widely the products and the possibilities of these great Colonial possessions are known, the more clearly will the fact be accentuated that our interests, whether scientific, industrial, or commercial, are one.

XXX. *Humus as a Geographical Agency.*[1] By Marcel Hardy, University College, Dundee.

The excellent translation by M. Ed. Henry[2] of E. Wollny's book on the decomposition of organic matter and kinds of soils, has again drawn attention to this fundamental work. E. Wollny greatly added to, arranged methodically, and criticised the researches on this subject which were scattered throughout scientific publications; and from these he draws conclusions which are of interest to the botanist, the agriculturalist, and the forester, no less than to the geographer. Thus it is necessary to give a concise account of this important work, not only in order to direct the attention of specialists to the original, but also to give the general public a grasp of the whole question, that they may utilise practically the results.

Organic remains lie either on the surface of the ground or in its more superficial layers, where they are continually undergoing physical and chemical changes, which vary with the nature and state of the material and with the external conditions. From a chemical standpoint these processes may be reduced to two main types: oxidation, when there is a sufficient supply of air to the organic matter, and reduction when otherwise. Slow oxidation or eremacausis is chiefly characterised by a somewhat abundant formation of volatile products, such as carbon dioxide, ammonia, water, leaving a residue of mineral matter, most of which is available for immediate use to the higher plants.

On the other hand, if oxygen is not supplied to the decaying matter in sufficient amount, the mode of decomposition becomes a process of reduction or putrefaction. The gaseous products are then much less abundant. They are principally carbon dioxide, marsh-gas, hydrogen, sulphuretted hydrogen, and some others. The solid residue is consequently greater, mainly consisting of nitrogenous compounds, volatile fatty acids, and mineral matter, and is unfit for immediate use by the higher plants. It is dark in colour and very resistant to any further decomposition changes. In both cases, however, these phenomena are chiefly of a biological nature, and due mainly either to

[1] Reprinted from the *Scottish Geographical Magazine*.

[2] E. Wollny, *La décomposition des matières organiques et les formes d'humas dans leurs rapports avec l'agriculture*. Traduction E. Henry, 1902.

the micro-organisms which air, water, and soil contain in varying amount, or to soluble ferments. Most of these micro-organisms are lower plants, such as bacteria, Mucorineæ, and, to a less extent, yeast. The Mucorineæ have a considerable oxidising power, whereas a great many bacteria, by nature or circumstances anærobic, act as reducing agents. In putrefaction, for instance, these bacteria bring about the first stages of reduction. All these organisms live exclusively in the superficial layers of the soil, though protected from the light. At a depth of one metre their numbers have greatly decreased; at two metres they have practically disappeared.

Quite a number of animals contribute to the eremacausis process of decomposition. These are rhizopods, earth-worms, Anguillulæ, crustaceæ, snails and slugs, myriapods, many insects, both larval and adult. They work by tearing up the material, or swallowing and digesting it.[1]

Various agencies are at work, modifying both the rate at which the transformation proceeds and its nature. On the one hand, the physical and chemical conditions of the matter itself; and on the other, the external conditions—air, heat, moisture, light, and chemical agencies.

Thus, the general process of decomposition is the outcome of a number of simultaneous minor processes. Apart from purely chemical forces, each of these is controlled by the activity of certain micro-organisms and soluble ferments, this activity being in its turn controlled by the combination of the conditions of the matter and of external circumstances. The decomposition thus varies its aspects according to the prevalence of one or another process. But, as a rule, the whole is controlled in quantity and quality by the factor which is at a maximum or at a minimum.

In nature these factors at once depend upon the climate and the soil, with its living and dead plant covering. We may thus approach the problem from this standpoint, and investigate the influence of each component of the climate, soil, and vegetable carpet upon each of the main processes, especially on the freeing of carbon dioxide, which may be used as a criterion of the intensity of decomposition. We are thus enabled to

[1] C. Keller, *Humusbildung und Bodencultur unter dem einflusstierischer Thätigkeit*, 1887.

formulate certain general conclusions, based upon the law of maximum and minimum, which we have already mentioned.

Among the different factors of climate, we must above all consider temperature and moisture.[1] When we remember that lowering of temperature is associated with a decrease of biological and chemical activities, we easily understand why decomposition must be slower, and hence accumulation of organic residues faster, in the north than in the south, in the highlands than in the lowlands. Where moisture is relatively constant, it is the temperature which controls the decomposition, as in the Lombardo-Venetian plain. Conversely, when temperature is moderate and constant, moisture becomes the predominant agency, as in Sicily and Southern Italy.

The influence of the soil varies with its position, slope, and physical and chemical constitution. In the dry season, or in a dry country, for instance, a northern exposure will offer the more favourable conditions for decomposition. Among the mountains of the south of France the soil is deeper on the northern slopes, because there the moisture necessary for eremacausis is more abundant and remains longer than on the southern slopes, showing that the greater moisture more than compensates for the lower temperature. With these conditions reversed, a southern exposure will produce the greater intensity of eremacausis. As regards the slope of the ground, when there is an average inclination of 20°, the production of carbon dioxide is at a maximum. It decreases when the slope is steeper or more gentle.

The physical constitution of the soil will determine its heat and the quantity of air and water which it holds. Hence its effects are very complicated. As the amount of water increases, there is a corresponding decrease in the permeability to air. The finer the grain of the soil, the less the permeability to water. Soils which are rich in colloidal substances—humus, clay, and iron—are impermeable to air even when they contain an amount of water still far from saturation. On the other

[1] Researches made by a number of scientific workers have shown beyond doubt that light, especially its blue and violet rays, has an injurious influence on bacteria. It is to be hoped that methodical observations and experiments will bring into greater prominence the consequences of this fact, which are, in all probability, of importance in the decomposition of organic matter in nature.

hand, the amount of water influences conduction and calorific capacity. For example, during the cold season, a peaty soil is the warmest, then loam, limestone, and lastly sand. In spring these temperature relations are altered, so that in summer the sand is warmest, then peaty soil, limestone, and loam. Thus if we are considering the warm period only, the thermal characters of clay or loam are the least favourable for decomposition, those of sand the most favourable. Hence it will be seen why practical men call clayey grounds cold and sandy soils warm.

The chemical nature of the soil may be of great importance. For example, lime, as carbonate, furthers the formation of humic acids; as sulphate, it favours nitrification.

The carpet of living plants and the decaying deposits are at work hastening or abating the above-mentioned influences. A living covering retards the decomposition of organic matter just in proportion to the vigour and density of the plants composing it, while in a soil coated with dead material the eremacausis is slower than in bare earth, but more rapid than in ground clothed with growing plants. The result of the decomposition of organic matter is thus the production of a number of elementary volatile substances with a solid organic residue containing also mineral salts. It is to this organic residue that the name humus applies.

Wherever a moderate amount of moisture, and a fairly high temperature, along with enough air, produce a strong eremacausis, humus is only formed in trifling quantity. When one of the factors falls to minimum, the gasification of the organic matter correspondingly decreases, balanced by an increase of solid residues. Climate and soil thus both have their influence upon the production of humus. Humus is comparatively thin in a moist and moderate climate, as in the greater part of France, where peat-bogs are rare, occurring only in the mountains. In tropical regions, where the insolation is continuous, fermentation may proceed so rapidly that practically no humus residue is left. With the lowering of temperature at higher latitudes or altitudes, the thickness of organic residues increases, as we see in the zone of lowland peat-bogs or morasses of Ireland, Holland, Hanover, North Germany, and Russia, or in the mountain peat-bogs.

Similarly, the greater the permeability of the ground, the less can humus accumulate upon it. In fine-grained soils there is not enough air, under normal conditions, for an active eremacausis; consequently the organic matter is but slowly decomposed, leaving an abundant residue.

In some cases the air-supply may be so meagre that the disintegration is a process of putrefaction, and humus gathers forming thick layers. According to the permeability of the soil, there is every link between these extremes, and the transitions are represented by very various types, on account of the number of the agencies which are brought to bear upon the eremacausis.

Humus varies in colour from a dark brown to reddish yellow, according to its mode of formation. It presents widely different textures, porous in mould, spongy or friable in peat, earthy or fibrous elsewhere. Old peat has a greasy appearance, and forms an amorphous plastic moss. Humus consists of organic substances with a greater or less amount of mineral matter. Among the former are ulmin and ulmic acid, humin and humic acid, crenic and apocrenic acids, which arise from subsequent oxidation of humin and its acid. A comparative analysis of living and humic matter shows in the latter an increase of carbon and a corresponding decrease of hydrogen and oxygen. The nitrogen varies from 3 to 20 per cent. of the total humus weight, but is usually combined as insoluble compounds.

Humus forms an almost waterproof layer; but it absorbs the water easily, and retains it even better than clay. On the other hand, it is subject to a very great evaporation. On the whole, humus contains more water than any other kind of soil, but gives it off to the plants with greater difficulty. It must therefore contain a greater proportion of water than sand or clay does, in order to meet the requirements of its vegetation.

Humus dried up in air becomes more permeable to gases. When water increases and the volume of the pores decreases, the quantity of carbonic, ammoniacal, and other gases, which is here always greater than in the open air, diminishes correspondingly. The humic substratums are very hygroscopic, and remarkable by their power of condensing ammonia, marsh-gas, sulphuretted hydrogen, etc.

On account of its dark colour, humus has a strong absorbing power for the sun's rays. On the other hand, it has but weak

radiation. One might then naturally expect to find it warming rapidly. But this is not the case, for the specific heat of this soil is greater than that of sand or clay. Moreover, an intense evaporation from the usually moist surface, prevents any considerable rise in temperature near the surface. The heat proceeds slowly downwards on account of the poor calorific conductivity of the material. All these properties explain how, with normal temperature variations, humus is on the average colder than sand in summer and warmer in winter.

Classification of Humus.—According to the external circumstances which control the production of humus, it may be classified into more or less well-defined groups.

Eremacausis products.—Humuses formed in favourable conditions of air, moisture, and temperature have this in common, that they disappear more or less quickly, forming carbon dioxide, water, and ammonia, leaving a solid residue of the mineral constituents contained in organic matter, and that they give an alkaline or neutral reaction. This soil is generally termed mould (*Mull or Terreau*).

Agricultural mould is made from harvest remains and organic material brought to the land. It decomposes quickly and does not gather.

Forest mould includes the humus of the ground (*Waldmull*) and the humus of the covering (*Streumull*) or leaf-mould. The former comes from the roots of trees that die in the earth every year. The latter is spread over the soil as a thin covering, which decomposes rapidly. It is overlaid by a shallow, unstable layer of detritus. This humus is composed of an intimate mixture of organic constituents with the mineral elements of the soil.

Slime-mould (*Schlamm mull*) is formed in well-oxygenated water. Should bad conditions be offered, the reaction grows less active and turns to putrefaction. This forms *rohhumus* or raw humus, which gathers in thick, compact layers.

Steppe raw humus is mainly due to the physical nature of the soil, which prevents free access of air. It is formed in various climates, in very fine grained, little permeable soil, which interferes with the water-supply to the deep roots, and determines the exclusion of the forest and the predominating of the steppes, prairies, and similar herbaceous formations.

Heather raw humus results from lack of moisture in the regions where the dominating heather produces a dense felting or network of roots. It is often characterised by the formation, at no great depth, of a brown or black grit or pan, of organic origin, usually called Ortstein in German, Alios in French, and Moorpan in English.[1] This dark humus, of compact structure, is as tough as peat.

Forest raw humus[2] is derived from the material of the covering (*Streumull*), when, either on account of the temperature or the growth of the trees, moisture decreases and air no longer is supplied in sufficient amount. Decomposition is retarded; the covering becomes more and more impermeable. The plants which settle on that humus, heaths and vacciniums, help by the compact network of their roots and their own remains to increase the deposit and exhaust the superficial layers of the ground.

Meadow or Pasture raw humus originates, on the contrary, from the decomposition of roots of grasses and other meadow herbs, with a limited supply of air and an excess of moisture. It is formed especially in the meadows or pastures, in the low-lying parts of the land.

Products of putrefaction.—The result of decomposition without oxygen is peat or acid humus, a very stable mass, which may accumulate in vast beds. They are divided into lower or infra-aquatic marsh or peat, and sphagnum, or supra-aquatic moors.

Lower or infra-aquatic marshes are formed in the neighbourhood of running water or in lake hollows, on physically and chemically very different soils. They arise from the putrefaction of grasses, sedges, and rushes, and a few mosses which grow on the quiet river banks and lake shores usually covered with alluvial deposits. When they thus invade ponds and lakes, they restrict the surface area.

The first condition for the occurrence of the plants of these marshes is a soil rich in nutritive elements, especially lime.

Sphagnum moors, or supra-aquatic moors (*Haide moors*), are formed in hollows both in the plains and the mountains by the putrid decomposition of sphagnum mosses which grow at

[1] P. E. Müller, *Studien über die Natürlichen Humusformen und deren Einwirkung auf Vegetation und Boden*, Berlin, 1887.

[2] C. Grebe, *Aufforstung von Ödlandereien*, 1896.

the surface of the water. They are constantly associated with very pure waters, especially poor in lime. They arise on very different subsoils, but more particularly on impermeable clay, peaty pastures, or on infra-aquatic marshes, if the nature of the water happens to change. These sphagnum moors often form in the forests on mountain slopes or plateaux, owing to the thick layers of raw humus which accumulate there, and the moorpan which it produces.[1]

Between these two types there is every stage of transition; they may even be intermixed.

Influence of Humus on the Fertility of the Soils.—Humus exerts a different influence, according to whether it forms part of the soil itself or is spread over it as a covering. As a constituent of the soil, its effect on the vegetation varies with the amount contained in the soil. A moderate proportion of humus is a considerable help to the fertility, but an excess of humus is extremely unfavourable. Humus matter enriches the soil by contributing soluble food-stuffs, and protects it against percolating water which would otherwise dissolve and wash away its salts. From the researches of Petermann, P. P. Dehérain, Lawes, Gilbert, and Breal, we may conclude that higher plants can utilise some organic matters supplied to them, but it has not yet been ascertained whether those substances can be directly absorbed, or whether they have to undergo a chemical change brought about by the action of certain substances secreted by the roots. Besides, quite a number of plants have symbiotic fungi or mycorhiza in their roots, which can supply to their hosts carbon and nitrogen from the organic detritus.

The formation of carbon dioxide in humus furthers the disintegration of the underlying rock and the solution of certain otherwise insoluble mineral constituents, and thus helps to increase the fertility of the soil. Humus has also the power of loosening compact soils, thus making them permeable; whereas with sand, it diminishes permeability. Consequently evaporation is furthered in sand, but checked in clays and compact subsoils. Finally, humus moderates extremes of soil temperature arising from variations in external conditions.

The quality and quantity of the dead covering spread over the ground in forests depends upon many factors, but chiefly

[1] P. Græbner, *Die Heide Norddeutschlands*, Leipzig, 1901.

upon the nature and the condition of the materials composing it.[1] Organic matter amounts to 80 per cent. of the total weight of the covering, dried in open air. Of that mass, the greater part is made up of non-nitrogenous compounds. This humic covering or leaf-mould absorbs a certain amount of water, which is proportionate to its thickness, but becomes more nearly constant as the thickness increases. Another portion of the fallen water percolates into the subsoil. This is greatest with a layer, 20 centimetres deep, of leaf-mould. Evaporation is lessened in this layer, till, after a certain thickness, it remains constant. Upon the temperature of the soil, the dead covering also exerts a moderating influence, in that it does not undergo so wide a thermal variation range as does inorganic earth.

In all these ways the materials of the covering and the humus which arises from it constitute the natural manure of forest soil.

However, this influence of the covering on the physical and chemical constitution of deeper layers of the soil may become injurious, if the detritus decomposes in unfavourable conditions.

In a mould soil, there is first a superficial layer,[2] the most decomposed and exhausted by drainage; then a zone rich in soluble food-stuffs, and yet deeper, the crude earth, very little, if at all, modified. But where there is acid humic decomposition, the dissolving and washing away of the salts is of much greater import. Often there arises, thus, at no great depth, in the layer of active decomposition, a hard stratum of agglutinated humic substances which had first been dissolved and then reprecipitated. This organic grit or pan (*Ortstein-Alios*) constitutes an impermeable layer which offers a mechanical obstacle to the penetration of roots, water, or air into the soil beneath it, and becomes very injurious to the vegetation and healthiness of the country. Before a good many wells and pits had been dug through the pans of the landes of Gascony, this region, now one of the healthiest of France, was noted for its barrenness and unhealthiness.

From the foregoing, we see that humus deserves to rank

[1] E. Ramann, *Die Waldstreu und ihrer Bedeutung für Boden und Wald*, Berlin, 1890.

[2] E. Ramann, *Der Ortstein und ähnliche Secundärbildungen in den Alluvial- und Diluvial-sanden*, Berlin, 1886.

among the agencies which determine the aspect and the future of a country, *i.e.*, among the geographical agencies. Owing to its *rôle* having been overlooked, or not fully appreciated, many phenomena failed to find their correct interpretation.

In modifying the physical and chemical constitution of the soil, it affects the superficial erosion of the rocks. Here, by soluble acids, it furthers the disintegration of the solid rock, and impoverishes the superficial layers. Elsewhere, by covering the soil, it protects it from extreme variations of temperature and moisture, prevents the transportation of disintegration products, and checks erosion. In those light soils where it accumulates in proper quantities, it binds together and acts against a too rapid mechanical washing away.

Humus forms enormous deposits, particularly in peat-bogs, in tundras, and in steppes (*Tchernozom*). The coal-beds, too, we may in most cases conceive as derived from former infra-aquatic marshes of geological ages.

No less striking and varied is its action on vegetation. For instance, it changes a forest into a sphagnum bog or a heather tract, and again the bog into heather. It transforms pasture into marsh, marsh into infra-aquatic bog, this into sphagnum moor, etc. Elsewhere it develops slowly forest at the expense of steppe.

The geographer must take humus into account and understand its influence if he desires to interpret aright the relief and nature of the land, its vegetation and fauna, the economic and social history of man.

XXXI. *The Altitude of Forest Trees on the Cairngorm Mountains.*[1] By Hugh Boyd Watt.

In the region of the Cairngorm Mountains is to be found the finest wild forest scenery in the country, in respect both of extent and of natural features. From the hill-slope above Boat of Garten, for instance, the prospect is such as no other district in the country can show. That fine river, the Spey, is immediately below the eyes; across it are the massed and serried ranks of the pine trees of the forests of Abernethy and Rothiemurchus, extending for miles up and down the river, and stretching up the hills, which culminate in the principal summits of the Cairngorms. This great background, far in the distance, dwarfs by its size and remoteness the woodlands at its base. They seem, in proportion, only dense plantations such as may be seen on any hill-side, and it is perhaps not until the forests are actually visited and passed through that their extent is properly appreciated.

I do not know that the history of these woodlands has yet been told with any fulness or scientific accuracy, tradition, legend, and imagination—all admirable things in their proper places—having been too much drawn upon. Nor will this side of the subject be taken up here, this paper being limited to some observations, recently made, on the kinds of trees found on the Cairngorms, and particularly as to the altitudes at which they grow.

It may be said generally that about 1700 feet above sea-level represents the line above which only few or exceptionally situated trees occur, and these only of a very few species. It might be more accurate to say that 1500 feet is the limit; about this height the Abernethy and Rothiemurchus Scots pines die out. In Glen Feshie, and on the Don above Cock Bridge, and in Glen Quoich, the highest pines are also at about 1500 feet. In Glen Dee they stop at about 1300 feet, and in Glen Lui, at Derry Lodge (alt. 1386 feet), there is a detached clump of fair-sized pines. At Braemar, Creag Choinnich (alt. 1764 feet) is wooded nearly to the top, chiefly with Scots pines and larches. The only other tree which attains the heights just named is the birch, which seems better able than the Scots pine to hold its own, and even gain ground. In some places—such as Glen Quoich—the wreck of the pines, blown down and decaying, while not unpicturesque, is in some aspects painful. The fallen pines seem

[1] Reprinted from *Cairngorm Club Journal*, January 1903, Aberdeen.

not worth clearing away, and a new plantation at the height-limits named is quite unusual. There is a dense one of Scots pines in Glen Lui (alt. about 1300 feet), carefully fenced, well grown, and healthy looking, but such a plantation cannot be said to add to the beauty of the spot. The birch, on the other hand, cannot be other than beautiful, and one of the finest and most extensive birch woods known to me is at Braemar. Many of the houses in the village of Braemar are built in clearings in this wood, trees frequently being left standing at and around the houses. By the side of the Dee the birches are tall, and many are above the average size; but when an altitude of 1500 feet is reached, they have become beautifully small and well proportioned—regular dwarf trees. There are thousands not over six feet in height. They ascend in almost unbroken numbers to an altitude of about 1700 feet on the side of Morrone, and sweep along its northern slopes from about Corriemulzie to Glen Clunie—a distance of more than two miles. It is somewhat curious how they immediately die out in Glen Clunie, and from near the Croft of Muickan, till the Spital of Glenshee is reached (about 14 miles), not a group of forest trees is to be seen. The Morrone Wood is a characteristic Highland native wood, with an undergrowth of heather, juniper, and bracken. Amongst the birches are occasional aspens, occurring up to 1500 feet, and Scots pines come in in places, but the wood is a typical birch one. Since I made these observations, I have learned that Macgillivray knew this Morrone Wood (previous to 1855), seemingly much in the same state then as it is now (*Natural History of Deeside and Braemar*, 1885, p. 172). This writer's remark that "the whole tract along the river from . . . Birse to the Linn may be considered a birch forest" (*op cit.*, pp. 164-5), is at variance with Lord Cockburn's observation made in 1846. The last-named remarks on the equal profusion of the birch and Scots pine near Castleton (*Circuit Journeys*, 2nd ed., 1889, p. 305). Macgillivray, however, seems to have looked on the Scots pine as not a native of Braemar (*op. cit.*, pp. 17 and 361). The present conditions are that by the Dee at and above Braemar the Scots pine is predominant, and by the time the Linn is reached the trees are almost entirely of this species. Hazel and alder occur by the river side above Braemar, and at or near the village (alt. 1110 feet) are well-grown and flourishing examples of the lime, great maple, elm, horse-chestnut, beech, and larch. A dark copper beech is right in the village. These last-named

species must all be noted as introduced, not native. I did not observe any oaks higher up than about 700 or 800 feet.

Through the kindness of Miss J. G. Watt, I had some observations made at Tomintoul (alt. 1160 feet) this summer on forest trees. These, along with my Braemar notes, may be concisely given in the form of a list of species observed at an altitude of 1100 feet and over. This limit is fixed because it covers both Braemar and Tomintoul, and not because any scientific value attaches to an elevation of 1100 feet. Nor can any deduction or inference be safely made from the list as to the limits up to which the species named can grow on our mountains. It is, in short, an "observational," not a theoretical list.

Near Tomintoul, at a height of about 1200 feet, is an interesting peat-moss. It is being cut for fuel, and shows a depth of some ten feet in places. In it are found trunks of large trees; the species I have not ascertained, but the probability is that it is the Scots pine. The local story is that this wood was burned by our "auld enemy" the English in "Queen Anne's time." It is much more likely that this and the remains of other burnt woods frequently found in the Highlands are evidences of the primitive methods by which the earlier inhabitants cleared the land for their own purposes.

List of Species of Forest Trees noted at 1100 *feet and upwards.*

1. Lime,	*Tilia europæa*,	1100-1200 feet.
2. Great Maple,	*Acer Pseudoplatanus*,	,, ,, ,,
3. Laburnum,	*Cytisus Laburnum*,	,, ,, ,,
4. Wild Cherry,	*Prunus avium*,	,, ,, ,,
5. Rowan,	*Pyrus aucuparia*,	1100 feet.
6. Hawthorn,	*Crataegus oxyacantha*,	,, ,,
7. Ash,	*Fraxinus excelsior*,	1100-1200 feet.
8. Elm,	*Ulmus montana*,	,, ,, ,,
9. Birch,	*Betula alba*,	up to 1700 ,,
10. Alder,	*Alnus glutinosa*,	1100-1200 ,,
11. Hazel,	*Corylus Avellana*,	,, ,, ,,
12. Horse-Chestnut,	*Æsculus Hippocastanum*,	1100 feet.
13. Beech,	*Fagus sylvatica*,	,, ,,
14 & 15. Willows,	*Salix* (2 species at least),	1100-1200 feet.
16. Aspen,	*Populus tremula*,	up to 1500 ,,
17. Scots Pine,	*Pinus sylvestris*,	,, ,, ,,
18. Larch,	*Larix europæa*,	over ,, ,,

XXXII. *The Douglas Fir Plantation at Taymount.*[1]

Of all the exotic conifers, this appears to be by far the most important for British conditions. It grows best in Ireland and the west of Great Britain, where the air holds the maximum amount of humidity, but it also thrives well wherever it is sheltered from strong prevailing winds, provided the soil is sufficiently deep. It shows a marked aversion to chalk. Of the two chief varieties—the green, from Oregon, and the glaucous, from Colorado—the green appears to be by far the more important for British conditions. It grows much faster, and yet yields better timber than the other, while, although a little more delicate, it is sufficiently hardy for all practical purposes.

No.	Age.	Height.	Girth.	County.	Remarks.
	Years.	Feet.	Ft. in.		
1	12	24	2 5	Galway.	
2	18	43	4 0	Moray.	
3	22	62	7 0	Carmarthen.	
4	30	80	6 0	Moray.	
5	40	100	7 6	King's.	
6	46	92	7 1	Perth.	Measured 1891.
7	58	103	9 0	Perth.	Same tree as No. 6, measured 1903.
8	61	120	10 10	Buckingham.	From seed sent home by Douglas in 1827, measured 1891.
9	73	127	11 6	Buckingham.	Same tree as No. 8, measured 1903.

In the case of the Douglas fir I am able to give some figures from a wood (Taymount) of eight acres planted with four-year-old plants in the spring of 1860 on the estate of the Earl of Mansfield, about seven miles from Perth, in central Scotland.

Professor Schlich puts the quality of the locality in the first class, but in doing so I think he estimates somewhat too highly. My reasons for thinking so are two-fold: (1) the impression gathered from an inspection of the soil is that there are many

[1] Abstracted from a paper entitled "Exotic Conifers in Britain," read by Dr Somerville before the Congress of Forestry Experimental Stations, Vienna, September 1903, and reprinted in the *Journal of the Board of Agriculture*, December 1903.

more suitable situations, and (2) the height-growth recorded in the Table above is in many cases better than that at Taymount. The planting was done in squares, the Douglas firs being placed 12 feet apart, and the interspaces filled with larch, so that the trees stood 6 feet apart. An acre thus contained, theoretically, 1210 plants, of which 908 were larch and 302 Douglas firs. By the year 1880 the larches had all been removed, and in 1887 the Douglas firs were thinned, so that only 202 remained per acre. The Douglas firs (600–700) removed from the eight acres realised by auction sale £34. There can be no doubt that too many trees were removed at this time. What with too wide planting to begin with, and too much thinning in 1887, the trees remaining in the latter year were very rough and branchy, and about 1896 all the branches to a height of 30 to 35 feet were pruned off. No thinning has taken place since 1887.

On July 20th, 1888, Professor Schlich[1] made a careful estimate of the volume of the growing stock. By counting and measuring the diameter of all the trees on $\frac{4}{10}$ acre, he arrived at the following result, in terms of an acre:—

Diameter at 4½ feet from Ground.	Number of Trees of each Diameter.	Total Sectional Area at 4½ feet.	Diameter at 4½ feet from Ground.	Number of Trees of each Diameter.	Total Sectional Area at 4½ feet.
Inches.		Square feet.	Inches.		Square feet.
4	3	·26	11	33	21·78
5	12	1·64	12	20	23·56
6	3	·59	13	35	32·26
7	7	1·87	14	17	18·17
8	10	3·49	15	20	24·54
9	17	7·51	16	8	11·17
10	15	8·18	17	2	3·15

Total number of trees, 202; Total Sectional Area, 158·17 square feet.

The average sectional area is thus ·783 feet, equal to a diameter of 12 inches.

An average tree was felled, and gave the following dimensions:—

Diameter at 4½ feet from ground, .	11·78 inches.
Sectional area, . . .	·757 sq. ft
Total height, ...	60 feet.

[1] *Trans. Royal Scottish Arboricultural Society*, Vol. XII. p. 226.

The tree was found to measure 3 inches in diameter at 48 feet from the ground, and there it was cut through. It was then divided into eight sections of 6 feet each, each of which was measured, with the following result:—

No. of Section.	Length of Section.	Mean Diameter of Section.	Volume of Wood in each Section.
	Feet.	Inches.	Cubic feet.
1	6	12·5	5·11
2	6	10·0	3·27
3	6	9·5	2·95
4	6	8·5	2·36
5	6	7·0	1·60
6	6	6·5	1·38
7	6	5·0	0·82
8	6	3·5	0·40
Total, . .	48	...	17·89

The top and branches measured 50 cubic feet, say—

$$50 \times \cdot 15 = 7 \cdot 5 \text{ cubic feet of solid wood.}$$

These figures are calculated by Dr Schlich to give a total volume of wood, exclusive of top and branches, of 3738 cubic feet per acre. The trees being four years old when planted, had reached an age of nearly thirty-two years on July 20th, 1888, so that the increment, apart from thinnings and branches, was 117 cubic feet per acre per annum.

By the courtesy of the Earl of Mansfield, I have been able to bring the statistics of this interesting wood up to date, by measurements taken by Mr Pitcaithley on June 22nd, 1903. Two typical areas, each of $\frac{1}{10}$ acre, were selected, and the trees counted and measured. The results are given in the accompanying Table:—

Sample Area No. 1.			Sample Area No. 2.		
No. of Tree.	Diameter at 4½ feet.	Sectional Area at 4½ feet.	No. of Tree.	Diameter at 4½ feet.	Sectional Area at 4½ feet.
	Inches.	Square inches.		Inches.	Square inches.
1	11·1	96·8	1	6·5	33·2
2	12·0	113·1	2	7·0	38·5
3	12·7	126·7	3	7·2	40·7
4	13·7	147·4	4	8·0	50·3
5	15·0	176·7	5	9·6	72·4
6	15·3	183·8	6	10·8	91·6
7	15·6	191·1	7	12·0	113·1
8	15·9	198·6	8	12·3	118·8
9	18·1	257·3	9	12·4	120·8
10	18·3	263·0	10	13·5	143·2
11	18·5	268·8	11	14·5	165·1
12	18·6	271·7	12	14·8	172·0
13	18·9	280·5	13	15·0	176·7
14	19·3	292·5	14	15·8	196·1
15	19·6	301·7	15	15·9	198·6
16	19·9	311·0	16	16·5	213·8
17	20·1	317·3	17	16·9	224·3
18	21·8	373·2	18	17·0	227·0
			19	17·4	237·8
			20	18·0	254·5
			21	18·1	257·3
			22	18·5	268·8
			23	18·6	271·7
			24	19·9	311·0
			25	20·5	330·1
Total Sect. Area in sq. in.,		4171·2	Total Sect. Area in sq. in.,		4327·4
,, ,, ,, sq. ft.,		29·0	,, ,, ,, sq. ft.,		30·0
,, ,, ,, per Acre,		290	,, ,, ,, per Acre,		300
Average Sect. Area per tree in sq. in., . . .		231·7	Average Sect. Area per tree in sq. in., . . .		173·1
Do. in sq. ft., ...		1·6	Do. in sq. ft., ...		1·2

Average Sectional Area per tree on both sample Areas = 197·6 sq. inches.
,, ,, ,, ,, ,, = 1·372 sq. feet.

On area No. 1 there were 18 trees, and on area No. 2, 25 trees, the mean for the whole wood being probably not less than 210 per acre. In order to facilitate accurate comparison with Dr Schlich's figures of 1888, we may assume the same average number of trees per acre, namely, 202. In the case of area No. 2, four of the trees were exceptionally small, and in a wood planted sufficiently close in youth they would certainly have disappeared in the thinnings. The total sectional area of the stems at 4½ feet was 290 and 300 feet respectively per acre, mean say 295. From these figures the mean diameter of the trees of area No. 1 works out at 17·2 inches (girth, 4 feet 6 inches), while in the case of area No. 2 it is 14·8 inches (girth, 3 feet 10½ inches).

The mean diameter may be put at 15·9 inches, equal to a girth of 4 feet $1\frac{3}{4}$ inches. In 1888 Dr Schlich found the average diameter to be 12 inches, his sample tree being a quarter inch less.

Some trees having last winter been blown down towards the margin of the wood, Mr Pitcaithley measured a typical one in 6 feet sections, the details of which are given below. The total length was 80 feet, the diameter of 3 inches being reached at $71\frac{1}{2}$ feet. The true cubical contents work out at 58·93 feet, or 46·76 feet calculated by quarter-girth measure.

No. 1.—Sample Douglas Fir, Measured 1903.

No. of Section.	Length of Section.	Mean Diameter of Sections.	Volume of Wood in each Section.	Mean Circumference of Sections.	Volume of Wood by Quarter-girth Measure.
	Feet.	Inches.	Cubic feet.	Ft. in.	Cubic feet.
1	6	18·0	10·60	4 $8\frac{1}{2}$	8·31
2	6	16·2	8·59	4 3	6·77
3	6	15·3	7·66	4 0	6·00
4	6	14·5	6·88	3 $9\frac{1}{2}$	5·41
5	6	13·5	5·96	3 $6\frac{1}{2}$	4·68
6	6	12·6	5·19	3 $3\frac{1}{2}$	4·08
7	6	11·6	4·40	3 $0\frac{1}{2}$	3·45
8	6	10·5	3·61	2 9	2·84
9	6	9·2	2·77	2 $4\frac{3}{4}$	2·15
10	6	7·6	1·89	2 0	1·50
11	6	5·5	·99	1 $5\frac{1}{4}$	0·77
12	$5\frac{1}{2}$	3·6	·39	0 $11\frac{1}{4}$	0·30
Total, .	$71\frac{1}{2}$	...	58·93	...	46·76

As, however, this tree was rather larger than the average, girthing, as it did at breast-height, 4 feet 7 inches (17·5 inches diameter), Mr Pitcaithley was good enough to select a normal standing tree, girthing 4 feet 1 inch (15·6 inches diameter, 1327 square feet section area) at $4\frac{1}{2}$ feet from the ground, and this was duly measured in 6 feet lengths. Its total height was 83 feet, the point of 3 inches in diameter being reached at 75 feet. The true cubical contents, neglecting top and branches, were found to be 50·25 feet, or, calculated according to English measure, 39·49 feet. With 202 trees to the acre—and there are probably rather more than less—this gives the enormous total of 10,150 cubic feet, or, by quarter-girth measure, 7977 cubic feet.

No. 2.—Sample Douglas Fir, Measured 1903.

No. of Section.	Length of Section.	Mean Diameter of Sections	Volume of Wood in each Section.	Mean Circumference of Sections.	Volume of Wood by Quarter-girth Measure.
	Feet.	Inches.	Cubic feet.	Ft. in.	Cubic feet.
1	6	17·52	10·04	4 7	7·88
2	6	15·29	7·64	4 0	6·00
3	6	13·54	6·00	3 6½	4·70
4	6	12·66	5·24	3 3¾	4·16
5	6	12·02	4·73	3 1¾	3·71
6	6	11·31	4·19	2 11½	3·37
7	6	10·35	3·51	2 8½	2·73
8	6	9·39	2·89	2 5½	2·28
9	6	8·44	2·33	2 2½	1·81
10	6	7·16	1·68	1 10½	1·31
11	6	5·89	1·14	1 6½	0·88
12	6	4·62	·70	1 2¾	0·54
13	3	3·13	·16	0 9¾	0·12
Total, .	75	...	50·25	...	39·49

If the volume per acre be deduced from the equation—

$$\frac{\text{Volume per acre}}{\text{Volume of sample tree}} = \frac{\text{Sectional area per acre}}{\text{Sectional area of sample tree}},$$

we get, volume per acre $= \frac{295 \times 50{\cdot}25}{1{\cdot}327} = 11{,}171$ cubic feet.

Seeing that this was the method adopted by Dr Schlich, we may accept the last result for purposes of comparison. Deducting the volume per acre in 1888 (3738 cubic feet) from the volume in 1903 (11,171 cubic feet), we get the almost incredible result that 7433 cubic feet of wood have been added per acre during the past fifteen years, an average increase during that period of 495 cubic feet per acre per annum. When, however, it is seen that even the smaller of the two sample trees contains about three times as much timber as the sample tree of 1888, and bearing in mind the fact that no trees have been removed since that year, the result becomes more easy of credence.

During the same period the average height has increased from 60 to 83 feet, the point of 3 inches diameter being reached at 48 feet in 1888 and 75 feet in 1903.

Taking the age of the wood (forty-seven years) from the time

the seed was sown (1856), we have a mean height-growth of 1·77 feet per annum, and a mean annual increase in volume per acre of 238 cubic feet.

The contents of the two sample trees are calculated both as to true contents and also by the English system of quarter-girth measure. In the case of No. 1, the true volume was 58·93 cubic feet, while the quarter-girth contents were 46·76 cubic feet, so that, to reduce the former to the latter, it is necessary to deduct 20·65 per cent.; while to convert quarter-girth measure into true contents it is necessary to add 26·03 per cent.

In the case of tree No. 2, the corresponding percentages are 21·41 and 27·25. For ordinary purposes, therefore, it will suffice to add a fourth in converting quarter-girth contents into continental or calliper measure; while to convert the latter into the former a fifth must be deducted. Dr Schlich's sample tree contained about 14 cubic feet quarter-girth measure, so that an acre carried—

$$14 \times 202 = 2828 \text{ cubic feet.}$$

The smaller of the sample trees measured this year contained 39·49 cubic feet by the same system of measurement, therefore—

$$39{\cdot}49 \times 202 = 7977 \text{ cubic feet per acre.}$$

In 1888 Dr Schlich calculated the "form figure" of the Douglas fir, at the age of thirty-two years, to be ·39, and anticipated that it would gradually decline.[1] This, however, has not proved to be the case, for, in the case of sample tree No. 1, the form figure works out at—

$$\frac{\text{Volume}}{\text{Sectional area} \times \text{height}} = \frac{58{\cdot}93 \times 12 \times 12 \times 12}{240{\cdot}53 \times 80 \times 12} = {\cdot}441,$$

while in the case of No. 2 it is

$$\frac{50{\cdot}25 \times 12 \times 12 \times 12}{191{\cdot}13 \times 83 \times 12} = {\cdot}456.$$

If the less favourable of these form figures, namely, ·441, be used to calculate the true timber contents from the mean of the two sample areas, we get—

$$295 \times 80 \times {\cdot}441 = 10{,}407 \text{ cubic feet,}$$

[1] *Loc. cit.*, p. 237.

which is very near what we came to (10,150 cubic feet) by multiplying the volume of the smaller sample tree (50·25 cubic feet) by the assumed number of trees per acre (202). As, however, I believe there are, on an average, 210 trees per acre, the calculation would probably be more correct thus—

$$50{\cdot}25 \times 210 = 10{,}552 \text{ cubic feet,}$$

which differs from the result (10,407 cubic feet) got by using the form figure by less than $1\frac{1}{2}$ per cent.

These figures show that, in the Douglas fir, we have a tree of extraordinary value, and although it is a little fastidious both as to soil and climate, there are doubtless large tracts where its cultivation will prove in the highest degree remunerative.

XXXIII. *Diseases, Insects, and Animals Injurious to Forest Trees.*

By Gilbert Brown, Forester, Beaufort.

Diseases Injurious to Pines.

Speaking broadly, there are two great classes of diseases which imperil the life of conifers. There are, on the one hand, diseases due to the action of animals and plants, which injure or destroy the roots, stem, or leaves, etc., of conifers, and so bring about the death of the whole or part of them ; and, on the other hand, there are dangerous physical conditions of soil, climate, atmosphere, etc., which render the life of conifers more or less impossible. These two classes of dangers are frequently found acting together, and so a given case of disease may be complicated owing to the co-operation of many factors. The symptoms, too, of one disease may more or less closely resemble those of others, and thus discrimination and determination may be a matter of difficulty.

So many are the diseases of trees due to parasitic fungi, it would be impossible to deal with the whole. I will therefore only deal with serious diseases, and those are seen in our everyday routine. Some of the most deadly and common are *Trametes radiciperda*, *Agaricus melleus*, and *Peridermium pini*. These fungi differ considerably in their mode of action and manner of inducing disease, but they all eventually destroy the timber of the trees by dissolving and consuming the structural elements. The conducting and supportive functions of the wood are interfered with, and death of the whole or a part of the tree is the result.

Trametes radiciperda.

This disease attacks the roots of the Scots fir and a few other of the pines, sending its snow-white mycelium beneath the bark and travelling thence up the stem, to finally penetrate the wood by way of the cambium and inner parts. The rotting of the wood rapidly follows, and other symptoms so peculiar appear that the presence of this fungus can be concluded with certainty from them. Owing to reddish discoloration of the timber which results, the disease has been termed red-rot. This disease is extremely difficult to eradicate, because the mycelium travels from root to root in the soil, and the spores are supposed to be carried by burrowing animals from one place to another or by direct infection from the roots of neighbouring trees.

Agaricus melleus.

This mushroom or honey fungus, although a less pronounced parasite, is not less destructive; the details of its action on the timber, and its mode of spreading from root to root in the soil by means of its long, purple-black cord-like mycelium strands, also differ. These threads extend themselves under the surface of the soil, push their way into the bark of the roots with which they happen to come in contact, and develop themselves under it as long, ribbon-like filaments, ultimately causing the death of both young and old trees. Infected plants exhibit a strong outflow of resin at the base of the stem, which penetrates and cements the soil round the foot of the tree. Characteristic features of its occurrence are the dying off of the plants here and there in patches; the rapidity with which plants in excellent growth are attacked and killed off, after having, perhaps the same year, developed very good growth in height; and the large numbers of tawny coloured mushrooms round the root of the tree.

Peridermium pini.

Of all the fungous diseases which affect pines, none is more interesting, and few more disastrous, than one induced by a form long known as *Peridermium pini*. This disease makes its appearance as bladder-like bags of spores protruding from the leaves or cortex, and springing from the mycelium which destroys the cell-tissues; in consequence of this the growth of the tree ceases at these places. The damage done by the cortical form is twofold in character. In the first place, the cortex and cambium are killed at the spot invaded, and this injury may go so far as to ring the stem or branch. Then, in the second place, an abnormal formation and excretion of turpentine is incited and soaks into the wood, and renders the passage of water upwards difficult or impossible The natural consequence is the perishing of the whole part above the infected places, and in dry summers such a result is apt to follow rapidly. The dying off of the tops of old pines is very often caused by this fungus.

Æcidium elatinum.

When going through silver fir woods, a very frequent sight is a few of the silvers broken over, and on looking closely it is found that they have broken over at a dry, bare part or cankerous swelling of the stem; this is invariably caused by the silver fir

fungus, *Æcidium elatinum*. It is noticeable at different heights up the stem; the bark gradually dies off from excrescences formed, often of very considerable size, and the wood is laid bare and begins to rot. Sometimes two or three cankerous spots may be seen on one tree, rendering the bole more or less unsuited for technical purposes, and, under any circumstance, there is considerable loss in value.

Nectrias.

Spruces, and to a less extent silver fir and pines, are often affected with a disease caused by the "*Nectria cucurbitula*," the hyphæ of which invade the small sieve-tubes of the bast. As long as the fir is doing well the parasite is confined to the resting parts of the bark, and cannot make its way into the active cambial region, the living cells of which go on dividing and growing quite normally. There is considerable reason for believing that it makes all the difference to the fungus what kind of start it gets. If the mycelium is young and feeble the active tissues of the cortex may cut it out very soon, and the ordinary observer can find no trace of the invading fungus or of disease; but if it starts in a bed of dying cells capable of yielding it sufficient food materials (the hyphæ can grow in a cavity flooded with turpentine), its rate of spread depends entirely on what resistance is offered by the vegetable activity of the cells around. This raises the interesting question of the mutual actions and reactions between the hyphæ and the living cells of the tree. All I can say here is that the hyphæ may excrete some poison-like substance whose action the living cells of the cortex and cambium may resist so long as they are strong, well fed, and vigorous, and may even break up and destroy. Once let such cells, however, fall below a certain standard of health and activity, and the hyphæ make their way in and carry all before them. Factors in the environment (soil, temperature, light, etc.) determine the result.

Hysterium pinastri.

This is a disease which is very often noticeable on young pines when in the seed-bed. In autumn the leaves first show a slightly mottled appearance, occasioned by the mycelium of the fungus developing in the interior of the foliage. In the following spring the needles rapidly assume an entirely brown colour and die off, and the spermogonia of the fungus show as black pimples. Pines so affected are of very little or no use for shifting, as they are so

weakened by the loss of their leaves that they are unable to obtain sufficient nutriment for their sustenance. Care should be taken to clear away all the needles from the seed-bed, as the spores lying in the soil can play an important part in the cause and spread of the disease.

Peziza Willkommii.

The canker of the larch disease is due to the attack of a fungus known scientifically as "*Peziza Willkommii.*" Like all fungi, it spreads by spores, which in this case are produced in cup-shaped fructifications, which are always to be seen protruding from the dead bark of the larch in the neighbourhood of a blister. These bodies are about the size of a biggish pin-head, and when fresh are of a rosy hue inside and white externally. On the spores germinating, the mycelium enters under the bark wherever it can find any damaged place. Then it spreads forth branches, so that in a short time a regular network is formed, which attack and kill all living cells with which they come in contact. In this way all the cells of the cortex, bast, and cambium are killed, no new wood being formed on that part, and if the growth of the parasite is faster than the growth of cambium, the tree will undoubtedly die. The outflow of resin, which is so characteristic of the disease, is due to the shrinkage and cracking of the wood and tissues consequent on their death. In regard to the part of the tree attacked by the disease, it is generally to be seen at the base of a branch or twig, and if the blister be examined, a dead branch or twig may generally be seen protruding from the centre of the diseased part. If a part of a tree should escape infection until it is two or three inches thick, the chances are decidedly in favour of its escaping the disease altogether at that particular part. The belief is that if the spores of this fungus germinate on the sound bark, cortex, or other part of the larch tree, the hyphæ fail to effect an entrance; on the other hand, if the spores are sown on a wound, however slight, the mycelial threads are able to enter and set up the disease.

Diseases Injurious to Hardwoods.

There are a few diseases which attack seedlings, which, in favourable circumstances, prove disastrous to the young plants.

Rosellinia quercina.

This disease attacks the roots of young oak seedlings in nursery-beds, and occasions fading and dying away of the plants. The

roots appear to be woven round with fine fungous filaments, in the vicinity of which the bark tissues turn brown, whilst black pimples about the size of a pin-head make their appearance here and there on the main root. Wet weather is very favourable for furthering the spread of this disease.

Phytopthora fagi.

This disease occurs chiefly on the seed leaves of beech, also on those of the maple and sycamore: it makes itself apparent by the blackening of the shoots and cotyledons, or by the breaking out of black spots on these, which is soon followed by the death of the seedlings.

Injurious Insects.

Hylobius abietis—Pine Weevil.

The worst enemy to young conifers, especially after planting out, is the *Hylobius abietis*, the large dark brown beetle of convex shape, with light yellow marks between the eyes and on the thorax and wing-covers. The weevils lay their eggs in spring and continue to lay during summer, in dead but not dry pine, choosing especially the cut stumps of recently felled trees, also unbarked logs and the lower parts of dead standing trees. Under the bark the grubs gnaw irregular galleries in the sap-wood, changing at the end of these to pupæ. Like the grubs of all weevil, they require shelter, and will not feed exposed to daylight. They will, however, thrive in the closely-packed sawdust heaps which accumulate while the wood is being sawn up, and which serve excellently as a focus for infection. The duration of larval life is very variable, and depends greatly on the temperature and the season. As a rule, if the eggs are laid in the spring, the larvæ are seen in about a month, and are full grown by the autumn. These full-grown larvæ lie in their hollowed-out beds until the early summer of the next year, when pupation takes place, followed by the issue of the adult beetles in June. The beetles have a long life, and can continue egg-laying for a long time, so that adults, pupæ, larvæ, and eggs may all be got at the same time. No injury whatever to growing plants of any value is done by the feeding of the grub; it is the work of the perfect beetle which is so harmful. The insects can fly, but hardly ever do so, except at pairing time; they therefore frequent the neighbourhood of their breeding-places. They prefer pine, but also attack spruce and larch, hardly ever deciduous trees, unless pressed by hunger.

Young plants up to five or so years of age are chiefly attacked, pieces of bark being eaten away into the cambium. Flow of sap or resin follows the injury, the latter being often very conspicuous. They cannot do serious injury to old bark, consequently the damage done to trees over ten years of age is usually insignificant. The preventive measures consist in keeping the ground free from unbarked logs and trunks, heaps of rubbish and of sawdust, and in preventing egg-laying in the stools of recently-felled timber. This is done by barking the exposed part, covering with soil, and beating firmly down.

Hylesinus piniperda—Pine Beetle.

This beetle is, next to the *Hylobius abietis*, the most injurious insect to pines over the greater part of Scotland. It is a small, oblong beetle of brown colour. The pine beetle swarms very early, as early as March in good weather, or in April if it is less favourable, and deposits its eggs under the bark of newly-felled stems, also in standing trees of sickly growth, selecting as far as possible only the portions of the tree where the bark is thick. It, like the pine weevil, prefers Scots fir, but will make use of spruce and larch. The female commences boring under a projecting side where the bark is thick, often on the under side of a fallen trunk if it is free from the ground, and excavates a gallery in the bark, running, with the exception of the entrance which is curved, parallel to the axis of the stem. It is from three to four and a half inches long, and takes from three to five weeks to construct.

The eggs, which may reach a hundred and twenty in number, are placed in small hollows excavated alternately along its two sides. The bore-holes, by means of which the insects effect an entrance, are not infrequently noticeable from the yellowish outflow of resin on the bark. The eggs hatch in a few days, and the larvæ begin to eat galleries at right angles to that of the mother. The larval galleries are at first small, but increase in size with the growth of the inmate, and soon take an irregular course. The larvæ, when full grown, change to pupæ, in a small cavity hollowed out in the bark at the end of the burrow, and appear as perfect insects in June or July, emerging from the tree by eating out a circular hole from the pupal chambers. After the eggs are all laid the female dies; her dead body can be found at the end of the chambers. The borings of the parents are not at first conspicuous, but can be detected later by dust thrown out from between the scales of bark, whereas the hole made by the exit of the beetles,

which are in no way concealed, at once indicate that they have bred in the bark.

Other injury to the pine consists in the boring of the escaped beetle into the young shoots for feeding purposes. This is effected by making a lateral hole in the shoot at a distance varying from one to five inches from the top. The hole becomes marked by a circular ring of exuding resin, and from it there is a burrow running up the pith of the shoot, which is killed. These shoots, which break readily, through the entrance hole or above it, strew the ground after a high wind. This damage, repeated year by year, produces a striking change in the appearance of the tree, which loses its compact crown and becomes stag-headed, the foliage being thin and scant.

Lophyrus pini—Pine Saw-fly.

The females in late spring cut a longitudinal slit in a pine needle, and lay in it from ten to twenty eggs, repeating the process on adjoining needles till over a hundred eggs have been deposited, which are all covered over with a kind of frothy slime. The larvæ hatch in a fortnight or rather more, and feed in clusters on the needles of young Scots pine. So long as they are still small the caterpillars generally feed in twos on each needle, and leave the mid-rib standing; but when they are stronger and nearer the attainment of their full growth they devour the whole needle. During the month of July they enter into the pupal state, a small leathery cocoon being formed between the scales of the bark and on the branches of the foliage and on the ground. In about three weeks the fully developed saw-fly makes its appearance. A second egg-laying may take place.

Retinia buoliana—Pine Shoot Moth.

The caterpillar of this insect causes destruction to the shoots of pines. The moths are small, reddish brown or grey in colour. They lay their eggs singly in young pines at the base of the bud of the terminal shoot or lateral branches, and into these the caterpillars bore, hollowing out the centre bud and then attacking the lateral buds, so as to destroy the whole or part of the terminal whorl. The larvæ lie in the shoots throughout the winter, and pupate in spring. Their presence is easily recognised by the altered and stunted shoots which have failed to grow, and break off at a touch, as well as by a flow of resin caused by feeding. The lateral branches thus injured subsequently grow twisted, and

the twisted or curved shape lasts for many years after the injury.

Galls.

A gall is generally known as an abnormal growth of some plant tissues produced by animal agency acting from within. The exciting cause in the case of typical galls appears to be a minute quantity of some irritating fluid or virus secreted by the female insect, and deposited in the cortical or foliaceous parts of the plants. The virus causes the rapid enlargement and subdivision of the cells affected by it, so as to form the tissues of the galls. Larval irritation plays an important part in the formation of many galls.

Chermes abietis—Spruce Gall Aphis.

This very minute insect, of a yellowish green to a light brown colour, with whitish down and white wings, punctures the young buds for the purpose of depositing its ova. They have passed the winter in crevices and under bark scales, and early in April attach themselves each to the base of a young leaf, which reacts by a small swelling. There they lay a number of eggs. By means of the puncture thus made, and the absorption of sap by the young aphides, a cone-like swelling of the compressed needles takes place, green at first but afterwards ruddy brown. Each gall contains a series of cavities or chambers. In these cavities the larvæ live in numbers, either entering the chambers during the growth of the gall or being enclosed by the swelling of the surrounding needles. Fortunately the side shoots are much more frequently attacked than leading shoots, for the shoot when punctured assumes curious shapes and bends, and if badly attacked the young plants fall into a sickly condition. Such galls are now very frequent. They should be cut off and burned; by doing so twenty or thirty larvæ in each are killed. This would also not only save spruce, but larch, as the spruce aphis is understood to be one stage in the life-history of the larch aphis.

Chermes laricis—Larch Aphis.

This small dark brown insect, easily recognisable from its white woolly pad, damages the needles of the larch from April to August by sucking the sap, and when the insects attack the leaves they render them incapable of performing their functions, and they may leave wounds by which the spores of injurious fungi may gain entrance.

There are many gall insects which attack hardwood trees, but few of them do serious injury. Most of them give rise to cankerous spots and small pimples on the leaves, but as the leaves of these trees fall every year, the damage is not so disastrous as it is to pines.

Cryptococcus fagi.

This scale is to be seen on many beech trees throughout the country. It presents the appearance of a shower of snow having frozen. It is generally known as "Felt Scale." When the pest is but sparsely distributed on the stem, little damage results; but when the attack is very bad the bark separates from the stem, and the tree ultimately dies in consequence. On moving the white covering about midsummer, the insects may be found in all their respective stages.

Coccus fraxini.

This is a scale becoming very common amongst ash, and known as the "Ash Felt Scale." The bark is all covered with white or greyish spots, and on rubbing the bark a reddish substance appears, which substance is caused by the eggs being squeezed. That part of the tree affected by the scale is unable to perform its usual growth; the trees are considerably less in circumference at the affected part than the stem of the tree above it.

Damage caused by Animals.

Roedeer.

The damage done to woods by roedeer consists partly in biting off the buds and young shoots of most species of trees, thus causing the immedate death of young plants, and when often repeated crippling and stunting older plants and interfering completely with their normal development. Roebuck do a deal of damage by rubbing the bark off the tree in the act of cleaning the velvet off their horns. It is well-nigh impossible to rear plants successfully where a strong head of roedeer is maintained, unless special measures are adopted to secure them against the bucks.

Hares.

The damage done by hares consists in the nibbling of the young buds of broad-leaved species, and in cutting over the young shoots of conifers; this, however, seldom takes place but in very hard winters, when there is a decided want of food.

Rabbits.

Of all ground game rabbits are by far the worst enemies to plants; they nibble the buds, and eat and nibble all sorts of trees, especially those newly planted. They also cause annoyance by burrowing in the ground near trees, causing them to be more easily blown down.

Squirrels.

These little rodents, when numerous, do considerable harm to woods. They are very fond of devouring seeds of many kinds, especially acorns and beech nuts and the seed of conifers, which they procure by picking the cone to pieces. They also love to peel the soft, sappy bark from young pines in spring, stripping it off in patches, biting the external covering and sucking the sap, so that the slender stems are injured to no slight extent. Scots fir about twelve years old suffers severely; they are often to be seen with four and five feet all bare of bark. They also strip off the film of bast, and use it for building their nests. The damage done by squirrels is especially noticeable after a gale of wind, the young trees being broken over at the peeled parts.

XXXIV. *Notes for Planters.* By G. U. Macdonald, Raith.

Now that the planting season is again with us, it may not be out of place to touch upon a few points of interest to those about to enter upon this important work for the first time.

Assuming that the area to be planted is sufficiently protected against game and field stock, and that the soil has been properly drained, if needed, the important question that the planter has to decide is what trees are best adapted to the varying conditions of soil and situation with which he has to deal. For as a general rule it is only on very small areas that the quality of the soil and the other conditions are so uniform as to warrant the use of only one species of tree over the whole ground.

Frequent mistakes have been made in the past, and are still being made, in planting trees on soils and in situations unsuitable to their natural growth, and no doubt many of the diseases which affect our forest trees have been induced by this unnatural treatment. Little wonder that proprietors and foresters have so often to complain of "pumped" elm and "royed" larch, when it is found that these species have been planted on soil which was eminently better adapted for beech and spruce.

In the hope of being of some service in helping beginners to avoid the mistakes referred to, I venture to offer a few hints on the soils best adapted for the healthy growth of a limited number of the more common and useful timber trees grown in Great Britain, and also a few remarks as to the manner in which these trees should be planted.

Oak, perhaps the most valuable of our timber trees, should be planted on rich, strong soil of considerable depth. If planted on light soil, it attains a premature maturity and decays early. Oak thrives best on a high, well-drained situation. Trees of this species, when grown on marshy soil or along the margins of water-courses, not infrequently get "frost cracked," which renders the timber practically useless; hence the importance of choosing for it a moderately dry situation. Select strong, well-shaped plants of from 2 to 3 feet in height, with an abundance of fibrous rootlets, and plant them in pits previously prepared for their reception, at distances of about 5 feet apart when a pure crop is wanted. Avoid mixing this tree with a number of other species, but if for amenity or reasons

of exposure another species is considered desirable, then the beech is pre-eminently the best tree to associate with it. In this case plant the oaks 10 feet apart, with a beech between, leaving the plants 5 feet apart as formerly. Should the stems of any of the young oaks get destroyed during the first or second spring after planting, cut them back in the month of May, and allow them to sprout from the bottom. When the sprouts have reached a height of 2 or 3 feet, select the best one for the future stem.

Ash, another of the most valuable of our timber trees, to be grown to perfection must be planted in a rich loam, with plenty of moisture. Care must be taken, however, to drain away all stagnant water. Along lower slopes, or the foot of glens and valleys, the ash generally luxuriates. Being of little value as a soil protector, owing to the openness of its crown, this tree should not be planted on large areas as a pure crop. It does best when mixed with one or more of the following species: plane, horse-chestnut, and maple, and in certain localities even spruce may be profitably associated with it. If grown in groups as a pure crop, it should be planted at a distance of 6 feet apart. The young plants should be from 3 to 4 feet in height, with a stout, firm stem, and should be taken from a nursery where they have had plenty of room, both in the seed-bed and in the lines. When grown closely together in the nursery lines the plants are apt to be overdrawn and lanky, the stems remaining soft throughout the winter, and, as a consequence, are more easily destroyed by frost after they are put out in the forest. If to be mixed with others, place the plants at distances of 12 feet apart, and fill in the intervening spaces with one or more of the species formerly mentioned, so that, when finished, the plants will stand at about an equal distance of 6 feet apart.

Wych elm, to be grown sound, must be planted on moderately rich, well-drained ground, with an open subsoil. It should never be planted on very exposed situations, nor in cold, moorish soil. Owing to the spreading and irregular nature of its crown, it is best planted in groups or on small areas as a pure crop. When pitting for this species, make sure that there is ample room to receive the spreading roots without any chance of their being doubled up in the holes. Use plants from 3 to 4 feet in height, and plant at intervals of 5 feet. Kept together in this manner they soon shoot upwards, and form straight, clean stems.

Sycamore, or Scotch plane, if grown on suitable soil, forms a very valuable asset to most wooded properties. It requires a moderately light, deep soil; and though quite hardy even in exposed or wind-swept places, it should be planted in sheltered hollows and on the lower slopes of well-drained glens when it is grown for profit and early use. This species thrives well as a pure crop, and owing to its heavy leaf-fall is an excellent preserver of the soil. Like the ash, if the plants have been crowded in the nursery-bed or lines, the young growths are difficult to ripen so as to withstand the frost, and much injury results after their removal to the forest. Select therefore plants which have had plenty of growing space in the nursery. These should be from 3 to 4 feet in height, and should have been twice transplanted. Plant in the forest at 5 feet apart.

Beech.—Of all our hardwood trees there is perhaps none which can adapt itself to so many varying conditions of soil and situation as the beech. For forming shelter-belts for more delicate species, or growing under the shade of other trees, it is unequalled. To see it at its best, however, it should be grown as a pure crop, on light, dry soil of moderate depth overlying whin. The ground should be thoroughly drained if necessary, and the young trees —from $2\frac{1}{2}$ to 3 feet in height—should be planted at about $4\frac{1}{2}$ feet apart.

Black Italian Poplar.—This is the only variety of poplar worth cultivating for profit. It thrives best in deep, rich loam containing an abundance of moisture. Grown by itself, or in company with the white Huntingdon willow, it forms a valuable crop at a comparatively early age, especially in the vicinity of mining districts. Plants, which should be taken from cuttings and twice transplanted in the nursery lines, should be finally put out at a distance of 6 feet apart.

Larch, the most valuable of our coniferous timber trees, should be planted on a moderately deep, sandy loam, on the slopes of hills having a northern aspect. If the ground is wet, it should be thoroughly drained one year at least before it is planted. On no account should larch be planted in low, humid hollows, no matter how suitable the soil may appear to be. Under such conditions it is sure to become diseased. If the ground to be planted is free from rough herbage, the best plants to use are two years bedded and one year transplanted; but if the reverse is the case, then use plants two years bedded and two years transplanted. If planted

as a pure crop, they should be notched into the ground at from 4 to 4½ feet apart. If mixed, the best species to associate with it are beech and Douglas fir, but beech is the better of the two. In this case plant alternately at 5 feet intervals. In planting larch, the greatest care should be taken that the young trees are not injured by the heel of the planter's boot coming in contact with them when firming the ground.

Scots fir thrives best on light sandy or moorish soil which has been previously drained and freed from all stagnant water. For growing on heath-land it is the most reliable of all our timber trees. Unless the surface of the ground is coated with rough heather or weeds which cannot be burned, the best plants to use are two years bedded, one year transplanted. If the ground is rough, then use plants two years bedded and two years transplanted. Put in the plants at intervals of 3 feet, and use the T notch system. This species should always be planted as a pure crop.

Norway spruce grows to perfection in moist hollows, at the foot of glens, and alongside water-courses, although it will often grow to a profitable size on comparatively high ground which has a free subsoil. Avoid planting it on exposed situations, as, owing to its shallow root system, it is easily uprooted by gales. Use plants which have been two years bedded, and two years one year transplanted. Notch or pit at intervals of 4 feet. This tree does best when planted in bulk by itself.

There are other species, such as the Douglas fir, *Thuja gigantea*, *Abies grandis*, etc., well worthy of notice, but those which have been dealt with are the most reliable kinds for planting for economic purposes.

XXXV. *The Rapid Ageing and Fireproofing of Wood.*[1]

The preservation of wood was formerly accomplished by drying and covering it with coatings designed to prevent the entrance of air and moisture. But these have now given place to numerous plans for the introduction of antiseptic liquids.

The decomposition of wood commences soon after it has been felled and exposed, whether in logs or pieces, to the air, to moisture and to variations of temperature. It is also destroyed by being buried in the ground. Cut up into planks, and dried in the open air, it warps and cracks, causing considerable reduction in its value. At 300° C. (572° Fahr.) all wood, dry or preserved by antiseptics, is carbonised without production of flame; but if subjected to a red heat or to the action of a burning body, as in fire, the pieces of wood are completely destroyed, even if they are covered with a coating opposing a certain resistance to the fire. Whence the multitude of processes made use of for more than a century for increasing the durability of wood.

Not only are the chemical and physiological causes of the changes of wood now understood, but a remedy has been found for the evil. It has been known for a long time that dry wood is much less subject to decomposition than moist wood, which is still impregnated with sap. This knowledge has led to submitting the wood before use either to natural or to artificial and rapid desiccation.

Until within the last few years the first or natural method, the most simple, that of exposure to the air for a time, afforded good results; but natural drying, which occupies a good deal of time, especially for hard species and for considerable thicknesses, necessitates a very large surface for piling the wood, and the loss by waste due to splits at the extremities increases the cost of dry wood. This explains the numberless methods employed for securing the rapid drying of the wood under the best possible conditions.

Paulet describes one hundred and seventy-three methods, most of which have been patented, and which may be distributed in the three following groups:—

1. By natural infiltration or displacement, applicable to standing wood or to that recently cut down.

[1] Condensed from the translation of an article from the *Revue de Chémie Industrielle*, printed in the *Scientific American* and the *Indian Forester*.

2. By pressure in the open air, applicable to wood in its bark; or by pressure in an enclosure, applicable to dry wood.

3. By superficial application of antiseptic agents (by carbonisation, immersion and coating), applicable to all kinds of wood.

In the first group may be mentioned rafting, which consists in immersing the pieces in water. This allows of drying the wood more rapidly; for the sap having been partially driven out by the water, which has replaced it, the latter will evaporate more readily than the sap. For instance, oak for flooring, which would require two years of drying in the open air, may be dried in four months after having been subjected to the action of the water. Wood is immersed in a stream or basin for three or four months. If the circumstances allow of raising the temperature of the water to 30° C. (86° Fahr.), the time of immersion may be reduced to fifteen or twenty days.

Steam also afforded good results so far as the drying is concerned, but unfortunately the fibre is affected to some extent and the wood becomes much less tenacious. In the Leclerc process the operation is conducted by steam, followed by drying in a current of warm air. The wood is arranged in a close chamber of masonry, and the steam is brought in for forty-eight hours by perforated pipes. Under the action of the condensed water a part of the sap comes from the cells of the wood, and the other part is coagulated. Thus the result is not complete. The wood is afterwards dried by causing a current of warm air (30°–35° C. = 86°–95° Fahr.) to circulate in the same chamber for a fortnight in the case of planks of ordinary thickness. The wood is piled upon the open-work floor of the chamber, inclining it sufficiently to cause the sap to flow. Each piece is separated from its neighbours, and this allows the air and steam to circulate freely over the whole surface. For drying, the warm air is introduced, at one time from above, at another from below, and alternately at one or the other extremity of the chamber. It is drawn in through the wood and drawn out by a ventilator working at the opposite extremity.

Boucherie's processes, which belong to the first and second groups, utilise at one time the vital osmatic force of growing trees; at another they effect the infiltration of a liquid, or the displacement of the sap by this liquid, on the tree recently felled. In the first case, one or two saw cuts are made at the base of the trunk, or several deep holes are drilled into it. An earthen band,

or a strip of cloth smeared with rubber, is placed around the base and communicates by means of a tube with a small cask containing an antiseptic solution, which must not be too concentrated. The sap on rising in the tree draws with it the liquid, according to the diameter of the capillary vessels. The tree receives the poison as it receives the nutritive element. In the second case, if the tree is felled, it is placed in a slightly inclined position, and a leather sack, as impermeable as possible, is attached to the trunk and put in communication with a reservoir 10 or 15 millimetres above.[1] The results are quite appreciable, but the process is incomplete, the penetration being irregular, and the displacement of the sap almost *nil* in the heart of the wood.

In the Renard-Perin process, the piece of wood is sawn at the two ends perpendicularly to its axis. One of the extremities is covered with a sack of impermeable canvas, into which the solution is poured; the other extremity is connected with a metallic receiver, in which a vacuum is produced by the combustion of tow soaked with wood spirit, which completely closes the apparatus. The aspirator draws from the capillary interstices the natural liquids which they contain. These are replaced with the solution under atmospheric pressure. The operation is repeated two or three times.

In general, the processes by pressure in an enclosure, belonging to the second group, are worked by means of cast-iron cylinders containing the pieces of wood. In many cases a vacuum is produced, at the outset, in the cylinder which contains one or several pieces; and the liquid is then introduced under pressure maintained for several hours.

A modification of the Boucherie and the Renard-Perin processes is the new process of G. Lebioda & Co.,—the injection of the wood before conversion. The trunk or log is enclosed in a kind of cast-iron autoclave able to support a pressure of 150 atmospheres. The liquid is injected by a pipe under pressure which is gradually increased for a quarter of an hour, in the case of spruce, up to 100 atmospheres. The wood is surrounded by the liquid, which is always kept at the same pressure. According to the inventor, the fibres of the wood offer no resistance under this process. The liquid entering, acts like steam in the Gifford injector. When the

[1] The reservoir is usually fixed some 26 to 30 feet above the timber to be treated.—Hon. Ed.

object is to dry wood rapidly by this process, the treatment is effected simply with water.

Superficial carbonisation, belonging to the third group, is suitable to hard woods which cannot be impregnated with antiseptic substances. This treatment is of more lasting efficacy. The charring is produced by a flaming jet, which in the current of compressed air forms a kind of blow-pipe and causes a strong disengagement of heat. The flame draws out the water contained in the superficial layers, dries the fermentable portions, carbonising the external part completely, and it produces a torrefied surface about half a millimetre ($\frac{1}{50}$ of an inch) thick, almost distilled and impregnated with the products of this distillation, which are empyreumatic creosoted substances.

Drying with smoke is effected in a chamber of masonry heated by the combustion of moist sawdust, which yields a thick smoke, but renders the wood useless for many industries, on account of its disagreeable odour and the slight resistance of its fibres, which have undergone some change.

None of these processes, except that of Nodon and Bretonneau, solves in an entirely satisfactory manner the problem of the rapid drying of wood or the complete penetration of antiseptic or fire-proofing products. They have succeeded in utilising electricity for modifying the constituents of the sap.

The working of this process is quite simple. The apparatus consists of vats of cement or wood, which are filled with the solution employed for the treatment of the wood. This may be antiseptic, or formed of salts for rendering the wood uninflammable. That in use at Aubervilliers is a solution of crystallised magnesium sulphate (80 parts water, 20 magnesium sulphate) heated to 35° C. (95° Fahr.), in which the wood is immersed. This bath may be used indefinitely, provided it is regenerated with magnesium sulphate. About every month the bath is brought to the boiling point in order to coagulate and readily separate the organic matters proceeding from the wood.

Before the solution of magnesium sulphate was employed, other baths were experimented with, which were abandoned on account of practical objections, such as the deposit of resinous matter on the surface of the wood, which had to be removed by scraping and washing, or on the fibre itself, which quickly blunted the tools employed in working the wood.

In the treatment with the magnesium sulphate the continuous

current employed is 110 volts, but instead of being directed through the wood always in the same direction, a change is made every hour or every two hours, or half the amount of electric horse-power necessary for the operation is passed from the top to the bottom, and then the other half from the bottom to the top.

The duration of the treatment by electricity is proportioned to the electric resistance of the wood, which varies according to its nature, its thickness and its humidity. As in the processes by injection, the operation is the more prompt and complete, whatever the species of timber, provided it has been recently felled, that is, if the sap has not undergone modification. The time may vary from seven to fourteen hours.

During the electric treatment there is a formation in the mass of the wood, under the influence of the electrolysis, of new mineral compounds, stable and imputrescible, and this in a way much more complete than by any other process, preventing the ulterior development of the germs which cause the decomposition of the wood. The action of the electric current in the process of the ageing of wood is therefore very important. Investigation with the microscope, and the results of analysis, demonstrate the penetration of the action to the heart of the wood.

Drying of the Treated Wood.—After treatment, if the wood is in logs, it is cut up, according to need. After it has been thoroughly soaked with water, it is left from 8 to 15 days under a shed for drying. For this purpose the boards or scantlings are piled on each other separated by two or more spruce laths, according to length, the thickness of the lath varying from 8 to 25 millimetres ($\frac{1}{3}$ of an inch to 1 inch), according to the thickness of the boards.

If sufficient space is available, the wood can be left to dry entirely in the open air, but it there undergoes alternations of heat and cold. It seems, therefore, preferable, after a first drying without, to pile the timber in a chamber, where a current of heated air is kept in constant circulation for from two to eight weeks, according to thickness, at a temperature gradually increased to 35° or 40° C. (95° or 104° Fahr.). The wood is then thoroughly dried and ready for use.

Principal Advantages of the Artificial Ageing of Wood over the Process of Natural Drying.—If a piece of senilised wood and a piece of the same kind simply dried in the open air are compared under the microscope, it will be observed that the cells of the former have undergone contraction. The entrance of air is there-

fore rendered more difficult. Then the original albumenoid substances no longer existing, the wood will not be affected by the hydrometric condition of the air, and may be preserved without change, escaping putrefaction and attack by insects. These properties have been proved by tests which show an increase in the tenacity of the fibrous matter. Experiments made by the superintendents of wood paving in the city of Paris have attested conclusively the efficacy of this process. Pavements of senilised beech and pavements of beech simply creosoted have been laid in several quarters, particularly at the Porte Saint Martin. When taken up some time afterwards, the treated beech showed no sign of the usual decay, and exhibited more resistance to wear than the beech not treated.

By ageing, the colour of the wood is not modified, and its sonorousness is increased to such an extent that it is now sought for by the makers of instruments of music.

This process not only imparts to the wood the qualities that have been enumerated, but it causes an important saving over the methods hitherto employed, especially over that of drying in the open air, by diminution of the capital represented in the value of the wood and in the ground occupied, and by the prevention of waste. It is applicable not only to the rapid drying of wood, but by modifying the conditions of treatment, of increasing any one of the qualities previously cited, according to the kind of wood and the use to which it is to be applied.

Finally, by the electric treatment the uninflammability of wood may be increased by employing, for example, ammoniacal salts in the vats.

Fireproofing of Wood.

It is impossible to render wood completely incombustible, but an almost absolute immunity against the attacks of fire can be imparted.

Gay-Lussac was one of the first to lay down the principal conditions indispensable for rendering organic substances in general, and wood in particular, uninflammable.

1. Throughout the whole duration of the action of the heat, the fibres must be kept from contact with the air, which would cause combustion. The presence of borates, silicates, etc., imparts this property to organic bodies.

2. Combustible gases, disengaged by the action of heat, must

be mingled in sufficient proportion with other gases which do not burn easily, in such a way that the disorganisation of bodies by heat will be reduced to a simple calcination without production of flame. Salts which are volatile or decomposable by heat, but not combustible, like certain ammoniacal salts, afford excellent results.

Numerous processes have been recommended for combating the inflammability of organic tissues, some consisting in external applications, others in injection under a certain pressure of saline solutions.

By simple superficial applications only illusory protection is attained, for these coverings, instead of fireproofing the objects on which they are applied, preserve them only for the moment from a slight flame. Their power of resistance to the fire being of only short duration, these coatings scale off or are rapidly reduced to ashes, and the parts covered are again exposed. It often happens, too, that such coatings have disappeared before the occurrence of the fire, so that the so-called remedy becomes injurious from the false security which it occasioned.

We will cite some formulas still recommended. They are applied—

(1) By immersion or imbibition;

(2) By application of successive coats by mean of a brush.

1. For immersion or imbibition the following solution is advised:—Ammonium phosphate 100 grammes; boracic acid 10 grammes per litre, or ammonium sulphate 135 grammes; sodium borate 15 grammes, boracic acid 5 grammes per litre. For each of these formulas two coats are necessary.[1]

2. For application with the brush, the three following compositions are the best:—

(*a*) A mixture of hot sodium silicate 100 grammes, Spanish white 50 grammes, glue 100 grammes.

(*b*) For first application—hot water 100 grammes; aluminium sulphate 20 grammes: second application—hot water 100 grammes; liquid sodium silicate 50 grammes.

(*c*) First application, two coats hot of—water 100 grammes; sodium silicate 50 grammes: second application, two coatings of—boiling water 75 grammes, gelatine white 200 grammes; work up with asbestos 50 grammes, borax 30 grammes, and boracic acid 10 grammes.

[1] 1 gramme=(about) 15½ grains troy; 1 litre=a little less than 1 quart.

Oil paints are rendered uninflammable by the addition of phosphate of ammonia and borax in the form of impalpable powders; mortar of plaster and asbestos, and asbestos paint, are still employed for preserving temporarily from limited exposure to a fire.

In England, America and Paris, attempts have been made to introduce under strong pressure, preserving solutions into fibrous substances. Large establishments have been erected in different countries for this purpose. Unfortunately the process by pressure is still attended with the serious evil of introducing fireproofing products into the outer part of the wood only; the solution penetrating to quite a limited depth. The process consists in removing from the wood, by the aid of steam under pressure, a part of liquid products which it contains. This induces a sort of distillation of the inflammable products, for which solutions are substituted, generally composed of ammonium sulphate or phosphate, boracic acid or alkaline borate.

The best result has been obtained by electricity. In the Nodon and Bretonneau process fireproofing products have been introduced through the whole mass of the wood, and this in a way much more regular than by injection even under strong pressure. A truly exceptional power of resistance to the attacks of fire has been thus imparted. The quantity of fireproofing products depends on the strength of the bath and the duration of treatment. It has been ascertained by experiment that wood is really uninflammable; that is to say, that it resists for quite a long time a very high temperature, if it contains, according to its nature, from 15 to 20 per cent. of the salts employed.

Fireproofing of Wood by Electricity.

The successive operations and the apparatus for incorporating the fireproofing salts into the mass of the wood are nearly the same as those for the ageing of wood properly so-called. It is absolutely necessary for the treatment that the wood should be both green and not too hard.

The total duration of the operation is 48 hours, divided into two equal parts. At the end of the first period, the wood is reversed (turned upside down). The wood thus treated has absorbed from 15 to 20 per cent. of its weight of the salts of the bath. These salts penetrate to the heart of the cells and form a sheath around the fibre. If the wood after drying is submitted to the action of fire, the ammoniacal salts, which encompass the fibres, melt. On

increase of the heat, the fibrous matter is carbonised slowly and the gaseous products resulting from the decomposition of the salts prevent the ignition of the combustible products proceeding from the calcination of the fibre. In a word, the fire is limited to the points attacked, and is not communicated to the neighbouring fibres.

The official tests conducted at Paris by the fire department are conclusive. The inventors constructed a number of cubic boxes, 0·50 metre in size, of spruce and poplar fireproofed planks, 26 millimetres (about an inch) in thickness; the bottoms of the boxes were perforated with five holes. One of the boxes was filled with a kilogramme ($2\frac{1}{5}$ lbs.) of dry shavings, which, when set on fire, required five minutes for consumption. A large amount of heat was developed. After combustion, it was found that the outside walls of the box had remained cold, and that the inside had not been charred beyond the thickness of 1 millimetre ($\frac{4}{100}$ inch). No point remained on fire, and no part of the wood was disorganised under the influence of the extreme heat.

The second box contained a double weight of shavings, which were thirteen minutes in burning. When the combustion was completed, it was found that the interior of the box was red with heat, but there was no flame.

The third experiment took place with a fireproofed box of white wood, in which 3 kilos of shavings were burned. The test lasted for 30 minutes; the interior was incandescent and the wood charred for 5 or 6 millimetres ($\frac{1}{5}$ inch) in depth, while the exterior was simply heated.

Another test with a spruce box not fireproofed, containing 1 kilogramme of shavings, ended in three minutes in a small conflagration, which had to be extinguished with water. These results are conclusive.

A piece of fireproofed wood submitted to the action of the electric spark is simply carbonised at the parts of contact, while wood not treated bursts quickly into flame.

Some curious tests on the resistance of certain building materials to fire, conducted before the representatives of foreign fire departments, may also be cited. A square construction of cement was filled with 7 or 8 steres[1] of wood moistened with petroleum. It was furnished on one of its sides with an iron door,

[1] 1 stere = 35 cubic feet.

on its second side with a door of wood fireproofed by this process, and on the third with a window of protected glass, that is, glass cast on metallic gauze. Wood piled up in this enclosure was set on fire and extinguished after the interior temperature had reached about 1400 degrees. The wooden fireproofed door was consumed only after the lapse of one hour. But the iron door was very quickly put out of shape, and allowed such a quantity of heat to pass that ordinary boxes placed at a distance of three metres (about 10 ft.) were consumed.

Wood thus rendered incombustible is imputrescible, its tenacity is greater, but it can be readily worked. It can be glued perfectly, and can be painted or varnished to prevent the penetration of moisture and to avoid the decomposition of the ammoniacal salts.

This new method of rendering wood incombustible, while materially augmenting its value, does not involve a large expense. Experience, indeed, has shown that the cost of fireproofing by this process is less than that of other methods in use, and that the wood can be employed for numerous purposes, especially on war vessels, where metal has been hitherto used.

XXXVI. *The Twenty-Sixth Annual Excursion, July* 1903.

The Twenty-sixth Annual Excursion of the Royal Scottish Arboricultural Society was held in the Counties of Bedford, Hertford and Buckingham, on 28th, 29th, 30th and 31st July 1903.

The members from the North left the Caledonian Station, Princes Street, Edinburgh, at 2 P.M. on Monday, 27th July, and reached Leighton Buzzard shortly after 10 o'clock the same evening. The members from the South had already arrived. Here they were quartered during the tour, and as the company was a large one, the members had to be accommodated in the various hotels throughout the town, the headquarters being at the Swan Hotel, owned by Mrs Towers.

The following is an alphabetical list of the members present:—Thomas Ainslie, Penicuik, Midlothian; Robert Allan, Polkemmet, Whitburn; Alexander Angus, Dalzell, Motherwell; J. A. Barrie, Harlestone, Northampton; J. Barton, Hatfield, Herts; A. W. Borthwick, Edinburgh; David Brown, Wollaton, Notts; T. R. Bruce, The Old Garroch, Dalry, Galloway; Charles Buchanan, Penicuik, *Convener of the Excursion Committee;* Dr James Cameron, Loanhead, Midlothian; J. Arthur Campbell of Arduaine, Lochgilphead; William Christie, Fochabers; James Cook, Arniston, Midlothian, *Vice-President;* R. Craig Cowan, Craigiebield, Penicuik; R. W. Cowper, Gortanore, Sittingbourne; W. S. Curr, Ninewar, Prestonkirk; W. Davidson, Port Talbot, Wales; A. Douglas, Abbey Gardens, Wykeham, Yorks; Robert Douglas, Edinburgh; William Elder, Cholmondeley, Malpas; Walter Elgar, Hillside, Sittingbourne; W. J. Elwes, of Colesborne, Cheltenham; William Fenwick, Rockdale, Perth; John Fleming, Dalmunzie, Murtle; A. C. Forbes, Longleat, Horningsham, Warminster; James Forbes, Overtoun, Dumbarton; Robert Forbes, Kennet, Alloa; James Forgan, Lundin Links, Fife; Peter Fyshe, Newtonlees, Dunbar; R. Galloway, *Secretary and Treasurer,* Edinburgh; Wm. Gemmill, Greendykes, East Lothian; P. D. Gow, Bonaly, Colinton; George Halliday, Rothesay; D. Hamilton, Knowsley, Prescott; Geo. Hannah, Over Court Estate, Bristol; David Hardie, Errol; Marcel Hardy, University College, Dundee; A. M. Harley, Betterton, Wantage; John Hay, Kilmarnock; William P. Hay, Loanhead, Midlothian; Thomas Hood, Birdbrook, Halstead, Essex; George Jack, Dalkeith; Thomas Jack, Hermiston, Currie; James Johnstone, Alloway Cottage,

Ayr; William Johnston, Biel, Prestonkirk; Henry Jonas, 23 Pall Mall, London; R. C. Jonas, 23 Pall Mall, London; James Kay, Bute, Rothesay; John Kerr, Barney Mains, Haddington; D. P. Laird, Pinkhill, Murrayfield, Edinburgh; John Learmonth, Larchfield Nurseries, Dumfries; George Leven, St Quivox, Ayr; George Marshall, Frimstone, Liphook, Hants, *President of the English Arboricultural Society;* John Marshall, Maybole; R. V. Mather, Kelso; Robert Matthews, Duncrub Park, Dunning; John Methven, Blythswood, Renfrew; William Milne, Foulden Newton, Berwick; Alex. Morgan, Turret Bank, Crieff; Andrew Morgan, Estates Office, Glamis; G. A. Munro, Edinburgh; Bailie John Murray, Edinburgh; S. MacBean, Erskine, Glasgow; D. Macdonald, Trinity, Edinburgh; A. M'Gregor, Penicuik; A. Mackinnon, Scone Palace Gardens, Perth; George Mackinnon, Melville, Lasswade; William Mackinnon, Edinburgh; Andrew D. Page, Culzean, Maybole; T. W. Paton, Kilmarnock; James Pearson, Sessay, Yorks; Henry Philp, Dunfermline; A. Pitcaithley, Jeanie Bank, Scone, *Vice-President;* Colonel Porteous, Turfhills, Kinross; W. M. Price, Minto, Hawick; W. Ralph, Corstorphine, Midlothian; A. D. Richardson, Edinburgh, *Photographer to the Society;* John Robertson, Edinburgh; James Shiel, Abbey St Bathans, Grantshouse; John Smith, Peebles; Thomas Smith, The Nursery, Tring; Thomas Smith, The Castle, Maybole; Dr Wm. Somerville, Board of Agriculture, London; Duncan D. Stewart, Castlehill, Inchture; Fraser Story, The Glen, Innerleithen; Walter C. Stunt, Lorenden, Ospringe, Faversham; David W. Thomson, Edinburgh; R. B. P. Wallace, Leith; Charles Warwick, Clandeboye, Ireland; John Watson, Edinburgh; Jas. Wm. Watt, Carlisle; A. E. Wild, London; Wm. Wilson, Auchinleck; E. Wiseman, Elgin. There were also present James Stuart of James Dickson & Sons, Edinburgh, and Mordaunt Rider and J. H. Newnham, both of the *Timber Trades Journal*, London.

First Day.

Tuesday the 28th was devoted to the Duke of Bedford's Estate of Woburn. Leaving Leighton Buzzard at 8.30 A.M., the members drove first to Little Brickhill to view the young plantations, planted in 1901-2 and 1902-3. There they were met by Mr Mitchell, the estate forester, and were later joined by Mr Hall, the Duke of Bedford's resident agent. About 180 acres have

been planted during the last two years, while it is proposed to plant 95 acres during the next season (1903-4), and to eventually bring the whole area planted up to between 400 and 500 acres.

The plantations made in 1902-3 were first inspected.

No. 1 Plantation consisted of about 13 acres, part of which was planted with two year-old oak seedlings, and part with ash seedlings, of the same age, which were raised from the seed in the home nursery. It was considered unadvisable to sow the seed in the plantation itself, as the ground was somewhat infected with mice and other vermin, which would probably have destroyed it. The ash in this plantation appeared to be very thriving, but the oak looked somewhat sickly, and some of the company were of opinion that the soil was too light, in this part, for raising the best quality of oak. The plants were in lines 4 feet apart and 3 feet in the lines. The ground growth, or herbage, was annually cleared with the sickle, at a cost of 8s. per acre.

No. 2 Plantation comprised 35 acres of hardwoods, with larch and spruce mixed as follows:—Ash 50 per cent., oak 25 per cent., larch 12½ per cent., spruce 12½ per cent., planted at 4 feet apart in lines.

No. 3 Plantation consisted of nine acres of Scots fir, two years two years, planted in lines 3½ feet apart and 3 feet in the lines. These plants were reared from two years' seedlings in the home nursery.

No. 4 consisted of 30 acres of Scots fir, two years one year, planted in lines 3½ feet apart and 3 feet in the lines. In this case the ground growth or herbage was cleared away about 1 foot on each side of the lines, while the centre was left intact, evidently with the purpose of providing shelter for the plants, and, at the same time, preventing them becoming choked. All the plants in these plots were pitted in, the pitting being done by contract at the rate of 8s. per 1000 for the Scots fir and 12s. 6d. per 1000 for the hardwoods. The planting was done by the day.

The planting done in 1901-2 consisted of five plots. The first contained 90 acres, of which 70 were under Scots fir, and 20 under spruce, all pitted. Three of the plots consisted of 1 acre each, in which 4000 Scots pine plants, obtained from different nurserymen, had been inserted by the L system of notching, and the fifth of 1½ acre pitted in with Corsican pine from the home nursery.

With reference to the first plot, it was stated that 300,000 plants were put in originally, and that only about 3000 had

failed, whereas in the plots where the notch planting was used about 30 per cent. of the plants died. The soil, which was of a light, sandy nature, had been ploughed for an agricultural crop two years previous to planting, but had got no other preparation. The area to be planted next season is much stronger land, and was in course of being broken up with steam cultivators to a depth of from 10 to 12 inches.

Proceeding to the old woods, the Excursionists were surprised to find about 1200 acres of Scots pine of excellent quality, varying in age from thirty to eighty years. One of these woods, about seventy years of age, was said to contain over 5000 cubic feet per acre, and the market value of the standing timber was said to be as high as 8d. per cubic foot. They were further delighted with the splendid examples of natural regeneration shown to them. It was explained that five years previously a break of timber was cleared and the ground enclosed and well raked over, with the result that an extremely thick growth of naturally regenerated seedlings sprang up, very few bare patches appearing, and these were filled up to prevent undue irregularity. These young trees were looking very healthy and vigorous, and gave great promise, if carefully tended, of eventually developing into some of the finest timber of the kind on the estate. They offered direct contrast to a plantation close by, which was made at the same time with seedlings brought from the nursery. These latter were looking well, but were not to be compared to the native plants for strong growth. Unfortunately the pine beetle (*Hylurgus piniperda*) has attacked a few of the finest specimens.

Adjoining these plantations there are about 150 acres of heath land, intended to be planted with heather. A portion of this area is already stocked by means of planting and sowing seed; the plants are procured from the adjoining woods and the seed is imported. The planting has done very well, but the seeding is a failure. Some of the better sorts of heath have also been planted in beds by the grass carriage drives, and in most cases are doing very well.

A coniferous timber tree which abounds at Woburn is the Weymouth pine (*Pinus Strobus*). This is grown mostly in mixture with Scots pine and some other species, and it has done very well; but aphis (*Chermes*) was seen on both old and young trees, and the destructive parasitic fungus, *Peridermium Strobi*, was also found. In the course of a walk through the "Ever-

greens," many fine specimen trees were seen, including some fine old cedars of Lebanon, fine plants of *Pinus Cembra*, *Picea morinda*, *Tsuga canadensis*, *Juniperus virginiana*, and *Wellingtonia gigantea*, and a few specimens of the Douglas fir.

The members then drove to Woburn Abbey, where they were hospitably entertained to luncheon by the Duke of Bedford. Mr Protheroe, the Duke's chief adviser, presided, and expressed his Grace's great regret at his enforced absence. Mr Cook thanked his Grace for his kindness in allowing the party to visit his estates, and for the princely way in which he had entertained them. Mr Protheroe replied. Mr Buchanan then proposed a vote of thanks to Mr Hall, the local agent, and to Mr Mitchell, the forester, to which Mr Hall replied.

After luncheon the members had the privilege of inspecting the art collections and picture galleries in the Abbey, and the remainder of the afternoon was pleasantly passed in walking through the Park, where many fine specimen trees, including oaks, elms, black Italian poplars, beeches, etc., were seen, one of the finest of these being a beech 105 feet in height, with a clean bole of 50 feet, which girthed about 14½ feet at 5 feet up.

The following list of "Some Large Trees growing in Woburn Park" is taken from the printed programme supplied by the Duke of Bedford to the Excursionists :—

	Circumference at 5 ft.	Height of Bole.	Height of Tree.
	ft. in.	ft. in.	ft. in.
1. *Pinus Cembra*,	8 4	20 0	40 0
2. *Abies Menziesii*,	8 0	55 0	65 0
3. *Cedrus Libanii*,	18 0	28 0	80 0
4. Scots Fir,	11 0	23 0	75 0
5. Spruce Fir,	9 10	100 0	120 0
6. ,, ,,	9 0	90 0	120 0
7. *Wellingtonia gigantea*,	11 7		
8. ,, ,,	10 11		
9. ,, ,,	11 7		
10. ,, ,,	8 11		
11. ,, ,,	9 10		
12. ,, ,,	7 10		
13. ,, ,,	9 8		
14. ,, ,,	10 2		
15. Oak,	20 8	15 0	
16. ,,	18 0	20 0	65 0

Average 70 to 75

	Circumference at 5 ft.		Height of Bole.		Height of Tree.	
	ft.	in.	ft.	in.	ft.	in.
17. Ash, ...	14	0	40	0	80	0
18. Wych Elm, . . .	21	10	32	0	88	0
19. „ „ . . .	21	10	30	0	70	0
20. Oak, ...	18	0	37	0	85	0
21. „ (Pleasure Grounds), .	18	6	45	0	75	0
22. Beech, ...	14	5	50	0	105	0
23. Oak (Hop Gardens Pond),	16	0	48	0	90	0
24. „	17	4	28	0	90	0
25. „	16	2	38	0	90	0
26. „ (The Abbot's Oak), .	17	4	20	0	70	0
27. „	20	0	16	0	68	0
28. *Wellingtonia gigantea*, .	12	8	...		80	0
29. Poplar, Black, . . .	18	2	45	0	100	0
30. „ „ . . .	19	7	50	0	100	0
31. *Abies Menziesii*, . .	9	8	60	0	90	0

It may be interesting to mention that the Park extends to about 3000 acres, and that about 100 miles of grass walks and roads intersect it. The dairy, farm buildings, rubbish destructor, and crematorium were hurriedly passed over, and a visit to some of the more interesting groups in the zoological collection brought the first day's outing to a close.

Second Day.

Wrest Park.

A long drive through Woburn and Ampthill brought the party to Wrest Park, owned by Earl Cowper. A delightful time was spent in wandering through the gardens, pleasure-grounds, and groves. The predominating tree was the elm, but many fine specimens of long, clean oak, ash, and beech were also noticed and remarked upon. One splendid beech was about 11 feet 6 inches in circumference at 5 feet up, and had a bole about 52 feet high, and a few *Wellingtonias* were at least 70 feet high. Some of the grand old yew hedges, dating back to Tudor times, called forth unanimous admiration on account of their immense size and wonderful regularity of growth. A visit was paid to the old Roman bath, traces of which still exist, to demonstrate the ancient

beauties of this fine old place. After luncheon, which was served in the Whitehart Hotel, Ampthill, the party drove on to

Ampthill Park.

This park, which is the property of the Duke of Bedford, is one of the oldest in the kingdom, and is said to be even older than Windsor Great Park. It is here that what is considered to be the largest oak tree in England is to be seen. Its dimensions are—Circumference (5 feet up), 29 feet 6 inches; height of bole, 25 feet; height of tree, 75 feet. Other trees measure as under:—

	Circumference at 5 ft.		Height of Bole.		Height of Tree.	
	ft.	in.	ft.	in.	ft.	in.
Oak,	19	0	32	0	...	
,,	21	2	18	0	55	0
,,	19	9	32	0	40	0
,,	19	4	28	0	55	0
,,	19	3	40	0	55	0
,,	24	6	30	0	...	
,,	20	2	20	0	50	0
,,	27	0	24	0	...	
,,	26	0	32	0	...	
,,	22	3	24	0	...	
,,	20	2	15	0	55	0
,,	20	0	30	0	...	
,,	22	10	18	0	55	0
,,	20	3	38	0	...	
,,	24	3	22	0	...	

Of course most of these trees are unsound, some of them being quite decayed away with the exception of a mere shell.

After viewing the stone cross on the summit of the hill overlooking Ampthill House, erected to commemorate the memory of Catherine of Arragon, the company proceeded to

The Woburn Experimental Fruit Farm.

The printed catalogue of the experiments, which had been kindly presented to each of the members, contains the following description:—"The farm was established in 1894. The ground consists of 20 acres of heavy loam land overlying a deep bed of

Oxford clay. The elevation is 270 feet above sea-level. Previously, the land had formed a portion of an arable farm. The soil is of average, though somewhat variable, fertility. It was prepared for planting by trenching two 'spits' deep, and breaking up the subsoil, each spit being replaced in its original position. The ground was not manured."

The farm is owned by the Duke of Bedford, and is under the direction of Mr Spencer Pickering, F.R.S., who met the party and explained to them the nature of some of the experiments. Unfortunately a violent thunderstorm and heavy rainfall interfered very much with the proceedings. The object of the experiments is to ascertain the effects of growing fruit trees under different conditions as to surface cultivation, root and branch pruning, manuring, aeration of the soil, etc. Mr Pickering explained what had been done in some of the plots, and although there seemed to be much doubt in the minds of some of the practical horticulturists present as to the value of some of the results, all were impressed with the painstaking care with which the experiments were being conducted, even to the minutest detail. Some of the results obtained, however, seemed very puzzling. For example, the application of 12 tons of dung per acre, or of artificial manure corresponding in nutritive value to a dressing of 12 tons of dung per acre, to a plot of apple trees produced no appreciable result on their growth; but it was considered by some of the party that the clay subsoil might account for this result, and that a similar experiment on a more porous subsoil might give a different result, such as was afterwards observed at Tring. Again, a covering of grass or weeds on the surface of the soil over the roots produced bad effects, while in some cases trees carelessly planted and unattended grew even better than some that were carefully planted and received every attention. The evil effects of frequent root-pruning, which was performed at intervals ranging from one to four years, were to be expected; but when it is taken into account that most orchards are under grass, the bad effects which result from a covering of grass at Woburn are surprising. It may be, however, that the youth of the trees there, and the consequent nearness of their roots to the surface, have something to do with these bad effects. Before leaving, a vote of thanks was cordially given to Mr Pickering for his great kindness in meeting the members at great personal inconvenience, and for the explanations he had

given them. The day's outing concluded with a hurried inspection of some of the pot-culture experiments in connection with the field experiments conducted by the Royal Agricultural Society of England on the Woburn Experimental Station, which is close to the fruit farm. These were explained in detail by Dr Vœlcker's assistant, under whose supervision they were carried out.

Third Day.

The programme for the third day included visits to Ashridge Park, Tring Park, and Mentmore. Starting early, the company drove first to

Ashridge Park,

the "stately home" of Earl Brownlow. On entering the park the members were impressed with its great natural beauty and its magnificent trees, which, with very rare exceptions, were in a very healthy condition. Elms, oaks and ashes were abundant, but the beech was the predominant tree. The "Queen's Beech" had a clear bole of 70 feet, and was said to contain about 400 cubic feet of timber. The timber is of excellent quality, and commands a high price in the market. Mr Smith from Tring Park, Mr Liberty, the forester, and Mr Lowe, the gardener, accompanied the members in their walk through the gardens and pleasure-grounds, where a fine avenue of *Wellingtonias* was much admired.

The time allotted, however, was too short to permit the members to linger, and only a glance could be spared for the Monks Garden, the Grotto, and the Bamboo Garden. Many expressions of admiration were heard as the members took a last look at the beautiful mansion and chapel, and universal regret was expressed that a whole day had not been devoted to an inspection of the beauties of this magnificent place.

Tring Park.

A short drive brought the members to Tring Park, the seat of Lord Rothschild, where they were met by Mr Richardson Carr, the land agent. A visit was first paid to the nursery, where Mr Smith not only rears forest plants, but carries out experiments in fruit-tree growing. His experience of the application of dung to fruit trees has been quite the opposite of that obtained at Woburn.

A walk through a wood containing some fine grown beech brought the company to the park, where they saw the kangaroos, land tortoises, and other animals, and afterwards, under the guidance of Mr Hill, inspected the gardens and glasshouses, which were much admired. Lord Rothschild very hospitably entertained the party to luncheon in the Bungalow, and before leaving the table, Mr Cook, in name of the Society, thanked Lord Rothschild for his splendid hospitality. Mr Richardson Carr replied on behalf of his lordship. Votes of thanks were also accorded to the proprietors of Ashridge, Tring, and Mentmore for their great kindness in granting permission to visit their estates that day. Mr Smith and Mr Hill were also thanked for their kindness and assistance. After luncheon, the Jersey cows and Shire horses were paraded for the benefit of the agricultural members of the party, and later a hurried visit was paid to the splendid Zoological Museum, which is said to be the finest private collection in the country.

Mentmore.

The last place of call on the programme was Mentmore, one of the seats of the Earl of Rosebery. Mr Harrison, the agent, and Mr James Smith, the gardener, acted as guides. The racing stables were first visited, where the company had the privilege of seeing Ladas and Sir Visto, the brood mares, foals, and other less famous horses belonging to the stud.

A walk through the beautiful grounds was much enjoyed, the Italian garden, which is the special feature of the place, being much admired. After spending a very pleasant hour, the drive to Leighton Buzzard was resumed.

The Excursion Dinner.

The annual Excursion Dinner took place in the evening in the Swan Hotel—Mr Cook, vice-president, occupied the chair, and was supported by Dr Somerville, Mr Harrison, and Dr Wagstaff. Messrs Alex. Pitcaithley, vice-president, Wm. Mackinnon, and A. D. Richardson acted as croupiers. The loyal toasts having been given from the chair, Mr Pitcaithley gave the "Imperial Forces," which was replied to by Colonel Porteous; "Our Guests," proposed by Mr D. P. Laird, was replied to by Dr Wagstaff, of Leighton Buzzard; "The Royal Scottish Arboricultural Society" was given by Mr Harrison, and replied

to by Mr Buchanan; "The Landed Interest" by Mr Fleming, and replied to by Mr J. A. Campbell; "Kindred Societies" by Mr Wm. Mackinnon, and replied to by Mr Peter Fyshe; "Forestry Education," by Mr Wilde, and replied to by Dr Somerville; "The Chairman" was proposed by Bailie Murray; "The Croupiers" by Mr Smith, Maybole; and "The Secretary" by Mr Jack, Maybole.

Fourth Day.

The fourth and last day of the Excursion was devoted to an inspection of beech woods in Buckinghamshire, and cabinet and chair factories at High Wycombe.

The company, leaving their luggage at Leighton Buzzard Station to be forwarded to Euston Station, London, took train for Aylesbury, where carriages were waiting to convey them to

HAMPDEN,

the seat of the Earl of Buckinghamshire. Wyburn Woods were first inspected, and here Mr James, the local agent, explained the system of management followed. The woods on the estate extend to about 2000 acres, and are worked according to a regular system peculiar to the district. One-third of the area is taken in hand each year, and from it are extracted the stems of a size that meet the local demand. Those stems are also taken which are very broad crowned, diseased, or otherwise faulty. On the spots from which the trees have been removed there springs up a plentiful supply of seedling beech, so that no expense is incurred in establishing the young crop. It takes about forty years for beech to grow to the most useful size for chair-making timber. They did not care about cultivating the large plank trade, as better prices were realised for good clean timber for turning. From 10d. to 1s. 3d. per cubic foot on the ground were the prices realised, according to quality and existing demand, and everything that could possibly be classified as timber was sold at these figures. Many of the purchasers brought their machinery into the woods and did their turning there, sending direct into the chair factories, and saving the cartage on the waste. Anything down to 2 inches in diameter could thus be worked up. The timber was usually felled by the vendors, and sold in lots of about fifty trees, averaging from 10 feet to 15 feet each.

Some oak was grown with the beech, but there was not much demand for it, and it was usually sold at about 1s. 6d. per cubic foot. It was principally long and clean grown, as the trees present in the woods showed, and was of good quality. The net yield was said to be 15s. per acre per annum over the whole area.

A few minutes were spent at Hampden House, and the company then drove on to

Hughenden,

which formerly belonged to the late Earl of Beaconsfield, and is now the property of Mr Coningsby Disraeli. On this property the woods are gone over in a succession period of seven years, operations being conducted over one-seventh of the area each year. From these areas about one-tenth part of the stock is removed. In this way the felling age being about seventy, an amount of timber approximately equal to the growth of the year is removed each felling season. By this arrangement the main stock or capital of the forest is not touched, and only the annual production or interest is removed. In the case of the Hughenden woods, Mr Arthur Vernon, who has the management of the estate, informed the party that the annual receipts amounted to 40s. per acre per annum for the last thirty years. It is expected that this income, subject, of course, to fluctuations in the price of timber, will annually be reaped in perpetuity. So long as the principle above enunciated is adhered to, there is no reason why this expectation should not be realised.

West Wycombe.

The woods on this estate, which is owned by Sir Robert Dashwood, Bart., were also visited under the guidance of Mr Vernon. The system of management is similar to that followed on the Hughenden Estate.

From West Wycombe the party drove back to High Wycombe to see the chair and cabinet factories of Messrs Birch & Son. All the stages of manufacture were watched with greatest interest by the visiting party. So far as possible, beech timber is employed in the construction of the chairs, but owing to the small extent of the woods in the district, a quite insufficient supply is obtainable locally. Eighty per cent. of the timber must be imported from abroad,

Canadian birch being found to be the best substitute for English beech. The latter, however, is much preferred and eagerly purchased.

This was the last item on the programme, but before leaving for London the members dined together at the Red Lion Hotel, Mr Vernon, Mr Birch and Mr Smith from Tring being the guests. Mr James had unfortunately to leave earlier in the day. Mr Cook thanked Mr Vernon for his kindness in arranging the programme for the day, and Mr Birch for the privilege of seeing over his factories. In replying, both gentlemen made very interesting references to the beech woods of the Chiltern Hills, and to the development of the chair industry at High Wycombe.

Mr Buchanan, Convener of the Excursion Committee, thanked the Local Secretaries, Mr Thos. Smith, Tring Park, and Mr James Smith, Mentmore, for all the trouble they had taken in connection with the arrangements for the Excursion, which had been so successfully brought to a close.

The company travelled by the 7.56 P.M. train to London, where a number remained for a few days, but the majority left for Scotland by the 11.50 P.M. train, and reached their destinations in the course of Saturday forenoon.

In preparing the foregoing report, use has been made of the printed programme prepared by the Duke of Bedford, the Catalogue of Experiments at the Woburn Experimental Fruit Farm, and the reports which appeared in the *Timber Trades Journal*, the *North British Agriculturist*, and the *Scottish Farmer*.

XXXVII. *Forestry Exhibition in the Highland and Agricultural Society's Showyard at Dumfries, July* 1903.

For the third year in succession the Royal Scottish Arboricultural Society organised a Forestry Exhibition in connection with the Agricultural Show, and the Highland and Agricultural Society for the first time placed a money grant at its disposal for the purpose of a prize fund. The sum voted was £20, to which the Arboricultural Society added a number of medals, making up a competitive list of a dozen classes, but, unfortunately, only one-half of these secured entries. This Exhibition was therefore not quite so attractive as those held during the previous two years, but it yet possessed a good deal of interest for the arboriculturist. There were three entries in the class for a collection of timber of four varieties of conifers grown in Scotland—viz., Scots fir, spruce, silver fir, and larch. In the class for a model of a portable saw-mill for estate purposes there was only one entry. For the best article for estate or farm use, made from home-grown timber, there were three entries, embracing two field gates and a farm cart. In the class for collection of furniture or house-fittings made from home-grown timber, there was a suite of rustic oak furniture in stag-horn design. And in the class for examples showing the best methods of utilising smallwood in the manufacture of fancy wood articles and turnery, woodwork, etc., there was only a fancy rustic oak seat. One of the most useful objects for which the Society offered a medal was for an instrument or method of expeditiously ascertaining the diameter of trees at a given height, and in this class a girth-finder and a pole instrument were entered. The Judges were James Cook, Arniston Estate Office, Gorebridge, and A. T. Gillanders, Forester to the Duke of Northumberland, Alnwick Castle. Their award was presented to the general meeting held on 27th July, and is printed in the proceedings of that meeting.

Among the articles sent for exhibition only, the Society again exhibited part of a collection of 170 sections of British-grown trees and shrubs, and a series of micro-photographic slides of plant tissue, highly magnified. Captain Walker of Crawfordton sent specimens of various forest trees showing the bad effects of "notch" planting. Messrs Thomas Kennedy & Co., nurserymen, Dumfries (of which firm Mr John Newbigging, one of the local secretaries, is a partner), exhibited a specimen of the Japanese

larch (*Larix leptolepis*) direct from its native country, where it was grown at an altitude of 5000 feet on the Fuji Mountain. The section was taken from a tree about forty-six or forty-eight years of age, and seemed to be of very good quality, but considering its rapid growth in this country when young, it certainly appeared small when compared with the common European larch. Allowance must, however, be made for the elevation at which it was grown. Photographs were also exhibited showing *Larix leptolepis* growing sylviculturally and arboriculturally. The same firm exhibited four young specimens of the same tree which were raised from seed on the Murraythwaite estate in Dumfriesshire seven years ago. They were about 10 feet high, which shows the rapid growth this tree makes in this country when young. Mr George Leven, forester, Auchencruive, Ayr, sent stobs and paling rails creosoted by the method described in the last Part of the Society's *Transactions*, which had been in use for eight years, and also specimens of Douglas fir showing the results of an attack of fungus, believed to be *Phoma pithya*. Mr John Smith, Peebles, exhibited an octagon table made from elm grown on the Stobo Estate, Peeblesshire, and also an interesting exhibit of tables made of natural and fumed oak in contrast with a piece of oak, polished, which had lain over four hundred years under water. He also sent a measuring instrument for ascertaining the height and diameter of trees. An interesting display from England was that of Messrs Joseph Gardner & Sons, Bootle, Liverpool, who sent a number of small specimens of foreign hardwoods arranged in mosaic panels. Mr T. Borrowman, Forester, Melville, St Andrews, exhibited a table made by himself.

The Local Secretaries were John Newbigging, Nurseryman, Dumfries, John Hayes, Dormont Grange, Lockerbie, and David Crabbe, Forester, Byreburnfoot, Canonbie, and they were assisted during the Show by Mr David Barrie, Comlongan Castle. Messrs Thomas Kennedy & Co., Nurserymen, Dumfries, kindly decorated the stands and grounds with a number of beautiful young conifers.

NOTES AND QUERIES.

Forest Fires.

The following notes, compiled from the translation of an article by M. Jacquot in the *Revue des Eaux et Forêts*, published in the *Indian Forester*, will interest students of this question.

Dead Leaves.

M. Berthelot, and more fully MM. Gauthier and Drouin, have proved that a fire, if sufficiently intense to decompose the humus and humic acid, thereby destroys the faculty they possessed of developing those most essential and scarce substances which contain nitrogen. Even if the fire does not destroy woody tissues, it burns up the covering of dead leaves. M. Détrie suspected what M. Coudon and especially M. E. Grandeau have proved, viz., that these dead leaves possess the precious faculty of *absorbing nitrogen from the air*. Since MM. Schlœsing and Müntz in 1877 discovered the nitromonad, the first bacterium whose powerful action on the chemical changes in the soil was proved, attention has been concentrated rather on its agricultural than on its forest utility. The researches of M. Henry therefore mark an important step in science. By his experiments in 1897 the learned professor of the French Forest School proved that dead leaves may even double their original richness.

The quantity of leaves produced annually on 1 hectare varies with the soil, climate, species, age, treatment, and density of the crop and the luxuriance of the crowns. It may reach 12,000[1] kilogrammes of the living substance. The Bavarian stations have supplied some valuable figures, but these, as M. Henry remarks, are minima: "They relate indeed to forests afflicted with rights to fodder. The impoverishment resulting from this detestable practice reacts fatally on the vegetation." Other countries supply similar proofs. Jaeger and Buro, working under the same conditions, arrived at the same results as Professor Ebermayer. But Dr Krutsch, examining soils that were not so impoverished,

[1] Equivalent to nearly 11,000 lbs. per acre.

found weights one-fourth greater for spruce and one-seventh greater for Scotch pine.

After giving figures to indicate the air-dried weight of the dead covering produced annually by the fall of leaves and other vegetable debris in forests of various species and ages, the author states that, according to M. Henry's weighings, at the end of one year, a weight of 100 lbs. of oak and hornbeam leaves produces a gain of at least ·666 lb. of nitrogen. The leaves have by that time lost their colour, but not their form, and are far from being reduced to humus. Their action as gas-absorbers is slowed down, but only ends with their complete decomposition. This takes three years for certain common species such as beech, and nearly twice as long for pine needles. It is thus a very moderate estimate to say that, after allowing for all losses of gas returned to the atmosphere during the process of decomposition, there still remains ·850 lb. of nitrogen absorbed and fixed from the air by each 100 lbs. of dead leaves. This quantity is pure profit—the increment of the leaves from the moment they fall to the ground. But at the time of falling they contain a certain quantity which amounts to over 1 per cent. for the principal species. This may be considered as the minimum for oak, beech and hornbeam. The total loss of nitrogen resulting from the burning of the leaves is therefore 1·850 lbs. per 100 lbs. of dry leaves of these three species. Probably it is at least 2·500 lbs. for pine, but for safety it may be taken as 2 lbs.

Debris.

The dead twigs, etc., etc., which reach the ground are also nitrogenous compounds. They decompose more or less slowly, but always end by conversion into substances useful to plants (such as starches, nitrates, ammoniacal salts). A fire, even a slight one, destroys these small organs and dissipates the nitrogen, which exceeds ·7 per cent.

Under normal conditions the nitrogen derived from the two above-mentioned sources would have contributed to the formation of ulmic compounds and humus incorporated in the vegetable soil. A fire dissipates it in pure loss. The damage corresponds to the price of a *manure containing the same proportion of the gas.* In the case of a hectare of high beech, aged 100 years, the loss of the soil covering would, on certain assumptions, amount to over £2, 16s. per acre. Similarly, in the case of a 40-year old pine forest, the

loss would be £2, 7s., and in the case of a 6-year old stored coppice, the loss would be £1, 10s. per acre. The cost of transport and labour would be additional.

The artificial product applied to restore the loss contains, it is true, some other substances of a fertilising nature, but these cannot be considered as replacing any of the nitrogen due. Mineral foods cannot be substituted even for each other. Forest crops, though less exhausting than field crops, nevertheless make equally imperious demands for certain substances, and suffer equally severely as soon as any one of the necessary elements becomes insufficient. Field manures are intended for field crops, and do not produce the same effects in forests. What the latter want is nitrogen, and nothing else can make good the loss of the soil covering. The author of a forest fire should be compelled to make good the loss, under strict analytical tests, to within 1 per cent., and he should furnish that manure which is most appropriate to the soil and the season.

Railway Rates.

The question of the injustice of preferential railway rates on foreign timber was raised at a meeting of Council in April, and a small committee was appointed to endeavour to collect information on the subject. Owing, however, to the difficulty experienced in getting information from the railway companies, and mistaken ideas as to the law on the part of traders and foresters, very little data is available as yet.

A few extracts from replies received in answer to inquiries made will best show how matters stand. One correspondent says: "I believe there is a great difference in the charges for carrying foreign compared with home wood." Another says: "Foreign timber has, and I am afraid will still continue to have, the cheaper rate over home-grown round timber on account of its being easier to handle, bought in larger quantities, and landed in ports where the railway companies have to cut their prices keen in competition. I know timber merchants who get reduced rates, but that being a private transaction between themselves and the company or companies, they, in my opinion, are quite justified in keeping to themselves what otherwise might mean hundreds (of pounds) per year." A third says: "In the general effect it keeps down home-wood prices." This writer complains of local deadweight rates compared with measurement rates for long

distances, the measurement loads not being "so convenient traffic as most of the dressed pit-wood we send for local consumpt. This cheap pit-wood is very much affected by the cheap transit of Norway pit-wood."

As an instance of how railway companies work, a trader was charged 26s. per ton for carriage on a quantity of timber, and on it being pointed out that 17s. 4½d. was the legal rate, they agreed to reduce it to 21s. The trader offered 17s. 5d., and after six months' delay and annoyance it was eventually settled at 17s. 7d. The same correspondent says: "Scotch traders in timber, no doubt, give way too much to railway companies. If they would bind themselves together and hold firm, no doubt they would enforce their rates."

A trader states that he is charged 2s. 1d. per ton for carriage of pit-wood from a seaport town to a certain colliery, while the rate for foreign pit-wood is 1s. 11d. per ton. He also states, what he considers a greater grievance, that he is charged 5s. per ton to a certain station about forty miles distant, while to an intermediate station on the same line, only thirty miles distant, he is charged 5s. 5d. per ton for the same class of timber.

In another case a rate for pit-wood was asked for a distance under two miles, but where, for certain reasons, it could not be delivered by cart, and the railway company at first offered a rate of 1s. 10d., and afterwards 1s. 8d., which they stated "was positively the lowest rate charged for any distance." Ultimately, however, they made the rate 1s. 6d., "considering that the class of traffic would weigh well," the consigner and consignee to load and unload the timber without assistance. The loads in this case averaged seven tons.

Another trader writes as follows:—"After pretty exhaustive inquiries, I find that there is not much difference between the rates charged on railways for foreign timber as compared with home timber, neither is there much difference as to whether it is coming from or going to the coast. There are a few anomalies, such as the following: The rate from Glasgow to Dundee is 7s. 6d. per ton, while from Callander and Bonnybridge to Dundee it is 8s. in either case, notwithstanding the fact that the distance is much less. The same thing takes place all over. If you get railway companies competing with water carriage the rates are much lower, and the fact remains that where you have a large quantity going from point to point, better rates can be got.

After looking over the Clearance House classification book, I have not been able to find that there is any preference given to foreign timber as compared with home."

From what has been stated above, it is evident that erroneous ideas are prevalent as to the powers with which railway companies are vested. Section 90 of the Railway Clauses Act, 1845, states that all tolls must "be at all times charged equally to all persons and after the same rate, whether per ton, per mile, or otherwise, in respect of all . . . goods or carriages of the same description . . . passing only over the same portion of the line of railway under the same circumstances." The Railway and Canal Traffic Act, 1888, declares that "whenever it is shown that any railway company charge one trader or class of traders, or the traders in any district, lower tolls, rates, or charges for the same or similar merchandise, or lower tolls, rates, or charges for the same or similar services, than they charge to other traders, or classes of traders, or to the traders in another district, or make any difference in treatment in respect of any such trader or traders, the burden of proving that such lower charge or difference in treatment does not amount to an undue preference shall lie on the railway company;" and it contains a proviso "that no railway company shall make, nor shall the Court or the Commissioners sanction, any difference in the tolls, rates, or charges made for, or any difference in the treatment of home or foreign merchandise in respect of the same or similar services." Further, the Act empowers the Court or the Commissioners "to direct that no higher charge shall be made to any person for services in respect of merchandise carried over a less distance than is made to any other person for similar services in respect of the like description and quantity of merchandise carried over a greater distance on the same line of railway."

As one of the writers above states, "this very important subject . . . is one that well deserves full consideration from all interested in timber," and unquestionably railway rates have a very important bearing on the growing of timber on a commercial basis in the British Isles. It is to be hoped, therefore, that the members of the Royal Scottish Arboricultural Society, and others interested, will endeavour to get up some evidence that may be laid before the President of the Board of Agriculture in supplement of the evidence on the subject collected by the recent Departmental Committee on Forestry.

Re-Afforestation in Italy.

Mr Neville-Rolfe, British Consul in Naples, refers in his latest report on his district to the widespread interest now being taken in Italy in the question of re-afforesting the country. In 1877 about four millions of acres were withdrawn from the operation of the old forest laws, as well as about one million acres in Sicily and Sardinia. The consequence was a reckless destruction of forests; and now it is generally admitted that the State must step in to save those that are left and to aid in replanting. The question now being discussed is, What trees are to be used for the latter purpose? The Italian oak is of little use except for railway sleepers; there is plenty of chestnut all over the country, and pine trees would grow luxuriantly and prove most useful. The cork tree, however, appears to be the one which would prove economically the most valuable, and it has hitherto been almost wholly neglected in Italy. In 1900 the cork exported was valued at only £36,000, and much, no doubt, was used at home. But a few years ago, Spain exported wine corks to the value of over a million sterling. In Italy about 80,000 hectares of land are under the cork tree, chiefly in Sicily and Sardinia; in Portugal, Spain, and Algeria, the areas respectively are 300,000, 250,000, and 281,000 hectares. The Calabrian cork forests have been almost wholly destroyed, the trees having been burnt for charcoal, and even Sicily now imports corkwood in considerable quantities. Seventy years ago nearly all the cork imported into England came from Italy; but since then most of the Italian forests have been destroyed for charcoal, and to produce potash, and those that remain are being devastated for the same purposes; and no one thinks of replanting the ground, which naturally gets washed away owing to the absence of trees. Large forests containing a majority of cork trees are continually being released from the forest laws, and there is a risk that the production of cork in Italy will soon cease. Nothing can replace cork in its manifold use, and now, when vast quantities are used in making linoleum and in shipbuilding, an adequate supply of it is of great economical importance.—*The Times*, April 21st 1901.

Forestry at the Royal Agricultural College, Cirencester.

The governing body of the Royal Agricultural College, Cirencester, have taken into consideration the report of the Depart-

mental Committee on British Forestry, recently presented to Parliament, and have decided, in consequence of the recommendation of that report, to remodel and largely develop the teaching of forestry at the college, in connection with the estate management branch of the curriculum. In furtherance of this object they have resolved to create a new chair, to be entitled the Chair of Estate Management and Forestry, and to appoint thereto a special professor or lecturer, who shall be required to devote all his time to the duties of the chair, and who shall have had good experience, not only of the management of woods in this country, but also of the Continental system of sylviculture followed in the State and Communal forests of France and Germany. This will be the first attempt in England to deal with this important question on these lines; and inasmuch as a large proportion of future land-owners and managers who attend regular courses of college instruction pass through Cirencester, the results will be watched with much interest.—*The Times*, April 20th, 1903.

The inauguration of the Chair above referred to took place on 17th November, when Dr Schlich delivered an address. The Principal, the Rev. J. B. M'Clellan, M.A., in the course of his remarks in opening the proceedings, said he desired to thank Lord Bathurst—who regretted to be unable to be present owing to another engagement—for the kindly way in which he had put his magnificent and exceedingly well-managed woods at their disposal for the purposes of practical instruction, and had also arranged to provide for them a forest garden, mainly at his own expense. He wished to tender through Mr Benjamin Bathurst, their Member, their best thanks to Lord Bathurst for his munificent offer. He was also glad to welcome others interested in forestry, including Mr Elwes, who had informed him that he should be glad to give the students an invitation to his extensive woods whenever they could avail themselves of it.

The late Mr Hanbury on the Departmental Committee's Report.

The late President of the Board of Agriculture, in the course of a speech delivered in the House of Commons on 21st April 1903, said: On the question of afforestation there were certain recommendations of the Departmental Committee to which he could say offhand that effect would be given. The Commis-

sioners of Woods and Forests were willing to set apart a certain district in the Forest of Dean for an experimental demonstration area, as suggested by the Committee, and he had no doubt that when he read the evidence there would be other portions of the report to which also he should be able to give effect, because he felt that the question of afforestation was one of serious interest to this country. He should do his utmost in pressing on the Treasury the necessity for carrying out, as far as he might be supported by the evidence, the recommendations of the Depart mental Committee.

The President of the Board of Agriculture on Forestry.

At the formal opening of the new college farm at Madryn, in connection with the Agricultural Department of the North Wales University College, Lord Onslow said, among other things, that North Wales possessed great natural advantages for the study of forestry, and might be made an excellent experimental ground. In this country we annually imported from foreign countries enormous quantities of timber, while the raising of timber for commercial purposes in our own country was almost wholly neglected. A considerable number of trees were planted for ornament, but very few for profit, and this largely haphazard, and with little practical knowledge. He hoped to be able to induce the Treasury to make a small grant which would enable them at least to begin experimenting in forestry in this country. He greatly deprecated the tendency in the country to allow the inhabitants to crowd to the towns. It was the duty of the county councils throughout the land to encourage the people in their districts to gain their livelihood in those districts, and to discourage them from going to swell the labour market, which was none too good already, in the towns.

The effort of Lord Onslow to secure a grant for forestry experiments is a commendable one from every point of view, and it shows that those in authority have at last realised the importance of fostering timber-growing in our own islands, a step which has long been advocated in the Press and elsewhere. But we will not shout till we see the edge of the money.—*Timber News.*

Lord Onslow was present at the inauguration of the new Chair of Forestry and Estate Management at the Royal Agri-

cultural College, Cirencester, and in seconding a vote of thanks to Dr Schlich for his address on that occasion, said: Dr Schlich's great knowledge of the subject was well known throughout the world, and he felt that they were greatly indebted to him for having sketched out for them a syllabus of instruction for the woodreeves or woodmen to whom he just now alluded as under tuition in the Government forests adjoining the Forest of Dean. That was, of course, a very small experiment, but it was an experiment, and if it should turn out to be a successful one, he was in great hopes that the advantages of education in forestry might be extended not only to the woodreeves in the Government forests in Gloucestershire and in other parts of the kingdom, but also to those who took an interest in the higher work of forestry—he meant the head woodmen and land agents who were concerned with the management of woods on the great estates throughout the country.

Forestry Instruction at the Forest of Dean.

The following note has been received from Mr Stafford Howard:—"With a view to giving effect to the recommendation contained in paragraph 25 of the Report of the recent Departmental Committee on British Forestry, the Commissioner of Woods in charge of Dean Forest and the Highmeadow Woods adjoining, has arranged, with the sanction of the Treasury, to start an experimental course of instruction for student woodmen who will be employed in these Crown woods during the time of their training. Mr C. O. Hanson, of the Indian Forest Service, has been appointed Instructor, under the supervision of Mr Philip Baylis, the Deputy Surveyor of Dean Forest. The classes will be held in the Crown Office, Coleford, and will begin about the middle of January 1904. The course will be spread over two years, and will include instruction in Forest Botany, Sylviculture, Forest Mensuration, and Protection of Woods. Eight young men have applied to become students; six from the Forest of Dean, where they are already employed, and two from Windsor. This is as many as employment can be found for at present. It is hoped that next year, when the first eight will have completed the first part of the course, and will go on to the second part, that eight more may be taken on to take up the first part in succession. At the end of the first two years, and every year afterwards, an examination will be held, and those student woodmen who pass satisfactorily will receive a certificate,

signed by the Commissioner of Woods and the Deputy Surveyor of Dean Forest."

The Preservation, Seasoning, and Strengthening of Timber.

Mr W. Powell, in a paper on the above subject read before the British Association at Southport, said that he proposed to show how some kinds of timber, at present valueless, might become exceedingly useful; how timber used for structural purposes might be so strengthened as to bear a much greater load or strain; how our streets might be cheaply paved with sanitary wood-blocks which would neither absorb surface water nor give out disagreeable effluvia; how the ravages of dry rot might be combated; and how all this might be done simply and at comparatively small cost. Seasoning timber, either by natural or artificial means, tended to impair its strength by reducing its specific gravity, and this was especially the case in timber rapidly dried by artificial means. He had found that by boiling timber in a thin saccharine solution until most of the air in the timber was exhausted, and then by leaving the wood in the syrup to cool, a certain amount of the sugar was absorbed by the timber, in some cases so much as to cause the timber to sink. After the wood had become sufficiently saturated, it was put into a drying-stove and the moisture driven off at a fairly high temperature until the wood was thoroughly dry-seasoned, as the term goes, and it was then ready for immediate use. This process differed from others mainly in the fact that before drying was attempted the interstices of the timber were filled in with a viscid, glutinous solution, which took the place of the natural sap and air which the wood has been forced to part with. So, when the moisture was driven off by stoving, the sugar which remained in the wood acted like a strong binder, and held the fibres together, just as cement or mortar bound the stones or bricks in a wall. He was informed by Dr Herman von Schrenk, the head of the Forest Products Branch of the United States Forestry Department, that there were thousands of square miles of land in the States covered with timber which at present was of little or no commercial value; and the same might also be said of Canada and most other timber-producing countries. These useless trees might aptly be called the weeds of the timber garden. Most of them were too weak, too sappy, too porous, and were so liable to rapid decay as to be

not worth cutting down. In some respects they were similar to our English poplar, and like it grew very quickly. This class of timber was especially amenable to the process he had described, and the results were somewhat astounding. Poplar absorbed over two and a half times its own weight of the solution, and when thoroughly dried was 75 per cent. heavier than its natural state. If this could be effected with our English poplar, there was every reason to believe the same results might be obtained with the soft-woods of America and other countries, and so a fresh source of supply of timber most suitable for railway sleepers, paving blocks, planks for piers, stations, etc., might be opened up. Everyone was aware of the power of wood pavements to emit stifling effluvia, especially on a hot, close, summer night. The excreta absorbed by the block, and thus evaporated, made it a perpetual source, not only of discomfort, but possibly of ill-health. If the good qualities of soft-wood could be retained, while making it not only harder and tougher, but above all less absorbent, then one of the great difficulties of the municipal engineer would have been solved. While the weight of pine was not much increased by the process, its effects on the strength of the wood were remarkable. Experiment showed that the tensile strength of pitch pine was increased from 14 to 32 per cent., of white pine from 29 to 39 per cent., and of yellow pine from 56 to 107 per cent. Tests as to the effect of the process on the flammability of wood, especially of such wood as the pines, showed that it was to make the wood less inflammable, by reason of its greater compactness and solidity. Beech came next to poplar in its greediness for syrup, and its weight was increased by treatment by about 50 per cent. It became a very firm, tough timber, nearly as tough as oak or teak, without having their brittleness. As to the cost of the process, sugar was a very cheap raw material, being only about the same price, weight for weight, as the lower-priced woods, and if the by-products of sugar manufacture were used, the cost would be almost nominal. The amount of labour involved in the process is comparatively small, and the plant was simple.—*The Times.*

Prevention of Sparks from Railway Engines.

The Glasgow Railway Engineering Co., Limited, write:—The Drummond's Patent Fuel Economiser and Spark Preventer

has now been in use for two years on a large number of locomotives in Great Britain, in the British colonies, and in foreign countries. It has been most successful both as regards economy in the consumption of fuel and the prevention of the emission of sparks from the chimney. This invention is used in England, Scotland, Ireland, the British colonies, India, South America, South Africa, and Japan. The demand for engines fitted with this arrangement by companies who have tested its value as a spark preventer and fuel economiser is greatly on the increase. There have been no claims for damage by fire-throwing from locomotives since the apparatus has been fitted to the locomotives of these railways. The invention is not only of the utmost importance to railway companies, both as a fuel saver and as a safeguard against the occurrence of fires, but also appeals strongly to the owners of property, either urban or agricultural, adjacent to lines of railway. It may be mentioned that the law only protects railway companies from liability on account of losses arising from fire-throwing when their locomotives are fitted with the best known appliances for the prevention of the emission of sparks. It therefore follows that, if the railway companies neglect to apply an approved device, such as that under notice, they incur the certain penalty of having to pay for any damage proved to be caused by fire-throwing by their locomotives.

Water-Supplies—Afforestation of Catchment Areas.

The following is a copy of a circular addressed to Local Authorities in Scotland by the Local Government Board:—

Local Government Board,
Edinburgh, *5th September* 1903.

Sir,—The Board of Agriculture having applied to the Local Government Board for information as to the municipalities in Scotland that have acquired the freehold or long leasehold of the catchment areas from which their water-supplies are derived, I am directed to request the Local Authority to favour the Board by furnishing them with specific information on the various points detailed in the appended schedule.

In order that the Local Authority may fully understand both the scope and object of the inquiry, I append for their information (1) a copy of the letter addressed to this Board by the Board of Agriculture, and (2) a copy of a relative extract from the Report

of the Departmental Committee appointed by the Board of Agriculture to inquire into and report upon British Forestry, 1902.

Three copies of this circular are herewith transmitted, and I have to request you to favour the Board by returning two copies with the schedule duly filled up, so that one of them may be sent to the Board of Agriculture for their information.—I am, sir, your obedient servant,

G. FALCONAR-STEWART, *Secretary.*

Copy of Letter addressed to Local Government Board for Scotland by the Board of Agriculture.

BOARD OF AGRICULTURE, 4 WHITEHALL PLACE,
LONDON, S.W., *3rd August* 1903.

SIR,—I am directed by the Board of Agriculture to transmit herewith, for the information of the Local Government Board for Scotland, a copy of an extract from the Report of the Departmental Committee on British Forestry, and to state that they would be glad if you could furnish them with a list of the municipalities in Scotland which have acquired the freehold or long leasehold of the catchment areas from which their water-supplies are derived, with a statement of the acreage and altitude of the respective areas. I am to explain that it is not a list of municipalities owning their waterworks merely that is required, but a list of those towns which have, usually from sanitary considerations, acquired by purchase or otherwise considerable areas of land from which their waterworks derive their supplies of water, or which exercise full control over such land. So far as the Board are aware, the municipalities of Liverpool, Manchester, Birmingham, Leeds, Bradford, Halifax, and Bury in England, and of Edinburgh and Glasgow in Scotland, would be included partly or entirely in the list, but there are doubtless others.

I am to say that, if no such list is available, the Board would be greatly obliged if the Local Government Board could see their way to have such a return prepared.—I am, sir, your obedient servant, A. W. ANSTRUTHER, *Assistant Secretary.*

The schedule includes the following headings under which information is asked:—1. Locality of catchment area of water-supply. 2. Terms under which land acquired; whether freehold or leasehold. 3. Acreage. 4. Range of altitude. 5. Description of gathering ground: (*a*) Geological formation; (*b*) how much of the area is hill pasture? (*c*) how much arable? (*d*) how much

peat? (*e*) how much wood or forest land? (*f*) from how much of the area are all kinds of farm live stock absolutely excluded? 6. Any observations the Local Authority may desire to make upon the recommendation of the Departmental Committee appointed by the Board of Agriculture.

It is understood that the matter is under the consideration of the Dundee Water Commissioners and the Edinburgh and District Water Trust. The secretary to the Water Department of the city of Birmingham writes, with reference to Dr Smith's article published in last part of the *Transactions*:—"The subject of tree-planting on our watershed has already received careful consideration by the Water Committee. A report has been prepared by an expert, and considerable areas have been allocated for the purpose of plantations. As stated in your pamphlet, page 91, an area of about eighty acres has already been planted as the beginning of a large scheme. Your statement with regard to Birmingham is in fact substantially correct, with the exception of the name of the contractors, who were not Messrs Herd."

The Canadian Forestry Association.

The Canadian Forestry Association was organised some five years ago, with the following objects, viz.:—

(1) To advocate and encourage judicious methods in dealing with our forests and woodlands.

(2) To awaken public interest to the sad results attending the wholesale destruction of forests (as shown by the experience of older countries), in the deterioration of the climate, diminution of fertility, drying up of rivers and streams, etc.

(3) To consider and recommend the exploration, as far as practicable, of our public domain, and its division into agricultural, timber and mineral lands, with a view of directing immigration and the pursuits of our pioneers into channels best suited to advance their interests and the public welfare. With this accomplished, a portion of the unappropriated lands of the country could be permanently reserved for the growth of timber.

(4) To encourage afforestation wherever advisable, and to promote forest tree planting, especially in the treeless areas of our north-western prairies, upon farm lands where the proportion of woodland is too low, and upon highways and in the parks of our villages, towns, and cities.

(5) To collect and disseminate, for the benefit of the public, reports and information bearing on the forestry problem in general, and especially with respect both to the wooded and prairie districts of Canada, and to teach the rising generation the value of the forest, with the view of enlisting their efforts in its preservation.

The question of the extent to which the timber resources of Canada can be relied on as a permanent source of supply to the United Kingdom must depend in large measure on the extent to which these resources are drawn upon to meet the demands of the United States; and this again depends, of course, on the extent to which the States are able to supply their own needs.

The situation in that country is well illustrated by the following extract from *The American Lumberman*, its leading timber journal:—

> The value of timber is appreciated to-day by the general public as it was not forty or fifty years ago. Then there were "worlds of timber," to use a favourite southern expression, and it seemed hardly possible to anyone that there could be a lack of any variety. Now lumbermen are still in active business who have seen the white pine of Pennsylvania disappear, who see the wonderful resources of Michigan represented by a few isolated tracts, who have seen the production of Wisconsin reduced, and who know that the life of the industry in Minnesota, the last stronghold of this king of American woods, is limited. Besides these veterans of the industry are thousands of younger men who have seen white pine stumpage double in value within their own active career, and so it does not require much faith or nerve, but only a modicum of common sense and prudence, to say that any timber at almost any price which now must be paid for it is a safe investment.

The Toronto *Globe*, from which the above is quoted, thus concludes:—

> Some of the influences favouring the sentiment in support of reciprocity with Canada may be traced to this cause, and to the fact that the pulp-mills are making such large demands upon the spruce forests that the lumbermen are practically shut out from dealing in that kind of timber, and the increasing demands of both industries make new resources of supply a necessity.
>
> Canada, however, has hardly as yet realised that it holds such an important place in the economy of the world in this respect, and with the improvidence of youth still leaves waste immense tracts that could with ordinary care be made useful and continued sources of wealth, while even that which is used is not made productive as it might be. The importance to the Dominion of the perpetuation of the lumber industry is shown by the value of the export of forest products (including manufactures), which during the last fiscal year amounted to 31,958,255 dols. In the Province of Ontario, out of a total revenue of 4,466,043 dols., woods and forests contributed 1,479,847 dols., and in the Province of Quebec, for the year previous, 1,112,529 dols. out of a revenue of 4,771,567 dols. In New Brunswick the return from woods and forests makes up about one-fifth of the ordinary revenue. While in the other Provinces the revenue is smaller, it is capable, with proper management, of becoming a very important addition to the Provincial income.

Indications of a similar nature come from all quarters, and render it impossible to doubt that, in the near future, a scarcity of timber will place in a very favourable position those countries and individuals who are wise enough to set their houses in order without delay.

Notes on Co-operative Agricultural Credit in Germany and Switzerland.

(Extracted from a Report by H. de F. Montgomery, D.L., Member of the Agricultural Board for Ireland.)

The requirements of the classes engaged in agriculture, as regards borrowed capital, involve two kinds of credit—real credit for long loans; personal credit for short loans. The spheres of the two kinds of credit tend to overlap, but in the countries where the problems of agricultural credit have been most thoroughly worked out, it is considered of great importance to restrict this tendency as much as possible.

Where the whole or part of the permanent working capital is borrowed, and the borrowing takes place without any immediate prospect of repayment of the principal or of more than the interest, with or without such small instalments of principal or contributions to a sinking fund as will not make the annual payments very substantially greater than mere interest payments, long loans are called for, on *real* credit—being a charge on immovables, especially on lands and houses, in the form of mortgage or hypothec. It is the function of this sort of credit also to supply funds required for building and permanent improvements, and also where the land itself is purchased wholly or partly with borrowed money, or is subject to family or other charges, for the benefit of persons other than the owner or occupier.

The organisation of this sort of credit began in Prussia nearly a century and a half ago by the formation among the larger landowners of mortgage debenture associations (*Landschaften*) (see "The Organisation of Real Credit," *National Review*, October 1892). Much has since been done in Germany to make it accessible to all classes of landowners, first by a perfected system of Local Registration of Title, and of all dealings with real property and charges thereon, and further by the establishment

of district savings banks and other institutions authorised to advance money on the security of real property.

On the other hand, in agriculture, as in every other business, when an amount of capital has been provided sufficient for the average needs of the undertaking, it frequently occurs that the operator finds he has money on hand which he does not immediately want, and quite as frequently that he has momentary need of money which he has not got, in order to make the most of his business, by taking advantage of favourable openings—buying in a cheap market—holding his produce for a rise—and the like. To provide the money thus required for a few days or weeks—in agriculture more often for a few months or even years—is the function of *personal* credit.

Every branch of business carried on in the great mercantile and industrial centres is conducted with the help of a highly developed system of mutual credit, and all sorts of devices have been conceived and adopted to make every pound or pound's worth handled by those who carry on these various businesses as profitable as possible.

The German farmer, besides protective customs' duties and bounties, the permanent advantage of which is open to discussion, enjoys sundry Government favours, and exceptional facilities as regards real credit. In addition to this, he has evolved out of the small beginnings of Schulze and Raiffeisen (of late years with the active assistance of the State) a system of co-operative personal credit and banking which goes far to place the poorest farmer in as good a position to make the most of his business in his degree, as that of the richest merchant, and which is daily going further in the same direction.

Roughly speaking, there are now nearly a million farmers in the German Empire, who are, as members of co-operative agricultural banks, in a position to obtain $3\frac{1}{2}$ to $3\frac{3}{4}$ per cent. interest on any savings or on any money they do not require for use, even for the shortest periods—in an increasing number of cases on credit balances in current accounts—while they can borrow any sum for which they can give reasonable security (often the security of a well-known good character is sufficient) at from 4 to $4\frac{1}{2}$ per cent. interest for short periods up to two or three years, subject sometimes to no charges, sometimes to very small charges in addition to the moderate interest; while for longer periods they can, without any delays, at insignificant cost, obtain money

on mortgage at 4 or $4\frac{1}{4}$ per cent., or $4\frac{1}{2}$ per cent. inclusive of $\frac{1}{2}$ per cent. sinking fund for gradual amortisation.

Looked at from another point of view, we may say that the German system of co-operative agricultural banking has the effect of running a flood of capital amounting to some seventy million of pounds sterling over the land of the co-operating farmers every twelve months (but increasing in amount every year), fertilising the land and enriching the cultivators, most of which, in the absence of this system, would flow in other directions or be unfruitfully hoarded.

The Japanese Larch and the Larch Disease.

Professor Schwappach writes: — In his memoir (1891) on planting with foreign trees, he stated that *Larix leptolepis* seemed remarkably resistant to the bite of *Caleophora laricinella* and to larch canker (Krebs), and that in most cases it seemed not to be attacked by either. In the few districts where it had been attacked by the moth, it seemed to suffer much less damage than the European larch, doubtless on account of its having stronger and more fleshy leaves. When this was written it was justified by the fact that out of twenty-four reports only two recorded the presence of canker, and the author himself had seen no sign of it. He has since written to the two head foresters who reported the presence of canker in 1890. From one of these only (at Homburg, near Frankfurt) has he received specimens. In Homburg *Larix leptolepis* is planted over a wide area, but it is only a group of trees planted on poor soil that is affected by canker; there, however, the disease is very bad. No other locality in West Prussia shows canker upon *Larix leptolepis*. In the neighbouring forestry department of Chorin a few specimens have been found. The author is therefore of opinion that although on good ground *Larix leptolepis* is more resistant to canker than the European larch, yet it cannot be said to be immune. In Germany the planting of *Larix leptolepis* was begun in 1887, so that the oldest trees are sixteen years old. The future fate of these trees is therefore still uncertain. For Scotland he advises that too great confidence should not be placed in the tree, and especially that it should not be planted alone, but mixed with *Pseudotsuga Douglasii*, *Picea sitchensis*, and *Picea pungens*, especially in large woods.

As it is desired to place upon record authentic cases of the occurrence of *Peziza Willkommii* on the Japanese larch, I send the following note:—In May of this year (1903), while examining the "Investigation Plots" of pure Japanese larch in the Liepe district, near Chorin (North Germany), I found several trees affected by disease. The well-known sunken patches or blisters, and the outpouring of turpentine from the cancerous spots, commonly observed on diseased specimens of the common larch, were in no way different upon *Larix leptolepis*. Yellowish-white pustules and cup-shaped ascophores were abundantly present. I took several specimens to Forstmeister Dr Kienitz, Professor of Forest Protection in Eberswalde Academy, with whom I was staying, and he at once declared them to be larch disease. Dr Möller, Professor of Cryptogamic Botany, concurred in this opinion.

One of the groups where the disease was present was thirteen years old (planted in 1890), the trees were 30 feet high, and had an average diameter at breast-height of 3 inches. A second small wood in which the blister was found was of still better general growth. Having been planted in 1892, it was eleven years old in spring 1903. The average height of the trees was 34 feet, and the diameter 4 inches. The attacked trees were somewhat crippled, and did not reach these dimensions. In neither of the woods could the damage done be said to be at all serious, but it gives evidence that the Japanese larch is not immune to the pest. Such cases make it doubtful if that tree will permanently maintain its present healthy state, and there is always the drawback to its adoption, that it requires a better soil and kindlier situation than the European larch.

FRASER STORY.

THE LARCH AND THE MOTH.

In the *Zeitschrift für Forst und Jagdwesen* for January 1902, there appears an article by Herr Forstmeister Franz Boden, Hameln, entitled "The Larch and the Moth." The particular moth referred to is, of course, the larch mining moth, *Coleophera* (*Tinea*) *laricella*, so often associated with larch disease.

During the course of his observations, Herr Forstmeister Boden found that the female moth selected the trees for oviposition with considerable nicety, choosing those lying favourably to the sun.

Most larvæ were observed upon diseased larches; in some cases these trees were dreadfully infested, as many as two and three caterpillars being upon each bunch of needles. The trees in great part recovered from these attacks by the production of new needles arising amongst the eaten ones. The outer and first-formed needles of sickly trees were shortened to the extent of one-third of their length, but the total diminution through damage to growth is placed at not more than one-sixth in normal circumstances, and only one-twentieth where the plants are growing very strongly, and therefore are better able to repair the mischief done.

The larvæ of the mining moth always envelops itself in a sheath made by hollowing out a larch needle. It never leaves this cover, but drags it about with it, hibernates and pupates in it; at most its head and prolegs are protruded from it. As the larva grows larger it requires more accommodation, and obtains this by attaching a second empty needle to the first by cutting the sides away from both. Inquiry into the formation of this curious dwelling was conducted as follows:—The cases were removed from a number of larvæ, which were then placed, one lot among whole needles and another among needles that had been cut into small pieces. The former set of caterpillars at once constructed new cases, but the latter were unable to do this, only sheltered under the heap of chips and did not thrive.

Placed upon needles of the Siberian larch, the larvæ at first appeared unwilling to eat. They wandered restlessly to and fro, but finally partook of the new fare and seemed well pleased with it. For two or three days they ate voraciously, after which sickness seized them, their excrement clung to their bodies, and they were gradually covered with an unhealthy, yellow-green crust. They stopped feeding, movements became weaker, then, gathering their whole strength, they with difficulty broke open their cases. No attempt to eat fresh needles was evinced, and they died. A week later the experiment was repeated with a similar result.

It would therefore appear that *Larix sibirica* does not form suitable food for the larvæ, and that the female moth will probably not lay her eggs upon it. But this finding should be accepted with reserve, as the trial was conducted under quite artificial conditions.

With the Japanese larch a contrary result was obtained. As soon as the needles were fully developed the caterpillars burrowed

readily into them, and did not suffer in consequence. As material for the making of cases, however, the long, soft needles on the youngest shoots were not cared for, being too large for the purpose.

In his conclusions respecting *Larix leptolepis*, Herr Forstmeister Boden receives the support of Herr Wirchow in Wilhelmshöhe. At Wilhelmshöhe, it seems, there are a few old Japanese larch which do not look at all well. According to Herr Wirchow they are severely attacked by the larvæ of the mining moth.

Larix dahurica and *L. occidentalis* also have to bear the enemies of the European larch. In North Germany, where greater injury is wrought by larch disease, the destruction done by the moth does not receive the same attention that it does in the south. But wherever the larch be placed, good soil and plenty light and air are the best means of combating the pest. The season at which to examine damage done is not when the needles first appear, but a little later, when they are fully developed.

All Russian Timber Society.

The tenth congress of this Society was opened in October last, under distinguished patronage. The congress lasted ten days, and considered, amongst other questions, the introduction of regulated felling of trees, the influence of railway rates on the wood trade, the comparative growths of trees in respect to origin of seeds, and generally the forest interests of the country. The congress was marked with a series of excursions to important wood-growing centres, governmental, municipal, and private.

Reafforesting the Black Country.

An association has been formed for the purpose of reafforesting the waste grounds in the Midlands, particularly in the parts of Staffordshire and Worcestershire known as the Black Country. Once this country was forest, and the association does not claim to be the first to attempt its replanting, but it seeks rather to make the knowledge gained from previous attempts, their successes and their failures, the basis of a great public movement which shall restore to the district some of its ancient beauty. In the Black Country an enormous area lies wholly waste, the greater part of which can be planted without much trouble, and it will readily

support trees of appropriate kinds. The association estimates that quite 30,000 acres can ultimately be planted, and that 14,000 acres are ready for immediate development. It is often said that the Black Country is fated to be for ever a desert, but on the Continent trees flourish upon pit waste, upon furnace slag, and even upon the ash of burnt-out shale. Already there are many trees growing near Walsall, and the Midland Reafforesting Association deserves a large measure of support in its attempt to grow trees on what is now a barren and desolate waste.—*The Timber News.*

Teaching of Forestry in the Provinces.

The Technical Education Committee of the Fife County Council have issued a circular intimating that they have made an arrangement with the Edinburgh and East of Scotland College of Agriculture, under which Mr Fraser Story, who studied Forestry at Edinburgh University and at Eberswalde Forest Academy, will conduct a course of nine lectures and two out-door excursions at Kirkcaldy and Cupar during the months of December, January, and February. In the circular the committee say: "It is the intention of the committee in these lectures to provide systematic scientific instruction of such a kind as to be readily adapted to local circumstances. As far as possible the class lessons will be of a practical kind, and further provision will be made by which the students will see for themselves the best methods to be carried out in daily practice."

Foreign Plants—Japanese Larch.

A Dumfriesshire proprietor states that for the past three years he has got all his young forest plants from France. They are sent over in March, and are at once put into the nursery, and they are planted out in the following autumn. All the plants thus received have done well, with the exception of the Scots fir, which he thinks suffers from frost more than the native plants. The hardwoods—oak, sycamore, and poplar—have done excellently, he says.

With regard to pine, he mentions that some plants were put in about twenty-five years ago on a shallow soil, and they have been blown down to a greater extent than spruce planted under the same circumstances. He has also tried Japanese larch, and mentions that he put in five hundred two-year-old plants last year, in shallow soil with a southern exposure. The roe deer ate

them in preference to European larch growing within a few yards of them, and almost without exception the remainder of the trees, which were scattered through the wood, lost their tops from frost, the tops being black for three or four inches. On a neighbouring estate some Japanese larch of three years old were also put in on a southern exposure, but sheltered by a belt of large trees. These have done well, and he concludes that the Japanese larch cannot, like the European larch, stand, when young, exposure to the sun during frost.

British Forestry Exhibition.

Under this heading the Royal Agricultural Society of England have issued a circular, signed by Lord Granby, Chairman of the Forestry Committee, intimating that their Council have decided to hold a British Forestry Exhibition in connection with the Society's Annual Agricultural Show of 1904, to take place at Park Royal, Willesden, London, N.W., from the 21st to the 25th June next. The Exhibition is evidently to be on similar lines to the Annual Exhibition of this Society, which is to be held at Perth this year, from 19th to 22nd July.

Prize Essay on Forestry.

It is gratifying to observe that the Worshipful Company of Carpenters, one of the old City guilds of London, have offered two prizes, of the value of £20 and £10, for the best and second best essays on the following subject:—"Adaptation of land which has either gone out of cultivation or which has only a very low rentable value for afforestation: showing the mode of procedure from taking the land over, and for twenty years after; and some statistics as to what returns may be looked for from this period up to maturity."

Systematic Management of Woods.

The advantages of systematic management are not yet generally recognised by the proprietors of wooded estates; but it is satisfactory to learn that some progress in this direction is made from time to time. Mr J. G. A. Baird, M.P., has recently arranged for the working of his woods on the Colstoun estate, Haddington, under a plan drawn up by Mr Fraser Story.

Sweden.

A recent issue of the *Timber Trades Journal* contains the following paragraph :—

"It is reported that the Finspong forest property, which was visited last year by the Royal Scottish Arboricultural Society, and in which Mr William Beardmore of Glasgow is understood to be largely interested, has been offered to the Swedish Forest Department. The estates cover over 50,000 acres, the most extensive area planted with ordinary red and white wood in Sweden."

Proposed School of Forestry for Wales.

A conference of delegates from various county councils was held recently in Wales for the purpose of considering the above subject. Mr Edward Robinson, timber merchant, Boncath, a member of the Pembroke county council, who is the leader of the movement, explained that the object in view was the planting of waste and at present unproductive woodlands in Wales. A school could be established with 100 to 200 acres of land to start with, and the option of acquiring a further 500 or 800 acres, and the total capital outlay at the outset ought not to exceed £5000 to £8000, which could be contributed by the councils according to their rateable values. It devolved upon the councils to take the matter up, for the Government had not yet acted on the recommendations of three committees on the subject. He believed the Government would contribute about half the amount required, and he assumed that an annual grant of £100 or less from each of the councils would be sufficient to cover all out-of-pocket expenses, and give a good return on capital. There were about a million acres of waste land in the Principality which could grow timber. Of the owners, half might require assistance, and the planting would cost not more than £6 an acre. Spread over thirty years, that would require a yearly grant of £100,000 from the Government, the money to be repaid in that period by half-yearly instalments, and by the end of that time they should have plantations worth from £30,000,000 to £40,000,000. It was proposed to teach forestry on a very limited scale at Aberystwyth College, but what was wanted was a bold and comprehensive scheme. Mr Robinson concluded his remarks by moving the following resolution, which was carried unanimously, viz.,

"That it is desirable to establish a School of Forestry for the whole of Wales and Monmouthshire."

It is understood that another conference will be held soon to carry on the movement.

On the Principal Advantages of using Chloride of Barium for the Impregnation of Railway Sleepers, and for the Preservation of Wood in general.[1]

A well-known Belgian engineer, M. Flamache, has conceived the idea of using chloride of barium, which has the advantage of being a cheap substance. The salt is very soluble, and can be easily injected into wood of all kinds. In combination with putrescent products, it forms an insoluble precipitate which effectively resists fermentation.

Moreover, chloride of barium possesses a property which renders it especially valuable in the preparation of building timber to be used in hot countries, in that it is poisonous to insects and gnawing animals, which will not touch wood impregnated with it.

Chloride of barium is not poisonous to man in doses less than $\frac{1}{5}$ to $\frac{1}{2}$ an ounce, and it passes out of the system in a very short time. It is, therefore, not dangerous to use. It is not absorbed through the skin. The use of chloride of barium may be strongly recommended for the preservation of railway sleepers in temperate climates, as well as for all species of wood used in tropical countries. The ravages committed by white ants, which render wood useless in regions where it grows most abundantly, are entirely prevented by the use of chloride of barium. All gnawing insects are kept off by it, and this is a great advantage in the case of sawyers' timber or shipbuilding timber, which is liable to be attacked by various parasites. The small durability of pit-wood is due to vegetable parasites, which cannot live on wood impregnated with this salt.

To sum up, soluble salts of barium offers, at a price much below that of any other impregnating substance, special advantages commending its use in all countries, and especially as a protection against insects and gnawing animals. It combines economy and efficacy, particularly in hot countries.

[1] Extract from *Le Bois*, published at Liége, 26th November 1903.

NOTICES OF BOOKS.

The Gardener's Assistant, by the late Robert Thomson, of the Royal Horticultural Society's Gardens, Chiswick. New Edition, edited by Wm. Watson, Curator, Royal Gardens, Kew. London: The Gresham Publishing Company, 1902. Two Volumes, £2, 10s.

The Gardener's Assistant has always been recognised as one of the standard works on gardening, and in the revised and remodelled form in which it has recently issued from the press, it may be looked upon as perhaps the most complete and up-to-date exposition of the practice of the art which has yet appeared. It is, in fact, to the gardener of the present generation what M'Intosh's *Book of the Garden* was to the gardener of half a century ago, or what Brown's *Forester* in its latest form is to the forester of to-day—an encyclopædia to which he may turn for reliable information on everything relating to the science and practice of his art or craft. The book, which consists of two bulky volumes, has been almost entirely rewritten, and the chapters on the various branches of gardening have been contributed by some of the most eminent specialists in their several departments. The introductory part of the first volume consists of a calendar of operations in the flower-garden and a short discourse on garden meteorology, followed by a series of chapters by specialists on plant structure and hybridization, insect and other friends and foes, fungoid diseases, soils and manures, tools, garden structures and heating appliances, propagation, transplanting and pruning, the flower-garden and pleasure-grounds, hardy trees and shrubs, hardy herbaceous perennials, aquatic and bog plants, annuals, popular garden plants, plants grown under glass; spring, summer, and carpet bedding, subtropical gardening and floral decoration. The second volume is entirely devoted to the cultivation of fruit and vegetables, finishing up with a calendar of operations in the fruit and kitchen garden, an appendix on the collecting, storing, and packing of vegetables, and an excellent index to the whole work. The book has been splendidly got up, paper, printing, and illustrating alike reflecting the greatest credit on the publishers. The illustra-

tions are well chosen, numerous, and excellent, the coloured plates especially being particularly well executed. The edition has been brought out under the able editorship of Mr Wm. Watson, curator, Royal Gardens, Kew, and the contributors include in their number such eminent authorities as Dr Maxwell T. Masters, F.R.S.; F. W. Burbidge, M.A., F.L.S.; Frederick Moore; John Fraser, F.L.S.; Geo. Massie, F.L.S.; H. C. Princep; J. M'Indoe; Richard Dean; W. Iggulden; the late Malcolm Dunn, and many other well-known names. The work should find a place in the library not only of the professional gardener, but in that of every one who takes an interest in practical horticulture.

A. D. R.

Webster's Foresters' Diary and Pocket Book for 1904. London: W. Rider & Son, Ltd. Price 2s. 6d.

In preparing the second issue of his book, the author has taken advantage of suggestions received from purchasers of the first issue to make considerable improvements upon it, which will doubtless further commend it to a large circle of foresters.

Government Publications.

The following publications referring to forestry may be purchased, either directly or through any bookseller, from Eyre and Spottiswoode, East Harding Street, Fleet Street, E.C., and 32 Abingdon Street, Westminster, London, S.W.; or Oliver and Boyd, Edinburgh; or E. Ponsonby, 116 Grafton Street, Dublin, at the prices mentioned, viz.:—

Minutes of Evidence taken before the Departmental Committee appointed by the Board of Agriculture to Inquire into and Report upon British Forestry, with Appendices and Index, 1903. Price 2s. 5d.

Reports from certain of His Majesty's Representatives abroad respecting Forestry Laws (Commercial No. 8, 1903). Price 4d.

Report on Instruction in Forestry, and the Present Condition of Forest Economy in Germany. By Dr Frederick Rose, His Majesty's Consul at Stuttgart (Diplomatic and Consular Reports, No. 596 Miscellaneous Series). Price 1½d.

REPORTS BY THE HONORARY SCIENTISTS.

1. *Report by the* Honorary Cryptogamist.

During the past year I have received, among other pathological specimens for identification, only four which are of general interest to foresters. Three of those cases were different diseases of the pine, while the fourth one related to the larch.

Pine:—Case I. Leaf-shedding fungus (*Lophodermium Pinastri*). This disease affects principally seedlings or young trees, and, when it has once made its appearance in the nursery, unless very stringent measures are early adopted, its eradication becomes a very difficult matter. The spores are very readily carried by wind, and, if the moisture conditions are favourable, the disease becomes epidemic. The first symptoms of the disease may appear in autumn, in seedlings of the current year, by the primary leaves assuming a speckled brownish-red colour. This is often accompanied by the formation of numerous minute black spots, in which conidia are produced. Those conidia are, however, incapable of infecting other trees. It is in the ascospores, produced in larger black swellings (asci), which usually appear in the second or third year, that the danger of infection lies. It is only in very wet summers, or after long-continued rain, that the spore-cases are ruptured and the spores liberated. A mild winter, therefore, following a moist summer, is extremely favourable to the spread of this disease; hence foresters would do well to keep a sharp look-out on their young pines during the coming winter if they have any reason at all to suspect the presence of this parasite. *Remedy and Prevention.*—Some small amount of good may be done by uprooting and burning infected plants directly they show the first symptoms of attack, but, if the disease is at all prevalent, this becomes impracticable. As regards prevention, a considerable amount of good may be done by keeping the young healthy plants to the windward of previously infected ones, and also, if possible, to intercalate the beds between those of another species. In fact, anything which tends to prevent the spores being carried by the wind to young plants will help to check the spread of the disease. Further, crowding of the young plants, or overshading by others,

should be avoided, as this tends to keep them too moist on the surface, which greatly facilitates the germination of the infecting spores.

Case II. Pine cluster-cups (*Peridermium pini*). In April and May the cups of this fungus may be found on the needles of young pines, but also on older trees, which, though less liable, are not immune from attack. The damage done by this fungus is not great, as the infected needles are not prematurely killed. This is one of those fungi which require two host-plants whereon to complete its life-cycle, the other host, in this case, being one of the several species of *Senecio* (*Senecio vulgaris* or common groundsel, *Senecio Jacobæa* or ragwort, *Senecio viscosus*, *Senecio sylvaticus*). Where the disease is common in the nursery or in young plantations, it may be checked and ultimately eradicated by the destruction of all *Senecio* plants in the neighbourhood.

Case III. Pine canker. A very fine specimen of canker on the pine was sent. The fungus in this case, probably *Peziza Willkommii*, was present in abundance, and the effect on the host was similar in every way to that caused by this fungus on the larch.

Larch:—Case IV. During the Society's visit to the south this year, Mr Mitchell, wood superintendent, Woburn, Beds, called attention to a young larch plantation at Woburn which was in an unhealthy condition. On examination it was found that many of the trees showed flattened and depressed areas in the cortex, near the apex of the main axis, recalling the characteristic markings caused in the Douglas fir by Phoma. Mr J. Barrie, Harlestone, Northampton, who was present, recognised the disease as one he had previously observed in another young larch plantation. This gentleman was good enough to send me some specimens for examination, and from those specimens it was quite evident that *Nectria* (probably *Nectria cinnabarina*) was the cause of the cortical depressions and ridge-like markings on the stem. However, the presence of this fungus was not sufficient to account for the general unhealthy conditions of the whole plantation. Its presence was more of the nature of an accompaniment, or the after effect, of some other disease-causing agency.

Among the other specimens sent were:—Ribes' twigs, with leaves badly attacked by *Æcidium grossulariæ; Rubus fruticosus* stem, attacked by *Phragmidium;* and a *Saprophyte*, *Xylaria Hypoxylon*, which occurs on dead wood. A. W. Borthwick.

2. *Report of* Honorary Consulting Entomologist *for Session* 1903.

During the year a considerable amount of material has been sent on to me for identification, and among it, as usual, that ever-present enemy, the Pine Beetle (*Hylesinus piniperda*). As I pointed out in a report on this beetle some years ago, nothing is so favourable for the encouragement and spread of the pest as leaving felled Scots pine timber or blow-downs unbarked for any length of time, as such material is instinctively chosen for breeding purposes. In woods where the beetle is troublesome, the most practical remedial measure is to adopt the system of traps or "catch-trees." These "catch-trees" may be sickly pines standing in the wood and marked, or else trees felled here and there at intervals for the purpose. Such standing trees, or felled unbarked logs, will be chosen by the beetles for their egg-laying. When these come to be barked at proper intervals, the whole of the enclosed brood in the larval stage can be burned with the bark. There should be a series of such traps from March right on till the autumn, a new series being prepared every month. Great care must be taken to make the round of such traps at regular and proper intervals, and as a guide in this connection I may mention that the whole life-cycle can be passed through in eighty days. Such predaceous insects—enemies of *H. piniperda*—as *Clerus formicarius* and *Rhizophagus depressus*, both of which I have found attacking wood-boring beetles, should be spared.

In the autumn of last year I had sent on to me, by Mr Wm. Inglis, Cladoch, Brodick, a specimen of *Sirex juvencus*, the Steel Blue Wood Wasp, and also its handsome parasite, *Rhyssa persuasoria*. This repeated capture of *Rhyssa* is interesting as another proof that the Steel Blue Wood Wasp breeds in our woods.

Mr Fred Moon, Foynes, Limerick, has been most active during the year in his insect observations. His sendings included *Melolontha vulgaris*, whose grubs caused much destruction in a nursery to young conifers. I hope that in the next *Transactions* Mr Moon will give a detailed account of his observations and fight against the pest. From the same observer came Eel-Worms, *Orchestes fagi*, *Orchestes querci*, and *Rhagium bifasciatum*. In connection with *O. querci*, the weevil whose grubs are destructive miners in oak leaves, there have been some interesting observations. When

these are completed they will be duly recorded in the *Transactions*.

Rhagium bifasciatum has reached me from several sources, both in the adult and the larval stages. *Rhagium* is one of the long-horned beetles, whose elongated flattish grubs are found infesting rotten timber, *e.g.*, the grubs are not uncommon in old gate-posts and palings. Mr James M'Callum of Lockerbie, in addition to *Rhagium* infested material, sent to me a beetle which had been preying on the grubs. The beetle was one of the Ground Beetles (*Carabus*). The family Carabidæ, or Ground Beetles, contains some species injurious in agriculture, but the majority of the species are carnivorous, and therefore, from the economic standpoint, useful. The *Rhagium* grubs were burrowing in an old larch log, and it was a very interesting observation to find the Ground Beetle in this position destroying the grubs.

Specimens of the common galls of *Retinia resinella* were received from Mr James Fraser, Dores, Inverness. Little or nothing can be done against the insects in this case, but the resin gall, inside which the caterpillar lives, should be destroyed before maturity is reached. The galls are generally on the side shoots, but sometimes on the leader.

Among insect galls received were those of *Cynips*, *Neuroterus*, and *Aphilotrix*.

R. STEWART MACDOUGALL.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON.

HIS MOST EXCELLENT MAJESTY THE KING.

PROCEEDINGS IN 1902.

THE ANNUAL MEETING.

The Forty-ninth Annual General Meeting of the Society was held in 5 St Andrew Square, Edinburgh, on Friday, 31st January 1902, at 2.30 P.M., and was presided over by the EARL OF MANSFIELD, President of the Society. There was a large attendance of Members.

MINUTES.

The Minutes of the General Meeting, held at Ayr on Tuesday 6th August 1901, were held as read, and approved of.

MEASURING INSTRUMENT.

Mr JOHN ANNAND, Haystoun, Peebles, gave in the report of the Judges appointed to examine and test an instrument, invented by Mr John Smith, Dovecote Works, Peebles, for recording from the ground at one observation the vertical and horizontal dimensions of any object, *e.g.*, the height and diameter at a given point of a standing tree. The report stated that the instrument recorded heights with perfect accuracy, but, as regards horizontal measurements, the grading of the scale was not sufficiently minute for accurate results. On the recommendation of the Judges, a No. 1 Silver Medal was awarded to Mr Smith.

ANNUAL REPORT OF THE COUNCIL.

The SECRETARY submitted and read the Annual Report of the Council, as follows:—

Royal Patronage.

The last Annual Meeting was held under the shadow of the great bereavement which befell the Empire, on the death of Her Majesty Queen Victoria, who for many years was Patron of the Society, and who, in 1887, granted it permission to assume the title "Royal." The loyal and dutiful address of condolence, which was drawn up and passed at that Meeting, was duly forwarded to His Majesty the King, who was graciously pleased to express his thanks to the Society, through the Secretary for Scotland. The Society subsequently presented a petition, praying His Majesty to become Patron of the Society in succession to Her late Majesty, and he was pleased to accede to this request. For this honour the grateful thanks of all the Members and friends of the Society are due.

Membership.

It is gratifying to be able to report that the death-rate, so far as known, has been lower than in previous years. Amongst those whom the Society has lost during the year may be mentioned Mr James Moffat, Edinburgh, for many years an active Member of the Council, Mr Campbell of Tullichewan, and Mr D. T. Fish, Edinburgh.

At the Annual Meeting last year there were 850 names on the roll; 102 new names have been added during the year; but 35 names have been removed, owing to deaths, resignations, and lapsing, leaving a net increase of 67, and a total Membership at this date of 917, made up as follows:—

Honorary Members, . . .	15
Honorary Associates, . . .	4
Life Members, ...	244
Ordinary Members, . . .	654
	917

Prizes.

The Syllabus in 1901 included 25 subjects, for which Medals and Prizes were offered. Six Essays were received in competition and reported on by the Judges. Special Judges were also appointed to examine and report on a hingeless gate, a patent planting iron, and an instrument for measuring the height and girth of trees. In all, 8 Medals were awarded, viz.:—three No. 1 Silver Medals, one No. 2 Silver Medal, and four Bronze Medals. One Essayist accepted the converted value of his medal in cash, and another preferred to receive books on Forestry subjects.

One of the papers received dealt with the subject for which Professor Bayley Balfour's prize of £10, 10s. was offered, viz.: "The Financial Results of the Cultivation of Woods," but the Judges did not consider

that it contained the information desired by the donor, and they were further of opinion that the information was not obtainable. This opinion was intimated to Professor Balfour, and at his request the £10, 10s., which had been in the possession of the Society for some time, was handed over to the University of Edinburgh, to be expended on books for the Forestry Class Library.

Donors.

The thanks of the Society are again due to Mr Munro Ferguson for the Raith Bursary of £30; to Messrs John Methven, D. P. Laird, and Wm. Mackinnon, for prizes offered by them for competition during the current year; and to Mr D. F. Mackenzie for his donation of £3 to the fund for illustrating the *Transactions*, being the converted value of the No. 1 Silver Medal awarded to him, but handed back to the Society.

The Transactions.

The Editing Committee have had a large amount of material available for printing, and they have in the press as substantial a Part as was issued in the beginning of last year. The contents are interesting and varied, embracing no fewer than twenty separate articles, besides notes and official matter. The Part, which concludes Vol. XVI., will be in the hands of the Members in the course of next month.

It is confidently expected that next year, under the Honorary Editorship of Colonel Bailey, the *Transactions* will be still further improved. Members are invited to send contributions at any time; if found suitable, they will be printed in the next Part.

Forestry Exhibition.

By the courtesy of the Directors of the Highland and Agricultural Society, a Forestry Exhibition, organised by this Society, was held in the Highland Society's showyard at Inverness in July last. There were over 20 entries, embracing more than 300 items. The Exhibition proved an attraction to many visitors, and was considered well worth the money and trouble expended upon it. Much of the success attending the Exhibition was due to the care and attention bestowed on the arrangements by Mr Jas. A. Gossip, the Society's Local Secretary at Inverness. A detailed report will be found in the *Transactions*. The Directors of the Highland Society have granted facilities for a similar Exhibition at their show, to be held at Aberdeen this year, and the Council have issued a circular to all Members, inviting offers of exhibits. The Local Secretaries will be Mr James Wilson, B.Sc., Department of Agriculture, Aberdeen University, and Mr John Clark, forester, Haddo House.

Excursion.

The Excursion to Ayrshire and the Glasgow Exhibition in August was well attended, there being over eighty Members present, and, as usual, they were everywhere received with the greatest kindness and hospitality. On the return of the party, the formal thanks of the Society were conveyed to the various proprietors and others whose estates and works had been thrown open for the Society's inspection.

On one of the evenings after dinner a very interesting discussion on the Larch Disease and other subjects was opened by Dr Farquharson, M.P., and was taken part in by a large number of Members. The discussion has since been continued with much vigour in the *Agricultural Press.*

A full report of the Excursion and discussion will appear in the *Transactions.*

After paying all accounts and expenses, the Committee had a considerable surplus in hand, and they decided to present to each Member who had taken part in the Excursion an enlarged photograph of the group taken at Culzean Castle, with the names of the Members printed on it. This has been done.

Deputation to the President of the Board of Agriculture.

On 9th October last, Mr HANBURY, the President of the Board of Agriculture, was kind enough to receive, in the City Chambers, Edinburgh, a deputation, consisting of the Council of the Society, who submitted to him the views of the Society on the present unsatisfactory condition of forestry in the country, and on the need for State Model Forests, with other facilities for obtaining Forestry education.

Mr MUNRO FERGUSON introduced the deputation, and in concluding his remarks, suggested that a Departmental Committee might be appointed to inquire into the whole matter, and to report. In his reply Mr Hanbury pointed out that there were other departments than his own which were concerned in the matter, and that it was impossible for him to do anything without the concurrence of these other departments. He, however, expressed approval of Mr Ferguson's suggestion, and promised to endeavour to get such a Committee appointed.

A full report of the deputation will be printed in the *Transactions.*

The Sparks Bill.

The deputation above mentioned took the opportunity of urging upon Mr HANBURY the necessity for the Government taking up this Bill, as otherwise there was little hope of its being got through Parliament. Mr Hanbury expressed himself as strongly in favour of some such measure being passed. It is understood that since then an

official of one of the Railway Companies has invented an appliance, which is expected to not only effectually prevent the emission of sparks from engines, but also to effect a considerable saving in fuel.

Malcolm Dunn Memorial.

The Joint Committee which was re-appointed to report on the complaint that too little money had been expended on the memorial erected in Dalkeith Cemetery, having inspected the monument, and considered the whole circumstances, decided that it would be injudicious to expend more money in endeavouring to add to or improve the present monument. They accordingly recommended that it be allowed to remain as it is, each of the Societies interested paying their proportion of the expense of its cost, and being thereafter at liberty to apply the balance of funds in their possession to the creation of such other memorials as they might severally decide on. The Council have accordingly authorised payment of this Society's share of the cost of the monument, amounting to £19, 1s. 10d. When this payment has been made, a balance of £94, 3s. 2d. will remain to be dealt with in some other way.

Jubilee.

At the General Meeting in Ayr, a Committee of the Society was appointed to consider the advisability of holding an *Industrial* Exhibition, in which Forestry would hold an important place, or of adopting some other means of celebrating the Society's Jubilee, which will take place on 16th February 1904. This Committee will report at a later stage of the proceedings. The Council desire to point out, however, that in the event of its being decided to hold the Annual Meeting, in 1904, on the anniversary of the Jubilee, it will be necessary to alter the present rule which provides that the Annual Meeting shall be held in the month of January.

The present rule is as follows :—

> The Annual General Meeting of the Society shall be held in the month of January, for the election of Office-Bearers, and the hearing of the Secretary, Treasurer, and Auditor's reports, and the transaction of all other appropriate business.

It is proposed that the words "in the month of January" should be deleted, and that the following words should be substituted for them, viz.: "at such time and place as the Council of the Society may determine."

An Irish Arboricultural Society.

The Secretary having received a circular, intimating the institution of an Irish Arboricultural Society, the Council instructed him to convey

their congratulations to the promoters, and to express their good wishes for its success.

The Council.

The motions, of which notice was given at last Annual Meeting, providing for an addition of six to the number of Ordinary Councillors, and for giving the Convener of the *Transactions* Committee a seat on the Council as Honorary Editor, fall to be discussed and disposed of at this Meeting. If these motions are accepted, it will be seen that seven Councillors will be required in addition to the usual number recommended in the Ballot List, and the election of these additional Councillors will be proceeded with at once.

Annual Dinner.

Members are reminded of the Annual Dinner to be held in the Royal Hotel this evening, at six o'clock, under the presidency of the Earl of Mansfield.

The Report was unanimously adopted.

FINANCES OF THE SOCIETY.

Mr JOHN METHVEN, Edinburgh, Convener of the Finance Committee, presented the Accounts for the Year, which had previously been printed and circulated amongst the Members. (An Abstract of the Accounts will be found in Appendix A.) Mr Methven, in moving the approval of the Report, pointed out that the balance on the capital account was £735, 6s. 5d., of which £622, 13s. 9d. was invested in names of the Trustees, and that the balance on the revenue account amounted to £315, 8s. 6d., which was, however, subject to the payment of the balance of the cost and the postage of the *Transactions* for 1901, estimated at £37. He said their finances were in an exceedingly satisfactory condition.

Mr ALEX. MILNE, Edinburgh, seconded the motion, which was agreed to.

EXCURSION FUND.

The following Abstract of Accounts for the past year was submitted by the SECRETARY :—

Excursion to Ayrshire and the Glasgow Exhibition, 5th to 9th August 1901.

RECEIPTS.

Balance in hand at close of last Account,	£27 18 8
Deposits and Payments to Common Purse,	198 1 9
Amount received for a Photograph,	0 4 6
	£226 4 11

PAYMENTS.

Auditor's Fee for 1900 Accounts,		£2 2 0	
Printing Programmes, Receipts, etc.,		2 6 9	
Hotels—King's Arms Hotel, Ayr,	£50 12 8		
Ayr Arms Hotel,	36 9 0		
Ayrshire and Galloway Hotel,	17 2 0		
Loudoun Arms Hotel,	9 0 0		
Grosvenor Restaurant (Glasgow Exhibition),	10 9 9		
		123 13 5	
Driving—A. Gemmell & Son, Culzean, Girvan, and Mauchline,		34 18 0	
Special Train—Glasgow and South-Western Railway Co., Girvan to Ayr,		6 14 9	
Photographs (including printing of names),		15 12 9	
Miscellaneous Expenses, being admission to Burns' Cottage and Monument, Gratuities at Hotels and to Drivers, and Petty Outlays,		8 3 9	
			193 11 5
Balance carried forward to next Year, being sum in National Bank of Scotland on Account Current,			£32 13 6

EDINBURGH, 17*th January* 1902.—Examined with Vouchers and found correct. Bank Certificate applicable to above balance exhibited.

JOHN T. WATSON,
Auditor.

On the motion of Mr D. P. LAIRD, Convener of the Excursion Committee, the Accounts were approved of.

CHAIRMAN'S ADDRESS.

The CHAIRMAN said his Annual Address would be a good deal shorter than usual. He congratulated the Society upon their satisfactory condition, and expressed the hope that the succeeding year might be as prosperous as the last year had been. There was plenty of interest shown in the Society. They had a good many young members, for whom they might arrange greater

facilities for taking advantage of the Society in all respects. He was desired, in continuation of the report which had been made as to the interview so kindly granted by Mr Hanbury a few months ago, to announce the following note, which would appear in the *Transactions* of the Society:—"We are authorised to say that it is Mr Hanbury's intention to appoint a Departmental Committee to inquire into and report as to the present position and future prospects of forestry, and the planting and management of woodlands in the United Kingdom, and to consider whether any further measures may with advantage be taken, either by the provision of further educational facilities or otherwise, for their promotion and encouragement. Mr Munro Ferguson, M.P., has been invited, and has consented, to act as Chairman of the Committee." The Chairman pointed out that the work of the Committee referred to the United Kingdom, which included Ireland, and that, therefore, whoever Mr Munro Ferguson got to act with him, would have a considerable amount of globe-trotting before they effected their object. They heard a good deal about the need in Ireland for more trees, and those of them who had gone to Ireland knew how painfully deficient that country was in woodlands. As they all believed that the planting of trees was one of the essentials of success in human life, it was to be hoped that the result of the Departmental Committee would be not only to the advantage of England and Scotland, but to the advantage of the sister country of Ireland as well.

Election of Office-Bearers.

Office-Bearers in room of those who retired by rotation were elected as follows:—The Earl of Mansfield was re-elected President: Lord Lovat and John Methven, J.P., Edinburgh, were elected Vice-Presidents; and John Boyd, Forester, Pollok Estate, Pollokshaws, Glasgow; James Forgan, Forester, Bonskeid, Pitlochry; George Fraser, Factor, Dalzell, Motherwell; D. P. Laird, Nurseryman, Pinkhill, Murrayfield; and William Mackinnon, Nurseryman, 144 Princes Street, Edinburgh, were elected to the Council. The Honorary Secretary, the Secretary and Treasurer, the Auditor, the Judges and *Transactions* Committee, the Local Secretaries, and the Photographic Artist were re-appointed. Mr A. W. Borthwick, B.Sc., Royal Botanic Garden, Edinburgh, was appointed Honorary Consulting Cryptogamist

in succession to Dr Somerville, resigned. The other Honorary Scientists were re-appointed.

(For a full list of Office-Bearers and Officials for 1902 see Appendix B.)

Forestry Exhibition at the Highland and Agricultural Society's Show at Aberdeen.

The attention of the Meeting was directed to the circular sent out with the notice calling the Meeting, to intimate that an Exhibition of Forestry, similar to that held at Inverness last year, was to be held at Aberdeen this year, and to invite offers of exhibits.

The Raith Bursary.

It was reported that the President, on the recommendation of the University Lecturer on Forestry, had awarded the Raith Bursary of £30 for 1901–02 to Mr Frank Scott, Royal Botanic Garden, Edinburgh.

Library and Museum.

The Secretary reported the additions that had been made to the Library during the year (see Appendix C.), and mentioned that several Assistant Foresters had borrowed Dr Schlich's *Manual.*

Sir Archibald Hepburn suggested that a list of the Society's books should be printed for the use of the Members.

The Secretary explained that about six years ago the Society's books were transferred to the Library at the Royal Botanic Garden, in terms of an old standing promise that in the event of forestry being taught there, the Society's Library would be so transferred. The books now in the Library were therefore very few, but were the most recent published. Sir Archibald Hepburn's suggestion was remitted to the Council.

Excursion in 1902.

It was intimated that the Council had solicited the Scandinavian Government to assist them in preparing a programme for a tour, extending over ten days (exclusive of the time occupied on the voyage from Scotland and back), during the last week in July and

the first week in August, and that it was estimated that the total expenses would not exceed £15. Members intending to join the Excursion were requested to send their names to the Secretary without delay. It was explained that by doing so they would not meantime bind themselves to attend, but they would ensure that further particulars would be sent to them when ready.

The SECRETARY said he had already received about eighty names of persons intending to join the Excursion.

THE SOCIETY'S JUBILEE (16TH FEBRUARY 1904).

The SECRETARY reported that the Committee appointed at the General Meeting, held in Ayr, had suggested that a very suitable memorial of the Jubilee would be an Excursion to the Forest School and Forests at Nancy, in France, and that the Annual Meeting and Dinner might be held on the Fiftieth Anniversary of the Society's foundation. To enable this to be done, the Rule of the Society, making it necessary to hold the Annual Meeting in the month of January, would require to be altered, and the Council accordingly proposed to give notice of a motion to accomplish this. The Committee was continued, with powers.

MOTIONS TO BE DISPOSED OF.

The following Motions, of which notice was given at last Annual Meeting, fell to be discussed and disposed of:—

(1) That the number of Ordinary Councillors be increased from fifteen to twenty-one, that seven Senior Councillors shall retire annually, and that three shall be eligible for re-election.

(2) That the Convener of the *Transactions* Committee be also Honorary Editor and a member of the Council *ex officio*.

Both motions were put to the Meeting, and unanimously agreed to.

ELECTION OF ADDITIONAL COUNCILLORS.

The Meeting then proceeded to the election of the additional Councillors required to make up the number of Ordinary

Councillors from fifteen to twenty-one, in terms of the foregoing Rule, when the following Members were elected:—Sir Kenneth J. Mackenzie, Bart. of Gairloch; Mr E. P. Tennant, younger, of the Glen; Sir John Stirling Maxwell, Bart. of Pollok, M.P.; Mr John Hay, Dollars Estate Office, Kilmarnock; Mr A. D. Richardson, Royal Botanic Garden, Edinburgh; Mr George Leven, Auchencruive, Ayr; and Mr Charles Buchanan, Overseer, Penicuik.

Notice of Motions.

Notice of the following Motions was duly given:—

1. By the Secretary, on behalf of the Council:

   That the words "in the month of January," in Rule 24, dealing with the date of the Annual Meeting, be deleted, and the following words substituted for them, viz., "at such time and place as the Council may determine."

2. By Mr Alexander Pitcaithley, Scone:

   That the name of the Society be changed from the Royal Scottish Arboricultural Society to the Royal Scottish Society of Forestry and Arboriculture.

3. By Mr George Leven, Auchencruive, Ayr:

   (1) That the Annual General Meeting of the Society be held alternately in Edinburgh, Glasgow, and Perth.

   (2) That the Council Meetings be held alternately in Edinburgh, Glasgow, and Perth.

Mr Elwes' Paper.

The Secretary reported that, apparently owing to a misunderstanding, Mr Elwes' paper on "Seeds and Seedlings," announced to be read at the Meeting, had not reached him, but that he had no doubt the Members would hear it read on another occasion. He said that Mr Pitcaithley had kindly agreed to open a discussion on the damage caused by squirrels, and he understood that Mr D. F. Mackenzie had something to say on the subject of the larch disease.

Damage to Woodlands by Squirrels.

Mr Pitcaithley, forester, Scone, opened a discussion on this subject. He began by referring to a report of a recent meeting of the Edinburgh Field Naturalists' Society, at which it was stated that the squirrel did not do so much damage to trees as was generally believed. Mr Pitcaithley said there was no doubt the squirrel did an immense amount of damage to seedling and young conifers, and he exhibited specimens of damaged plants. The squirrel also attacked maple, sycamore, horse chestnuts, larch, and spruce, and they ate the seeds of trees, particularly those of conifers, always selecting the best cones. On the other hand, he believed squirrels ate the larvæ of beetles, which was one point in their favour.

Mr D. F. Mackenzie corroborated Mr Pitcaithley's statements, and said the squirrel also ate eggs. He knew that in the neighbourhood of Fochabers, in Morayshire, whole plantations had been seriously damaged by squirrels. It was also true that squirrels ate fruit, especially stone fruit.

Professor Stewart MacDougall said that some foresters attributed the damage done by squirrels to the woodpecker or the crossbill. He believed the squirrel did some good by destroying, to a certain extent, some of the destructive insects, but he thought that they should not be allowed to become so numerous as they were in many woods.

Sir Archibald Buchan Hepburn said he thought that the gamekeeper should be induced to assist in destroying squirrels. He had seen squirrels eating walnuts off his trees.

Mr Clark, Haddo House, said great damage was done by the disbudding of conifers, from the beginning of February to the middle of March. He thought the gamekeeper was not the proper person to be asked to destroy the squirrel. He suggested that the forester, with the aid of boys as beaters, should make a raid on them in the beginning of February.

Mr M'Hattie, Edinburgh, and Mr Leven, Auchencruive, also took part in the discussion.

The President said he favoured the suggestion made by Mr Clark.

The Larch Disease.

Mr D. F. Mackenzie submitted the following Motion to the Meeting, viz.:—

"That it be remitted to the Council, with powers, to take such steps as may seem necessary to inquire into and experiment as to the cause and effect of the disease of the larch, and to report to a future meeting."

Mr Mackenzie produced a number of specimens of diseased larch, and a sample of the coagulated sap, which he explained to the Meeting.

Mr A. T. Gillanders, forester, Alnwick Castle, seconded Mr Mackenzie's motion, which was carried unanimously.

This closed the business of the Meeting, and on the motion of Mr Alexander Milne, a cordial vote of thanks was passed to the President for presiding.

THE ANNUAL DINNER.

The Annual Dinner of the Society was held in the Royal Hotel in the evening. The Earl of Mansfield, President of the Society, occupied the chair, and Mr D. F. Mackenzie, senior Vice-President, was croupier. There was a large attendance of Members. After the usual loyal and patriotic toasts had been duly honoured, the toast of the evening—"The Royal Scottish Arboricultural Society"—was proposed by the Rev. D. D. F. Macdonald, Swinton, Berwickshire, and the President replied. Various other toasts were proposed and responded to, and in the course of the evening several songs and recitations were given with much acceptance.

MEETING IN ABERDEEN.

An informal meeting of Members of the Society and others attending the Forestry Exhibition in the Highland and Agricultural Society's Show at Aberdeen, was held in the directors' room in the showyard, on Thursday, 17th July, at 12 o'clock noon, when a discussion took place on the Exhibits, and the best means of improving the Exhibition.

Sir Robert Menzies was called to the chair.

The Chairman expressed pleasure at seeing such a good Exhibition, but thought there was too great a tendency to send in freaks for exhibition, and advised that they should exhibit examples of things they ought to aim at.

Mr James Wilson, B.Sc., late Lecturer on Agriculture, Aberdeen University, one of the Local Secretaries, explained the means which he and Mr Clark, Haddo, the other Local Secretary, had taken to obtain a number of the exhibits. Besides sending out a large number of the Society's Schedules, they had called upon local manufacturers of wood products and others, and were thereby enabled to more than double the number of entries that had been sent in to the Secretary in Edinburgh. He also said the Local Secretaries had endeavoured to develop the Exhibition in an educative direction, and had tried to get foreign wood and articles manufactured from foreign-grown wood, in order to show what ought to be attempted at home. With regard to the classification of the Exhibits, he explained that this had not been done because of the shortness of time, and also because of the difficulty that would have been experienced in returning the various exhibits to their several owners. They had therefore decided to keep the exhibits of each exhibitor separate as far as possible. He suggested that in future an effort should be made to get more space, especially more covered space, as on account of the large crowds who attended the Exhibition, the Exhibits were not seen to advantage.

Mr Fraser Story proposed a vote of thanks to the Local Secretaries for the trouble they had taken, and suggested that in future several Members of the Society should be asked to attend and explain the Exhibits to visitors.

Mr Samuel Margerison, Calverley, Leeds, seconded Mr Fraser Story's motion, and said he thought that the Society might endeavour to establish a Central Museum, to which foresters and others could apply for information and advice.

Mr Wilson and Mr Clark replied. Mr Wilson defended the Exhibition of freaks, as he said this brought hundreds of people to the Section who might otherwise have passed it by. Mr Clark said the Exhibition had been to him a most interesting and enjoyable one, and that he and Mr Wilson had been kept fully occupied in describing the Exhibits. In this work they had got valuable assistance from Mr Story, Mr Macpherson from Novar, and others.

On the motion of Mr Wilson a vote of thanks was accorded to the Local Exhibitors of Industrial products.

Mr Frederick Moon proposed that the Society should make a collection of insects, so that Members might have samples sent round to them, in addition to having inquiries answered by the Society's Scientists as at present.

On the motion of Sir Robert Menzies the Highland and Agricultural Society were thanked for the use of their room, and on the motion of Mr France a vote of thanks was accorded to Sir Robert Menzies for presiding.

THE GENERAL MEETING

The General Meeting of the Society was held at No. 5 St Andrew Square, Edinburgh, on Friday, 18th July 1902, at 10.15 A.M. The Right Hon. the Earl of Mansfield, President, in the chair.

Minutes.

The Minutes of the Forty-ninth Annual Meeting, held on Friday, 31st January 1902, were held as read and approved of.

Election of Honorary Associates.

Mr William Matthews Gilbert, of the *Scotsman*, and Mr Fred. Smith, Highfield Mount, Brook Street, Macclesfield, were elected Honorary Associate Members. In moving their election, Mr Methven remarked that he had known Mr Gilbert for many years, and that he was well acquainted with the good work he had done for the Society by his numerous articles. Mr Smith had been senior student of the University Forestry Class during session 1901-02, and had been recommended for election by the Lecturer.

Election of a New Trustee.

Mr Walter Steuart Fothringham, of Fothringham and Murthly, was elected a Trustee, in succession to the late Mr John Ord Mackenzie of Dolphinton.

Judges' Report on Essays.

The Report of the Judges on the Essays received in competition was submitted, and the following awards were made, in terms of their recommendations:—

CLASS I.

(1) "The Forests of the Basses Pyrenées."

Award—No. 2 Silver Medal, to GEORGE CADELL, late Indian Forest Department, 1 Whitehall Gardens, London, S.W.

(2) "The Erection and Maintenance of a Saw-Mill."

Award—No. 2 Silver Medal, to W. M. MITCHELL, Forester, Lough Cutra, Gort, County Galway.

(3) "Report on the Plantations of the M—— Estate."

Award—No. 2 Silver Medal, to JAMES RODGER, Forester, Mortonhall Estate, Ringland, Norwich.

(4) "Creosoting Timber for Estate Purposes."

Award—No. 2 Silver Medal, to GEORGE LEVEN, Forester, Auchencruive, Ayr.

CLASS II.

(1) "The Propagation of Forest Trees and Shrubs."

Award—No. 1 Silver Medal, to GILBERT BROWN, Assistant Forester, Scone.

DEPARTMENTAL COMMITTEE ON FORESTRY.

The SECRETARY submitted the following letter and memorandum which he had received:—

4 WHITEHALL PLACE,
LONDON, S.W., 15*th March* 1902.

SIR,—I am instructed by the Departmental Committee on Forestry, to invite your Society to nominate a representative to give evidence before them upon the subject of their inquiry, as indicated in the enclosed memorandum.

The Committee propose to sit, in London, for the purpose of taking evidence, on the 22nd, 23rd, 24th, and 25th of April next; and I shall be glad to have an early reply as to whether it will be possible for your Society to give evidence, and, if so, whether any of the above-mentioned dates would be inconvenient.

It would be of the greatest assistance to the Committee if I could be furnished, as early as possible, with a short summary of the evidence that your Society may propose to offer, and also, if possible, with copies of any tables or documents to which your representative may intend to refer.—I am, Sir, your obedient servant,

R. H. Hooker,
Secretary to the Committee.

The Secretary,
Royal Scottish Arboricultural Society,
5 St Andrew Square, Edinburgh.

(*Enclosure referred to.*)

"The Right Hon. R. W. Hanbury, M.P., President of the Board of Agriculture, has appointed a Departmental Committee to inquire into and report as to the present position and future prospects of forestry, and the planting and management of woodlands in Great Britain, and to consider whether any measures might with advantage be taken, either by the provision of further educational facilities or otherwise, for their promotion and encouragement.

"The Committee consists of the following gentlemen, viz.:—

"Mr Ronald C. Munro Ferguson, M.P. (Chairman); Sir John F. L. Rolleston, M.P.; Mr Edward Stafford Howard, C.B., a Commissioner of His Majesty's Woods, Forests, and Land Revenues; Professor W. Schlich, C.I.E., Ph.D., Professor of Forestry, Royal Indian Engineering College, Coopers Hill; Colonel Frederick Bailey, R.E., Lecturer on Forestry, Edinburgh University; Professor John R. Campbell, B.Sc., an Assistant Secretary to the Department of Agriculture and other Industries and Technical Instruction for Ireland; Mr John Herbert Lewis, M.P., Mr George Marshall, and Dr William Somerville, an Assistant Secretary to the Board of Agriculture. Mr Reginald H. Hooker, of the Board of Agriculture, is the Secretary to the Committee."

Board of Agriculture,
4 Whitehall Place, London, S.W.,
26*th February* 1902.

The Secretary explained that he had furnished the Committee with copies of the pamphlet containing the views of the Society on the establishment of State Model Forests for Scotland; and that, at the request of the Council, Mr Donald Robertson, Forester, Dunrobin, had attended in London, and had given evidence on behalf of the Society before the Committee.

The Raith Bursary.

The Secretary submitted the following Report, which he had received from the Lecturer on Forestry on the Raith Bursary for 1901-02:—

Edinburgh, 10*th May* 1902.

The Secretary,
Royal Scottish Arboricultural Society.

Sir,—The Raith Bursary for 1901-02 was awarded by the President of the Society to Mr Frank Scott.

He had had four years practical experience as an Assistant Forester on the Marquis of Bute's Dumfries estate, under his father, before he entered the Royal Botanic Garden as a student in September 1900.

He there attended the following classes, in which he was examined with the results stated, viz.:—

Book-keeping, ...	95 per cent.
Forestry, ...	70·8 „
Manuring and Improvement of Soils, .	79 „

In addition to the above, he attended short courses on the following subjects, viz.:—Nursery Work, Horticultural Building and Heating, Timber marks, Greenhouse Plants, Florists' Flowers, Fruits under glass, Vegetables and Hardy Fruits, Classification of Plants, Seeds, and Bulbs. The Regius Keeper reported "he is an excellent workman, and I think very highly of him."

He attended the Forestry Class at the University regularly during the past winter session, and gained 80 per cent. of full marks in the examinations. He also joined classes at the Heriot-Watt College, with the following results, viz.:—

Agricultural Chemistry, . .	85 per cent.
Economic Natural History, . .	55 „
Botany, ...	51 „
Geology, ...	2nd Class Certificate.
Geometrical Drawing, . . .	1st Class „
Land Surveying, ...	88 per cent. and Medal.
Surveying and Levelling, . .	1st Class Certificate and Medal.

He proved himself an attentive and hard-working student, who gave me much satisfaction. He has received an appointment on Lord Selborne's estate in Hampshire.—I am, Sir, yours faithfully,

Fred. Bailey.

He also mentioned that Mr Munro Ferguson had intimated to the Council that he had decided to suspend the Raith Bursary in

the meantime, and that the Council had thanked Mr Munro Ferguson for his generosity in continuing it for the past three years.

Forestry Exhibition at the Highland and Agricultural Society's Show.

Mr D. P. Laird reported that the Exhibition at the Highland Society's Show was a very creditable one, in view of the fact that this was only the second year in which an Exhibition had been held. He mentioned that Mr Wilson and Mr Clark, the local Secretaries, had taken great trouble to make the Exhibition a success, and a hearty vote of thanks was passed to these gentlemen for their services.

Excursion to Sweden.

The Secretary reported that he had received about eighty names for the Excursion which was about to start for Sweden, but that a few of these gentlemen had, for various reasons, been unable to come forward, the actual number ready to start being 76.

Vote of Thanks.

A vote of thanks to the Chairman for presiding concluded the business of the Meeting, and the Members of the Excursion party then set out for Granton, to embark on board the s.s. "Balder" for Gothenburg.

APPENDIX A.

Abstract of Accounts for Year ending 31st December 1901.

I.—CAPITAL.

CHARGE.

1. Funds at 31st December 1900,		£652 15 6
£486 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 132¾,	£645 3 3	
In National Bank of Scotland, Limited,	7 12 3	
2. Life Members' Subscriptions in 1901,		155 15 0
New Members,	£133 7 0	
Ordinary Members by commutation,	22 8 0	
		£808 10 6

DISCHARGE.

1. Proportion of Life Members' Subscriptions transferred to Revenue,		£50 14 7
Unexhausted: £468 6 9, 66 12 4		
1/15 of Full Life Subscriptions,	£41 7 2	
1/10 of Commuted Subscriptions,	9 7 5	
2. Decrease in value of Railway Stock at 31st December 1901,		22 9 6
3. Funds at 31st December 1901,		735 6 5
£486 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 128⅛,	£622 13 9	
In National Bank of Scotland, Limited,	112 12 8	
		£808 10 6

II.—REVENUE.

CHARGE.

1. Balance in hand at 31st December 1900,		£232 4 8
Consisting of—		
(1) Professor Bayley Balfour's Prize,	£10 10 0	
(2) Surplus Revenue,	221 14 8	
2. Ordinary Members' Subscriptions,		243 12 6
Arrears at 31st December 1900,	£31 14 6	
Add Arrears then written off but since received,	0 18 0	
	£32 12 6	
Deduct Cancelled and written off as irrecoverable at 31st December 1901,	21 2 6	

DISCHARGE.

1. Printing, Stationery, etc.,		£106 15 0
Balance of cost of *Transactions*, Part 2 of Vol. XVI.,	£24 16 0	
And Authors' Reprints,	4 16 6	
	£29 12 6	
To account of cost of *Transactions*, Part 3 of Vol. XVI.,	75 0 0	
General Printing, Binding, and Stationery,	28 8 0	
	£133 0 6	
Less Receipts for Advertisements in *Transactions*,	26 5 6	

Subscriptions for 1901, .	£271 16 0		
Less Received in 1900, .	6 7 0		
		265 9 0	
Subscriptions for 1902 received in 1901, .		4 18 6	
		£281 17 6	
Deduct Arrears at 31st December 1901,		38 5 0	
		£243 12 6	
3. Proportion of Life Members' Subscriptions transferred from Capital, ...			50 14 7
4. Donations, ...			33 0 0
R. C. Munro Ferguson, M.P., for the Raith Bursary, ...	£30 0 0		
D. F. Mackenzie, for Illustrating *Transactions*,	3 0 0		
5. Dividends and Interest, ...			26 14 2
6. *Transactions*, etc., sold, ...			5 6 0
			£591 11 11

2. Raith Bursary for 1901–1902. Holder, Mr Frank Scott, .			30 0 0
3. Prizes (Money, £3; Books, £3; Medals, £2, 1s. 3d.), .			8 1 3
4. Forestry Exhibition at the Highland and Agricultural Society's Show at Inverness, ...			11 15 3
Printing, ...	£4 11 6		
Advertising, ...	4 5 5		
Other Outlays, . . .	2 18 4		
5. Expenses of Management, ...			109 1 11
Rent, ...	£4 6 6		
Reporter, ...	1 11 6		
Auditor, ...	3 3 0		
Secretary and Treasurer, . . .	65 0 0		
Advertising, Insurance, and Premium on Secretary's Bond of Caution, . .	6 9 11		
Postages and Miscellaneous Outlays, viz.:—			
Postage of 1900 *Transactions*, £10 12 6			
Postages of Billets of January and August meetings, . 3 16 2			
General Postages, Commission on Cheques, and Petty Outlays, . . . 14 2 4			
	28 11 0		
	£109 1 11		
6. Professor Bayley Balfour's Prize repaid, . . .			10 10 0
Note.—As desired by Professor Balfour, this sum was handed to the University of Edinburgh for the Forestry Class Library.			
7. Balance of Revenue carried to next year (being sum in National Bank of Scotland, Limited), subject to payment of balance of cost and postage of 1901 *Transactions*, .			315 8 6
			£591 11 11

EDINBURGH, *20th January* 1902.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1901, of which the foregoing 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.

Office-Bearers for 1902:—

PRESIDENT.

The Right Hon. the Earl of Mansfield, Scone Palace, Perth.

VICE-PRESIDENTS.

D. F. Mackenzie, Factor, Mortonhall, Liberton.
W. Steuart Fothringham of Murthly, Perthshire.
James Cook, Estate Office, Arniston, Gorebridge.
The Right Hon. Lord Lovat, Beaufort Castle, Beauly.
John Methven, Nurseryman, 15 Princes Street, Edinburgh.

COUNCIL.

John Annand, Overseer, Haystoun Estate, Peebles.
W. A. Mackenzie, Factor, Faskally, Pitlochry.
Alexander Pitcaithley, Forester, Jeanie Bank, Scone.
James Robertson, Forester, Panmure, Carnoustie.
James Crabbe, Forester, Glamis, Forfarshire.
Robert Forbes, Estate Office, Kennet, Alloa.
G. U. Macdonald, Forester, Raith, Kirkcaldy.
George Mackinnon, Overseer, Melville Castle, Lasswade.
John Boyd, Forester, Pollok Estate, Pollokshaws, Glasgow.
James Forgan, Forester, Bonskeid, Pitlochry.
D. P. Laird, Nurseryman, Pinkhill, Murrayfield.
William Mackinnon, Nurseryman, 144 Princes Street, Edinburgh.
Charles Buchanan, Overseer, Penicuik Estate, Penicuik.
John Hay, Overseer, Dollars Estate, 24 Picken Street, Kilmarnock.
Geo. Leven, Forester, Auchencruive, St Quivox, Ayr.
Sir Kenneth J. Mackenzie, Bart. of Gairloch, 10 Moray Place, Edinburgh.
Sir John Stirling Maxwell, Bart. of Pollok, Pollokshaws.
A. D. Richardson, 7 West Catherine Place, Edinburgh.
Edward P. Tennant, Yr., of the Glen, 31 Lennox Gardens, London, S.W.

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(*Note.*—Mr Fraser, Dalzell, declined to accept office, and Mr J. T M'Laren, Polmaise, resigned immediately after the Annual Meeting.)

HON. SECRETARY.

R. C. Munro Ferguson, M.P., Raith House, Kirkcaldy, Fife.

HON. EDITOR.

Colonel F. Bailey, R.E., University Lecturer on Forestry,
7 Drummond Place, Edinburgh.

SECRETARY AND TREASURER.

ROBERT GALLOWAY, S.S.C., 5 St Andrew Square, Edinburgh.

AUDITOR.

JOHN T. WATSON, 16 St Andrew Square, Edinburgh.

JUDGES AND TRANSACTIONS COMMITTEE.

Colonel BAILEY, R.E., University Lecturer on Forestry (*Convener*).
JOHN METHVEN, Nurseryman, Edinburgh.
JOHN MICHIE, Factor, Balmoral.
JOHN CLARK, Forester, Haddo House, Aberdeen.
ROBERT LINDSAY, Kaimes Lodge, Murrayfield.
A. C. FORBES, Wood Manager, Longleat.
ROBERT GALLOWAY, S.S.C., *Secretary*, 5 St Andrew Square, Edinburgh, *ex officio*.

HONORARY CONSULTING SCIENTISTS.

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

Consulting Chemist.—ANDREW PEEBLES AITKEN, M.A., Sc.D., Professor of Chemistry, Veterinary College, Clyde Street, Edinburgh.

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

Consulting Entomologist.—ROBERT STEWART MACDOUGALL, M.A., D.Sc., Professor of Entomology, etc., New Veterinary College, Edinburgh.

Consulting Geologist.—JOHN SMITH FLETT, M.A., B.Sc., M.B., C.M., Geological Survey, 28 Jermyn Street, London, S.W.

Consulting Meteorologist.—ROBERT COCKBURN MOSSMAN, F.R.S.E., F.R.Met.Soc., 10 Blacket Place, Edinburgh.

TRUSTEES.

The EARL OF MANSFIELD, R. C. MUNRO FERGUSON, M.P., and W. STEUART FOTHRINGHAM of Murthly.

LOCAL SECRETARIES.

Scotland.

Counties.	
Aberdeen, .	JOHN CLARK, Forester, Haddo House, Aberdeen.
	JOHN MICHIE, Factor, Balmoral, Ballater.
Argyle, . .	WALTER ELLIOT, Manager, Ardtornish.
	JOHN D. SUTHERLAND, Estate Agent, Oban.
Ayr, . .	JOHN HAY, Overseer, Dollars Estate Office, Kilmarnock.
	ANDREW D. PAGE, Overseer, Culzean, Maybole.
Banff, . .	JOHN BRYDON, Forester, Rothes, Elgin.
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.
	JOHN HAYES, Dormont Grange, Lockerbie.
	JOHN NEWBIGGING, Nurseryman, Dumfries.
East Lothian, .	W. S. CURR, Factor, Ninewar, Prestonkirk.
Fife, . .	WM. GILCHRIST, Timber Merchant, Ladybank.
	EDMUND SANG, Nurseryman, Kirkcaldy.
Forfar, . .	R. CAIRNS, The Gardens, Balruddery, near Dundee.
	JAMES CRABBE, Forester, Glamis.
	JAMES ROBERTSON, Forester, Panmure House, Carnoustie.
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.
Peebles, . .	* * * * * * * *
Perth, . .	W. HARROWER, Forester, Tomnacroich, Garth, Aberfeldy.
	W. A. MACKENZIE, Factor, Faskally, Pitlochry.
	ALEX. PITCAITHLEY, Jeanie Bank, Old Scone, 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, .	JAMES F. HARDIE, Factor, Skibo Castle, Dornoch.
	DONALD ROBERTSON, Forester, Dunrobin, Golspie.
West Lothian,	JAMES SMITH, Hopetoun Gardens, South Queensferry.
Wigtown, .	JAMES HOGARTH, Forester, Culhorn, Stranraer.
	H. H. WALKER, Monreith Estate Office, Whauphill.

England.

Counties.	
Beds,	JOHN ALEXANDER, 43 Ampthill Street, Bedford.
	FRANCIS MITCHELL, Forester, Woburn.
Berks,	W. STORIE, Whitway House, Newbury.
Bucks,	JAMES SMITH, The Gardens, Mentmore, Leighton-Buzzard.
Cheshire,	WM. ELDER, Cholmondeley Park, near Malpas.
Derby,	THOMAS DOW, Belvedere Road, Woodville, Burton-on-Trent.
Devon,	JAMES BARRIE, Forester, Stevenstone Estate, Torrington.
	WM. STORIE, Forester, Gulworthy, Tavistock.
Gloucester,	GEORGE HANNAH, Over House, Over Almondsbury, Bristol.
Hants,	ANDREW SLATER, Estate Office, Osborne, Cowes, Isle of Wight.
Herts,	JAMES BARTON, Forester, Hatfield.
	THOMAS SMITH, Overseer, Tring Park, Wiggington, 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.
	GEORGE CADELL, c/o The Secretary, Surveyor's Institution, 12 Great George Street, Westminster, S.W.
Norfolk,	JAMES RODGER, Forester, Morton Hall, Ringland, Norwich.
Northumberland,	JOHN DAVIDSON, *Secretary,* English Arboricultural Society, Haydon-Bridge-on-Tyne.
Notts,	W. MICHIE, Forester, Welbeck, Worksop.
	WILSON TOMLINSON, Forester, Clumber Park, Worksop.
Salop,	FRANK HULL, Forester, Lillieshall, Newport.
Stafford,	ROBERT T. COLLINS, Forester, Trentham, Stoke-on-Trent.
Suffolk,	ANDREW BOA, junior, Agent, Great Thurlow.
Surrey,	PHILIP PEEBLES, Estate Office, Albury, Guildford.
Warwick,	A. D. CHRISTIE, The Gardens, Ragley Hall, Alcester.
Wilts,	A. C. FORBES, Wood Manager, Longleat, Warminster.
York,	WM. FORBES, Forester, Swinton, Masham.
	ADAM MAIN, Forester, Rose Cottage, Loftus.
	D. TAIT, Estate Bailiff, Owston Park, Doncaster.

Ireland.

Dublin,	JAS. WILSON, B.Sc., Royal College of Science, Dublin.
Galway,	THOMAS ROBERTSON, Forester and Bailiff, Woodlawn.
Kildare,	ROBERT M'KERROW, Manager, Carton, Maynooth.
Kilkenny,	ALEX. M'RAE, Forester, Castlecomer.
King's County,	ARCH. HENDERSON, Forester, Clonad Cottage, Tullamore.
Tipperary,	DAVID G. CROSS, Forester, Kylisk, Nenagh.
Wicklow,	ADAM JOHNSTONE, Forester, Coollattin, Shillelagh.

PHOTOGRAPHIC ARTIST.

GEORGE PAXTON, Richardland, Kilmarnock.

APPENDIX C.

List of Presentations to the Society's Library during the year 1901.

1. *Annual Report on State Forest Administration in South Australia.* Year 1899-1900.
2. *Reports of the Conservators of Forests, Cape of Good Hope,* Year 1899.
3. *Annual Report Department of Agriculture, Victoria,* 1899.
4. *Transactions of the Nova Scotia Institute of Science,* vol. x., part 2, Session 1899-1900.
5. *The Forestal Conditions and Sylvicultural Prospects of the Coastal Plain of New Jersey.* By John Gifford, D.Œc. 1900.
6. *Handbook of the Destructive Insects of Victoria,* part 3, 1900. From the Secretary for Agriculture, Victoria.
7. *Notes on Forestry as a branch of Estate Management.* By R. C. Munro Ferguson, M.P. A Reprint.
8. *New or Little Known North American Trees,* Nos. 2 and 3. By Prof. C. L. Sargent. Reprints.
9. *Notes on Crataegus in the Champlain Valley.* By Prof. C. L. Sargent. A Reprint.
10. *Notes on a Collection of Crataegus made in the Province of Quebec, near Montreal.* By Prof. C. L. Sargent. A Reprint.
11. *Transactions of the Highland and Agricultural Society of Scotland,* 5th series, vol. xiii., 1901.
12. *Journal of the Royal Horticultural Society, London,* vol. xxv., part 3; vol. xxvi., parts 1 and 2; vol. xxvi., parts 2 and 3.
13. *Kew Gardens Bulletin,* 1899.
14. *Abstract of Meteorological Observations at Rothesay in* 1900. By James Kay.
15. *Transactions of the Massachusetts Horticultural Society,* part 2, 1900.
16. *Annual Report of the Ohio State University,* 1900.
17. *Catalogue of the Forestry Collection of the Surveyors Institution,* 3rd edition, 1901. From George Cadell.
18. The following Reprints from Prof. Stewart MacDougall:—
    On the Validity of Pissodes validirostris (Shoenh.) *as a Species.*
    The Life-History and Habits of Diaxenes dendrobii, Ganan.
    The Biology and Forest Importance of Scolytus (Eccoptogaster) multistriatus (Marsh).
    The Biology of the Genus Pissodes.
    The Biology of the Mites Injurious to the Domesticated Animals.
    On the Life-History and Habits of Clerus formicarius, Linn., *and of* Rhizophagus depressus, Fowler.
19. *Transactions of the English Arboricultural Society,* vol. iv., part 3.
20. *The Country Gentlemen's Estate Book,* 1901.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON.

HIS MOST EXCELLENT MAJESTY THE KING.

PROCEEDINGS IN 1903.

THE ANNUAL MEETING.

The Fiftieth Annual General Meeting of the Royal Scottish Arboricultural Society was held in the Lecture Hall of the National Portrait Gallery, No. 1 Queen Street, Edinburgh, on Wednesday, 28th January 1903, at 2 P.M. The Right Hon. the EARL OF MANSFIELD, President of the Society, occupied the Chair during the earlier part of the proceedings, but after the election of Office-Bearers, Mr JAMES COOK, Senior Vice-President, presided.

MINUTES.

The Minutes of the informal Meeting, held in Aberdeen on 17th July 1902, were read, and the Minutes of the General Meeting, held in Edinburgh on 18th July 1902, were held as read. The Minutes of both Meetings were approved.

ELECTION OF AN HONORARY MEMBER.

On the motion of the EARL OF MANSFIELD, JÄGMÄSTARE ELIS NILSON, a member of the Swedish State Forest Service, was unanimously elected an Honorary Member of the Society. In moving his election, the President referred to Mr Nilson's attainments in the science of Forestry, and to the invaluable services which he had rendered to the Society in connection with the recent tour in Sweden.

ANNUAL REPORT OF THE COUNCIL.

The SECRETARY submitted and read the Annual Report of the Council, as follows :—

Membership.

The losses sustained by deaths, resignations, and lapsing have been much heavier than during the preceding year. The deaths of two Honorary Members—Sir Richard Temple and the Hon. R. Southey—have been intimated, and amongst others whose names have been removed from the Roll by death in the course of the year, the following may be mentioned :—Colonel Trotter, Mr C. Bates, Sir Thomas Dyke Acland, Mr John Christie of Cowden, Mr J. Spender Clay, Mr J. Gilchrist Clark of Spedoch, Mr Alexander Campbell of Auchindarroch, and Mr J. O. Mackenzie of Dolphinton. The latter for many years held the position of one of the Trustees of the Society.

At last Annual Meeting the Membership was 917, and in the course of the year there has been a net gain of 38 members, giving a total at this date of 955, made up as follows:—

Honorary Members, . . .	14
Honorary Associates, . . .	6
Life Members, ...	243
Ordinary Members, . . .	692
	955

Prizes.

Last year's Syllabus included 29 subjects, for which Prizes and Medals were offered. Five Essays were received and reported on by the Judges, and, in accordance with their recommendation, one of the writers received a No. 1 Silver Medal, while the other four obtained No. 2 Silver Medals. Two of the Essayists preferred to take the converted value of their medals in cash.

The Council also offered two prizes of £10 and £5 for the best Essays on the Excursion to Sweden, and appointed the President, Col. Bailey, and Mr Elis Nilson, Sweden, Judges of the Essays. Two Essays were received, which the Judges decided were of equal merit, and the prize money of £15 was accordingly divided equally between the writers, who were Mr Fraser Story, The Glen, Innerleithen, and Mr Geo. U. Macdonald, Forester, Raith. The Essays will appear in the *Transactions*.

The Transactions.

The *Transactions* are being rapidly prepared for the Press, but it is not expected that they will be ready for publication for a few weeks. The coming Part should prove of exceptional interest to the Members of the Society, for it will contain the Report of the Departmental Committee on Forestry, and several important papers on the subject of the Larch Disease, besides other articles of general interest, reviews of books, notes, and official matter. Members are invited to send contributions, which, if found suitable, will be printed in the next Part.

Departmental Committee appointed by the Board of Agriculture.

The steps taken by the Council to lay the views of the Society before the Committee were explained at the General Meeting in July. The Committee visited Scotland in September, when a deputation of the Council met them at the Edinburgh University, and gave them all the information in their power regarding the facilities for Forestry instruction existing in Scotland. The Committee's Report has now been issued. As already mentioned, it will be printed in the *Transactions*, and will thus soon be in the possession of all Members of the Society.

Larch Disease.

In compliance with the remit from the last Annual Meeting on the subject of Larch Disease, the Council have made some progress in the matter. A preliminary Committee having reported that Hartig's book is still the leading authority on the subject, and having recommended that further investigations should be made, a large and representative Committee was appointed, with instructions to prepare a Scheme of Procedure. This Committee having reported that they proposed, as a preliminary step, to collect statistics as to the prevalence of the disease, and particulars as to the circumstances and conditions under which it is found in various localities in Scotland, they have been authorised to proceed with this inquiry. The articles printed in the coming Part of the *Transactions* will be helpful to Members of the Society in their efforts to assist the Committee in their investigations.

Forestry Exhibition at Aberdeen.

The space kindly set apart by the Highland and Agricultural Society for the Forestry Exhibition in their Show-ground, at Aberdeen, was fully occupied by interesting exhibits. There were 34 entries in the Catalogue,—a substantial increase as compared with those of last year. The exhibits included the Society's own Lantern Slides of Plant Physiology and Wood Sections, which were exhibited mounted in cardboard. The Exhibition appeared to excite much interest, as it was crowded during the four days of the Show. Much of the success which attended it was due to the untiring efforts of the Local Secretaries, Mr James Wilson, B.Sc., late of the Department of Agriculture at Aberdeen University, now of the Royal College of Science, Dublin, and Mr John Clark, Forester, Haddo House. These gentlemen have sent in a report, which will be of service in connection with future Exhibitions.

The Highland and Agricultural Society has not only granted facilities for a similar Exhibition to be held, this year, in their Showyard at Dumfries, but has generously voted a sum of £20 to this Society, to be expended on prizes for home-grown timber exhibited there. The

Council cordially accepted the offer of these prizes, and decided to add a number of Medals to the List of them. The prize list of 12 items, and also the usual circular inviting offers of articles for Exhibition only, have been issued to all Members. The Local Secretaries this year are Mr JOHN NEWBIGGING, Nurseryman, Dumfries, Mr JOHN HAYES, Dormont Estate Office, Lockerbie, and Mr DAVID CRABBE, Forester, Byreburnfoot, Canonbie.

Informal Meeting at Aberdeen.

The Minutes of this Meeting are printed in the *Proceedings* of last year.

Excursion to Sweden.

As soon as it had been definitely decided that the Society should visit Scandinavia, the Council, through the Foreign Office, asked the Scandinavian Government for advice as to a suitable programme, and for guidance in carrying it out. In course of time two programmes were received, one for Norway and one for Sweden, each of which would have occupied all the time available. It was found impossible, however, to get a special steamer for the fortnight necessary to carry out the Norwegian tour, and it was therefore decided to confine the tour to Sweden. Count Wachmeister, Director-General of the Royal Domains, Stockholm, interested himself in the arrangements, and kindly appointed Mr Elis Nilson, Member of the State Forest Service, to act as Guide and Interpreter to the party throughout the tour. Over 70 Members of the Society took part in the Excursion, and they were received wherever they went with the greatest kindness and hospitality. The tour, which extended over 18 days, was a most interesting and enjoyable one.

Malcolm Dunn Memorial.

The Subscription List having been closed, and the payments in connection with the monument in Dalkeith Cemetery having been made, there remained a balance of £100, 12s. 8d., whereof £99, 2s. 6d. was absorbed by the purchase of £100 of the Edinburgh Corporation 3 per cent. redeemable stock, leaving a balance of £1, 10s. 2d. in hand.

The Council have not yet decided how this balance, and the future income, are to be disposed of.

New Trustee.

Owing to the death of Mr J. O. MACKENZIE of Dolphinton, it was necessary to appoint a new Trustee, and Mr STEUART FOTHRINGHAM of Murthly was duly elected at the General Meeting held in July. The Society's securities have now been transferred, by the surviving Trustees, to themselves and the new Trustee.

Jubilee.

The Committee have not found it necessary to make any further report, but if the proposed Excursion to France is to be carried out, they should be authorised to proceed, as soon as possible, with the necessary arrangements.

Register of Foresters.

A Committee of the Council has had this matter under consideration, and they have now reported in favour of a Register being kept under the auspices of the Society.

Exhibition at Cork.

The Department of Agriculture for Ireland asked the Society for the loan of any permanent exhibits they might have available for exhibition. As the Society does not possess any such exhibits, and the time was too short to permit of exhibits being specially prepared, the Society could only offer to send some of their publications. The offer was accepted, and the publications were forwarded.

Mrs Wilson's Bequest.

The attention of the Council having been directed to an announcement that Mrs Wilson of North Kinmundy had bequeathed her estate to the Trustees of the Cruickshank Botanic Garden, Aberdeen, to be applied, amongst other things, to the teaching of Forestry, the Secretary communicated with the Agent for the Trustees on the subject, and was assured that, in dealing with the bequest, the Trustees would keep the claims of Forestry in view.

The Council.

By the passing of the New Law at last Annual Meeting, the number of ordinary Councillors was increased from fifteen to twenty-one, and seven Councillors now retire annually in place of five as formerly. In previous years the Council meetings were usually held on Wednesday afternoons, but in the beginning of last year the Council decided to meet on Saturday afternoons.

The Annual Dinner.

Members are reminded of the Annual Dinner, which is to be held in the Royal British Hotel this evening, at 6 P.M.

The Hall.

The use of the Hall for this Meeting has been kindly granted by the Commissioners of the Board of Manufactures, and the thanks of the Society are due to the Commissioners for this special favour.

The Report was adopted.

Finances.

The Secretary presented the Accounts for the Year, which, with the Auditor's report thereon, had been printed and circulated amongst the Members previous to the Meeting. (An Abstract of the Accounts will be found in Appendix D.)

Mr Methven, Convener of the Finance Committee, in moving the adoption of the Accounts, pointed out that although the Life Subscriptions were smaller than in the previous year, the Annual Subscriptions were considerably larger. The invested Capital amounted to £944, 17s. 2d., and the balance of Revenue to £329, 3s. 11d. This balance was subject to the payment of the cost of the *Transactions*, which were in course of being printed.

Mr W. Mackinnon seconded the motion, which was agreed to.

Excursion Fund.

The following Abstract of Accounts for the past year was submitted by the Secretary :—

Excursion to Sweden, 18th July to 3rd August 1902.

RECEIPTS.

Balance in hand at close of last Excursion Account,					£32	13 6
Contributions to Common Purse, including Deposits,					1110	13 0
Collected for Axes,	£4	19	0			
Less Paid,	4	13	3			
				0	5	9
Collected for Photographs,	£15	3	11			
Less Paid,	15	2	7			
				0	1	4
				£1143	13	7

PAYMENTS.

Auditor's Fee for 1901 Accounts,	£2	2	0			
Printing Programmes, etc.,	3	6	0			
Steamer Fares,	300	12	0			
Hotels, Railways, etc.,	766	10	0			
Gratuities and Miscellaneous Outlays previous to and throughout Tour,	48	9	8			
				1120	19	8
Balance carried forward to next Year, being sum in National Bank of Scotland on Account Current,				£22	13	11

Edinburgh, 17*th January* 1903.—Examined with Vouchers and Memorandum Book and found correct. Bank Certificate of above balance of £22, 13s. 11d. also exhibited to me.

John T. Watson,
Auditor.

The Secretary pointed out that there had been a loss of about £10 in connection with the trip to Sweden, and Mr William Forbes, Swinton, Masham, said that he thought the Excursionists should pay the loss. The Secretary explained that this fund was kept entirely separate from the funds of the Society, and that the money belonged to the Members who took part in the Excursions.

The Accounts were approved of.

Malcolm Dunn Memorial Fund.

The following Abstract of Accounts in connection with this fund was submitted and approved of:—

RECEIPTS.

Total Subscriptions, ...	£115 19 6
Bank Interest, ...	6 9 6
	£122 9 0

PAYMENTS.

Commission paid on collection of Dalkeith Subscriptions, ...	£2 10 0	
Rent of Room for Preliminary Meetings, .	0 4 6	
Society's Share of Expense of Monument in Dalkeith Cemetery, . . .	19 1 10	
Purchase Price of £100 3 % Redeemable Stock of Edinburgh Corporation at 98¾, *ex* Dis., ... £98 15 0		
Stamps, etc., . . . 0 7 6		
	99 2 6	
		120 18 10
Balance carried forward, being sum in National Bank of Scotland on Account Current, . .		£1 10 2

Edinburgh, 17*th January* 1903.—Examined and checked with Vouchers, Counterfoils, etc., and found correct. Bank Certificate of above balance of £1, 10s. 2d., also Stock Certificate Edinburgh Corporation for above £100, exhibited to me.

John T. Watson,
Auditor.

The Chairman's Remarks.

The Chairman said that his remarks would be in the nature of a dying speech, because after nine o'clock that night he should no longer be the President of the Society. He was only sorry that Mr Fothringham, the President elect, was not to be present that afternoon, but, of course, if one chose to go and get married, one could not be expected to perform all the other duties of one's

position. Proceeding, he said he had been four years President of the Society, and it was only natural he should take that opportunity of expressing very sincerely his thanks to the Members for their kindness during his four years in office, because he had had a great deal of enjoyment as President of the Society. He trusted that many of them would always recollect the way in which they had been brought together on many different occasions during those four years, in pleasure, and sometimes, on the sea at least, in pain, but they had warstled through it all, and he thanked the Society extremely for all the kindness they had extended to him. Anything he had been able to do as President had been done as a labour of love. They had heard more or less the transactions of the Society in brief, and he thought they might consider that they had been very satisfactory. They had a most interesting trip to Sweden. Of course, there were some of them who were a little captious about the state of matters in Sweden, and some, on the other hand, held that there was a great deal there not merely to admire, but also to be humbly imitated. They received nothing but the greatest possible kindness there, and he thought, so far as the limited time allowed them, they were able to see a great deal that was interesting, and a great deal that they could honestly admire, and they came back feeling that the interest taken in matters arboricultural in Sweden was an interest that might be well copied, and, perhaps, even increased in this country. Although the part of Sweden they visited was in a sort of transition state, still they felt the interest in a large portion of that country was being fully maintained, and, perhaps, maintained to a greater degree than the interest in similar matters was maintained in this country. That was a point that he should like to refer to for a moment, because there was no use hoping for success in any matter, whether arboricultural or otherwise, unless interest was put into it and kept in it. It was the bounden duty of all classes in this country who were interested in arboriculture, whether they were lairds or factors, or foresters or workmen, to put interest into their work, or they would never have a successful issue. The work the Society had done had been, he felt confident, a work of great advantage in Scotland, but he was aware there was left to his successors in the chair a considerable amount of work which it had not been possible to overtake at the present time. He should welcome any progress, and he should always be ready to

do what he could to urge that the science of Forestry, for it was no less, should be encouraged and maintained in Scotland as long as there were Scotsmen left in the world.

Election of Office-Bearers.

On the motion of the Chairman, seconded by Mr Alexander Milne, Edinburgh, Office-Bearers in room of those who retired by rotation were elected as follows:—Mr W. Steuart Fothringham of Murthly was unanimously appointed President; and the Earl of Mansfield and Mr Alexander Pitcaithley, Scone, were elected Vice-Presidents. The following gentlemen were elected to the Council:—Messrs John Annand, Overseer, Haystoun Estate, Peebles; Colin Chisholm, Forester, Lundin and Montrave Estates, Hattonlaw, Lundin Links; James Crabbe, Forester, Glamis, Forfarshire; Robert Forbes, Estate Office, Kennet, Alloa; A. T. Gillanders, F.E.S., Forester, Park Cottage, Alnwick, Northumberland; John W. M'Hattie, Superintendent of the City Parks, Edinburgh; D. F. Mackenzie, F.S.I., Estate Office, Mortonhall, Midlothian; and W. H. Massie, Nurseryman, Edinburgh.

The Honorary Secretary, the Honorary Editor, the Secretary and Treasurer, the Auditor, the Judges and *Transactions* Committee, the Local Secretaries, and the Consulting Scientists were re-elected.

Mr A. D. Richardson, Edinburgh, was elected Photographer in succession to Mr George Paxton, resigned.

(For a full list of Office-Bearers and Officials for 1903 see Appendix E.)

Forestry Exhibition at the Highland and Agricultural Society's Show at Aberdeen.

The Chairman (Mr Cook) called the attention of the Members to the Schedules which had been issued along with the notice calling the Meeting.

Mr Pitcaithley criticised the Prize Schedule, and suggested various alterations upon it. He thought ordinary estate sawmills could not produce boards of the required width.

Mr Forbes said there should be no difficulty about the width of the boards, but he thought it would be impossible to keep the pith in a board 7 feet long.

Mr Spiers objected to the length of the boards, and Mr Boyd, Pollok, said he thought it was not necessary to have the bark on both edges of the boards.

Mr D. F. Mackenzie defended the Schedule, and said he thought there should be no difficulty in Members complying with the regulations. He pointed out that it was the quality of the timber that was aimed at.

Mr Tait, Penicuik, said that Members should be allowed to get their wood cut up at any large mills in the neighbourhood.

Mr Buchanan, Penicuik, moved that the Schedule be remitted back to the Council, and this was agreed to.

Library and Museum.

The Secretary submitted a list of the additions to the Library since the last Annual Meeting. (See list in Appendix F.)

Excursion in 1903.

The Chairman mentioned that the Excursion Committee and the Council recommended that the next Excursion be made to Woburn, and Woods in that neighbourhood. This was unanimously agreed to.

The Society's Jubilee.

It was remitted to the Council to carry out the arrangements proposed in their Report.

Motions to be Disposed of.

The three Motions, of which notice was given at last Meeting, fell to be discussed and disposed of.

1. The Secretary submitted the following Motion on behalf of the Council:—

   That the words "in the month of January," in Rule 24, dealing with the date of the Annual Meeting, be deleted, and the following words substituted for them, viz., "at such time and place as the Council may determine."

Mr Boyd, seconded by Mr Mackenzie, moved the adoption of the Motion, which was unanimously agreed to.

2. Mr A. Pitcaithley, Scone, submitted the following Motion standing in his name, viz.:—

> That the name of the Society be changed from the Royal Scottish Arboricultural Society to the Royal Scottish Society of Forestry and Arboriculture.

The Motion was seconded by Mr M'Bean.

Mr D. F. Mackenzie moved a direct negative, and Mr Wm. Forbes seconded. After discussion, the vote was about to be taken, when Mr Pitcaithley rose to make an explanation. The Chairman, however, proceeded to take the vote, and thereupon Mr Pitcaithley withdrew his Motion.

3. Mr Leven, Auchencruive, Ayr, submitted the following two Motions standing in his name:—

> (1) That the Annual General Meeting of the Society be held alternately in Edinburgh, Glasgow, and Perth.
>
> (2) That the Council Meetings be held alternately in Edinburgh, Glasgow, and Perth.

Mr Pitcaithley seconded, on the understanding that the second Motion was not to be pressed by Mr Leven, and Mr D. F. Mackenzie moved the previous question, seconded by Mr Gilchrist.

On a vote being taken, the Motion was rejected by a large majority.

Notice of Motion.

Mr John Boyd, Forester, Pollok, gave notice that at next Meeting he would again bring up this Motion, viz.:—

> That the Annual General Meeting of the Society be held alternately in Edinburgh, Glasgow, and Perth.

Vote of Thanks to Lord Mansfield.

Mr John Methven moved a vote of thanks to Lord Mansfield for the able manner in which he had presided over the Society for the last four years. His Lordship had been good enough to say that it had given him much pleasure to act as President of the Society. On their side they could truly say that having had his Lordship as President for so many years had been of great benefit to the Society, and they desired to tender him their very hearty thanks. The motion was carried by acclamation.

Mr Gillanders' Lecture.

At the close of the business, Mr A. T. Gillanders, F.E.S., Forester to His Grace the Duke of Northumberland, delivered a lecture on "Forest Entomology," which was illustrated by a number of lantern slides.

On the motion of Mr Johnston, Ayr, a hearty vote of thanks was accorded to Mr Gillanders for his interesting and instructive lecture.

THE ANNUAL DINNER.

The Annual Dinner of the Society was held in the evening, in the Royal British Hotel. The Earl of Mansfield presided, and he was supported by Bailie Murray; the Rev. D. C. Stewart, Currie; Dr Graham, Currie; Mr F. Grant Ogilvie; Mr James Macdonald, Secretary of the Highland and Agricultural Society; and Mr John Methven. The croupiers were Mr James Cook, Arniston, and Mr A. Pitcaithley, Scone. There was a company of about sixty gentlemen. Apologies were intimated from Mr Munro Ferguson, M.P., Sir John Stirling Maxwell, M.P., and others. A cablegram from Sweden from Mr Nilson, the Society's latest Honorary Member, was also read amid applause. The loyal and patriotic toasts were given from the chair, and duly honoured. Mr W. Mackinnon, Nurseryman, Edinburgh, proposed "The Corporation of Edinburgh," and Bailie Murray replied. Mr Grant Ogilvie submitted the toast of the evening—"The Royal Scottish Arboricultural Society"—and in the course of his remarks reminded the meeting that in the Museum of Science and Art, of which he had charge, there was a valuable collection of wood specimens, and also a very complete library of forestry literature—namely, the Cleghorn Library—which could be consulted by Members any day. Lord Mansfield, in responding, said the Society were the trustees, as it were, of forestry for the kingdom of Scotland, and their work had influenced the past, and would influence the future. In later years they had got opportunities of contrasting the systems followed in other parts of the world. Modern facilities for travel made the seeing of these things with our own eyes quite easy. In some cases they had come to the conclusion that they had been very far wrong in the past, and in other cases they were not so sure

that the systems which suited these other countries would be altogether suitable for this country. We, in this country, did not enjoy the advantages of State forests as so many of the neighbouring countries did, and for his part he would not change places with these other nations, as we were very much freer for not enjoying those advantages. One could not but realise that those who worked in these forests had little or no choice in the matter, and he preferred the freedom in this country, even to the high pitch of excellence which they saw in some of these countries abroad. In conclusion, he expressed the hope that the proposed Register for Foresters, which he had advocated, would soon be in operation. Mr Crabbe, Glamis, proposed the health of "The New President," Mr Steuart Fothringham, and said that if the new President did as well as the retiring President, the Society would be very fortunate indeed. The toast was received with great enthusiasm, and Lord Mansfield said it would give him great pleasure to inform the new President that he had not been forgotten on that festive occasion. Mr Alex. Milne, Edinburgh, proposed "The Landed Interest," and Mr Cook, Arniston, replied. Mr John Methven proposed "Kindred Societies," and Mr Macdonald, of the Highland and Agricultural Society, and Mr Wm. Forbes, a Vice-President of the English Arboricultural Society, replied. Mr D. P. Laird proposed the health of Lord Mansfield, and in reply his Lordship said that he desired to express publicly the great help he had received, in connection with his duties, from the Secretary, Mr Galloway. The Secretary's health was also honoured, and the proceedings terminated with the singing of "Auld Lang Syne."

APPENDIX D.

Abstract of Accounts for Year ending 31st December 1902.

I.—CAPITAL.

CHARGE.

1. Funds at 31st December 1901,					£735 6 5
£486 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 128⅛,		£622 13 9			
In National Bank of Scotland, Limited,		112 12 8			
2. Life Members' Subscriptions in 1902,					98 14 0
New Members,		£79 16 0			
Ordinary Members by commutation,		18 18 0			
3. Sum transferred from Revenue to meet price of Stock,					187 1 11
					£1021 2 4

DISCHARGE.

1. Proportion of Life Members' Subscriptions transferred to Revenue,				£57 18 10
Unexhausted: £501 9 2, 74 5 1	1/15 of Full Life Subscriptions,	£46 13 7		
	1/10 of Commuted Subscriptions,	11 5 3		
2. Price of £250 Caledonian Railway Company 4 per cent. Debenture Stock, at 134¾,		£336 17 6		
3. Expenses in connection with above purchase,				3 12 3
4. Decrease in value of Railway Stocks at 31st December 1902,				14 14 1
5. Funds at 31st December 1902,				944 17 2
£486 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 126,		£612 7 2		
£250 Caledonian Railway Company 4 per cent. Debenture Stock, at 133,		332 10 0		
				£1021 2 4

II.—REVENUE.

CHARGE.

1. Balance in hand at 31st December 1901,					£315 8 6
2. Ordinary Members' Subscriptions,					263 15 6
Arrears at 31st December 1901,	£38 5 0				
Add Arrears then written off but since received,	1 6 0				
		£39 11 0			
Subscriptions for 1902,	£287 3 6				
Less Received in 1900 and 1901,	5 4 6				
		281 19 0			
Subscriptions for 1903 received in 1902,		4 19 6			
		£326 9 6			

DISCHARGE.

1. Printing, Stationery, etc.,				£23 9 5
Balance of cost of *Transactions*, Part 3 of Vol. XVI.,	£18 10 0			
And Authors' Reprints,	4 9 0			
	£22 19 0			
Maps and Plates for *Transactions*,	3 12 8			
General Printing, Binding, and Stationery,	21 18 9			
	£48 10 5			
Less Receipts for Advertisements in *Transactions*,	25 1 0			
	£23 9 5			

Deduct—						
Cancelled and written off as irrecoverable at 31st December 1902,	£28	6	0			
Arrears at 31st December 1902,	34	8	0			
				62	14	0
				£263	15	6
3. Proportion of Life Members' Subscriptions transferred from Capital,				57	18	10
4. Dividends and Interest,				32	9	5
5. *Transactions*, etc., sold,				12	11	7
6. Income Tax Recovered,				1	18	0
				£684	1	10

2. Prizes (Money, £19; Medals, £3, 2s. 8d.),				22	2	8
3. Forestry Exhibition at the Highland and Agricultural Society's Show at Aberdeen,				12	0	4
Printing,	£7	10	3			
Advertising,	0	10	0			
Other Outlays,	4	0	1			
4. Expenses of Management,				110	3	7
Rent,	£3	3	6			
Auditor,	3	3	0			
Secretary and Treasurer,	65	0	0			
Advertising, Insurance, and Premium on Secretary's Bond of Caution,	4	3	1			
Postages and Miscellaneous Outlays, viz.:—						
Postage of 1901 *Transactions*, £11 12 0						
Postages of Billets of January and August meetings, General Postages, Commission on Cheques, and Petty Outlays, 23 2 0						
	34	14	0			
	£110	3	7			
5. Sum transferred to Capital to meet price of Stock bought,				187	1	11
6. Balance of Revenue carried to next year (being sum in National Bank of Scotland, Limited), (*a*) £329 on Deposit Receipt, and (*b*) 3s. 11d. on Current Account, subject to payment of cost and postage of 1902 *Transactions*,				329	3	11
				£684	1	10

EDINBURGH, 16*th January* 1903.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1902, of which the foregoing 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 E.

Office-Bearers for 1903:—

PRESIDENT.

W. Steuart Fothringham of Murthly, Perthshire.

VICE-PRESIDENTS.

James Cook, Estate Office, Arniston, Gorebridge.
The Right Hon. Lord Lovat, Beaufort Castle, Beauly.
John Methven, Nurseryman, 15 Princes Street, Edinburgh.
The Right Hon. the Earl of Mansfield, Scone Palace, Perth.
Alexander Pitcaithley, Forester, Jeanie Bank, Scone.

COUNCIL.

G. U. Macdonald, Forester, Raith, Kirkcaldy.
George Mackinnon, Overseer, Melville Castle, Lasswade.
John Boyd, Forester, Pollok Estate, Pollokshaws, Glasgow.
James Forgan, Forester, Bonskeid, Pitlochry.
D. P. Laird, Nurseryman, Pinkhill, Murrayfield.
William Mackinnon, Nurseryman, 144 Princes Street, Edinburgh.
Charles Buchanan, Overseer, Penicuik Estate, Penicuik.
John Hay, Overseer, Dollars Estate, 2 The Glebe, Riccarton, Kilmarnock.
George Leven, Forester, Auchencruive, St Quivox, Ayr.
Sir Kenneth J. Mackenzie, Bart. of Gairloch, 10 Moray Place, Edinburgh.
Sir John Stirling Maxwell, Bart. of Pollok, Pollokshaws.
A. D. Richardson, 7 West Catherine Place, Edinburgh.
Edward P. Tennant, Yr., of The Glen, 31 Lennox Gardens, London, S.W.
John Annand, Overseer, Haystoun Estate, Peebles.
Colin Chisholm, Forester, Lundin and Montrave Estates, Hattonlaw, Lundin Links.
James Crabbe, Forester, Glamis, Forfarshire.
Robert Forbes, Estate Office, Kennet, Alloa.
A. T. Gillanders, F.E.S., Forester, Park Cottage, Alnwick, Northumberland.
John W. M'Hattie, Superintendent of City Parks, City Chambers, Edinburgh.
D. F. Mackenzie, F.S.I., Estate Office, Mortonhall, Midlothian.
W. H. Massie, Nurseryman, 1 Waterloo Place, Edinburgh.

HON. SECRETARY.

R. C. Munro Ferguson, M.P., of Raith and Novar, Raith House, Kirkcaldy.

HON. EDITOR.

Colonel F. Bailey, R.E., University Lecturer on Forestry, 7 Drummond Place, Edinburgh.

SECRETARY AND TREASURER.

ROBERT GALLOWAY, S.S.C., 5 St Andrew Square, Edinburgh.

AUDITOR.

JOHN T. WATSON, 16 St Andrew Square, Edinburgh.

JUDGES AND TRANSACTIONS COMMITTEE.

Colonel BAILEY, R.E., University Lecturer on Forestry (*Convener*).
JOHN METHVEN, Nurseryman, Edinburgh.
JOHN MICHIE, Factor, Balmoral.
JOHN CLARK, Forester, Haddo House, Aberdeen.
ROBERT LINDSAY, Kaimes Lodge, Murrayfield.
A. C. FORBES, Wood Manager, Longleat, Warminster.
ROBERT GALLOWAY, S.S.C., *Secretary*, 5 St Andrew Square, Edinburgh, *ex officio*.

HONORARY CONSULTING SCIENTISTS.

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

Consulting Chemist.—ANDREW PEEBLES AITKEN, M.A., Sc.D., Professor of Chemistry, Veterinary College, Clyde Street, Edinburgh.

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

Consulting Entomologist.—ROBERT STEWART MACDOUGALL, M.A., D.Sc., Professor of Entomology, etc., New Veterinary College, Edinburgh.

Consulting Geologist.—JOHN SMITH FLETT, M.A., B.Sc., M.B., C.M., Geological Survey, 28 Jermyn Street, London, S.W.

Consulting Meteorologist.—ROBERT COCKBURN MOSSMAN, F.R.S.E., F.R.Met.Soc., 10 Blacket Place, Edinburgh.

TRUSTEES.

The EARL OF MANSFIELD, R. C. MUNRO FERGUSON, M.P., and W. STEUART FOTHRINGHAM of Murthly.

LOCAL SECRETARIES.

Scotland.

Counties.	
Aberdeen, .	JOHN CLARK, Forester, Haddo House, Aberdeen.
	JOHN MICHIE, Factor, Balmoral, Ballater.
Argyle, . .	WALTER ELLIOT, Manager, Ardtornish.
	JOHN D. SUTHERLAND, Estate Agent, Oban.
Ayr, . .	ANDREW D. PAGE, Overseer, Culzean, Maybole.
	A. B. ROBERTSON, Forester, The Dean, Kilmarnock.
Banff, . .	JOHN BRYDON, Forester, Rothes, Elgin.
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.
	JOHN HAYES, Dormont Grange, Lockerbie.
	JOHN NEWBIGGING, Nurseryman, Dumfries.
East Lothian, .	W. S. CURR, Factor, Ninewar, Prestonkirk.
Fife, . .	WM. GILCHRIST, Kemback Sawmills, Cupar.
	EDMUND SANG, Nurseryman, Kirkcaldy.
Forfar, . .	R. CAIRNS, The Gardens, Balruddery, near Dundee.
	JAMES CRABBE, Forester, Glamis.
	JAMES ROBERTSON, Forester, Panmure House, Carnoustie.
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.
Peebles, . .	* * * * * * * *
Perth, . .	W. HARROWER, Forester, Tomnacroich, Garth, Aberfeldy.
	W. A. MACKENZIE, Factor, Faskally, Pitlochry.
	ALEX. PITCAITHLEY, Jeanie Bank, Old Scone, 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, .	JAMES F. HARDIE, Factor, Skibo Castle, Dornoch.
	DONALD ROBERTSON, Forester, Dunrobin, Golspie.
West Lothian,	JAMES SMITH, Hopetoun Gardens, South Queensferry.
Wigtown, .	JAMES HOGARTH, Forester, Culhorn, Stranraer.
	H. H. WALKER, Monreith Estate Office, Whauphill.

England.

Counties.	
Beds,	JOHN ALEXANDER, 43 Ampthill Street, Bedford.
	FRANCIS MITCHELL, Forester, Woburn.
Berks,	W. STORIE, Whitway House, Newbury.
Bucks,	JAMES SMITH, The Gardens, Mentmore, Leighton-Buzzard.
Cheshire,	WM. ELDER, Cholmondeley Park, near Malpas.
Derby,	THOMAS DOW, Belvedere Road, Woodville, Burton-on-Trent.
Devon,	JAMES BARRIE, Forester, Stevenstone Estate, Torrington.
	WM. STORIE, Forester, Gulworthy, Tavistock.
Gloucester,	GEORGE HANNAH, Over House, Over Almondsbury, Bristol.
Hants,	ANDREW SLATER, Estate Office, Osborne, Cowes, Isle of Wight.
Herts,	JAMES BARTON, Forester, Hatfield.
	THOMAS SMITH, Overseer, Tring Park, Wiggington, 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.
	GEORGE CADELL, c/o The Secretary, Surveyor's Institution, 12 Great George Street, Westminster, S.W.
Norfolk,	JAMES RODGER, Forester, Morton Hall, Ringland, Norwich.
Northumberland,	JOHN DAVIDSON, *Secretary*, English Arboricultural Society, Haydon-Bridge-on-Tyne.
Notts,	W. MICHIE, Forester, Welbeck, Worksop.
	WILSON TOMLINSON, Forester, Clumber Park, Worksop.
Salop,	FRANK HULL, Forester, Lillieshall, Newport.
Stafford,	ROBERT T. COLLINS, Forester, Trentham, Stoke-on-Trent.
Suffolk,	ANDREW BOA, junior, Agent, Great Thurlow.
Surrey,	PHILIP PEEBLES, Estate Office, Albury, Guildford.
Warwick,	A. D. CHRISTIE, The Gardens, Ragley Hall, Alcester.
Wilts,	A. C. FORBES, Wood Manager, Longleat, Warminster.
York,	WM. FORBES, Forester, Swinton, Masham.
	ADAM MAIN, Forester, Rose Cottage, Loftus.
	D. TAIT, Estate Bailiff, Owston Park, Doncaster.

Ireland.

Dublin,	JAS. WILSON, B.Sc., Royal College of Science, Dublin.
Galway,	THOMAS ROBERTSON, Forester and Bailiff, Woodlawn.
Kildare,	ROBERT M'KERROW, Manager, Carton, Maynooth.
Kilkenny,	ALEX. M'RAE, Forester, Castlecomer.
King's County,	ARCH. HENDERSON, Forester, Clonad Cottage, Tullamore.
Tipperary,	DAVID G. CROSS, Forester, Kylisk, Nenagh.
Wicklow,	ADAM JOHNSTONE, Forester, Coollattin, Shillelagh.

PHOTOGRAPHIC ARTIST.

A. D. RICHARDSON, 7 West Catherine Place, Edinburgh.

APPENDIX F.

List of Presentations to the Society's Library during the year 1902.

1. *A Manual of Indian Timbers.* By J. S. Gamble, M.A., C.I.E., &c. New and Revised Edition.
2. *Wood: a Manual of the Natural History and Industrial Applications of the Timbers of Commerce.* By Prof. G. S. Boulger.
3. *Timber.* Translated from the French of Paul Charpentier.
4. *Utilisation of Wood Waste.* Translated from the German of J. E. Hubbard by M. J. Salter, F.I.C., F.C.S.
5. *Official Year Book, New Zealand,* 1901.
6. *Transactions of the Highland and Agricultural Society of Scotland,* 5th series, vol. xiv., 1902.
7. *Journal of the Royal Agricultural Society of England,* vol. lxii.
8. *The Country Gentlemen's Estate Book,* 1902.
9. From the Korsnäs Sägverks Aktiebolag:—
   Bidrag till Gefle Stads Historia och Berkrifning af Oskar Fyhrvall. Gefle, 1901. Official Handbook to the Exhibition and Town.
10. *Reports of the Conservators of Forests, Cape of Good Hope,* Year 1900.
11. *Annual Report, Forest Department of Madras Presidency,* 1900-1901.
12. *Report of the Superintendent of Forestry for Canada,* 1901.
13. *New Zealand Timbers and Forest Products.* Compiled by Sir W. B. Percival, K.C.M.G.
14. *Reports of Conservator of Forests for South Australia,* for Years 1889-90 to 1901-02.
15. *Reports of the Department of Lands and Surveys, New Zealand,* 1897-98 to 1900-01.
16. *Transactions of the English Arboricultural Society,* vol. v., part 1; vol. i., part 6; and vol. iv., part 1.
17. *Journal of the Royal Horticultural Society of England,* vol. xxvi., part 4; vol. xxvii., part 1.
18. From the Royal Dublin Society:—
    Transactions, vols. i. to vi.; vol. vii., parts 1 to 13.
    Proceedings, vols. i. to viii.; vol. ix., parts 1 to 4.
    Economic Proceedings, vol. i., parts 1 and 2. General Index.
19. *Transactions of the Massachusetts Horticultural Society,* 1901, parts 1 and 2.
20. *Journal of Agriculture of Victoria.* Monthly.
21. *Report of the Secretary for Agriculture, Nova Scotia,* 1901.
22. *Agricultural Returns,* 1901.
23. From the Department of Agriculture, Victoria:—
    Bulletin No. 1. *Impressions of Victoria from an Agricultural Point of View.* By S. W. Wallace.
    Bulletin No. 2. *Treatment of Vintage by Diffusion.* By Pierre Andrien.
    Bulletin No. 3. *Black Spots on the Apple, and Spraying for Fungus Diseases.* By D. M'Alpine.
    Bulletin No. 4. *Review of the past Butter Season.* By R. Crowe.

24. *Quistione Arborea.* By Dr Luigi Savastano, Royal School of Agriculture. In Portici.
25. *Annual Report of the Ohio State University,* 1901, parts 1 and 2.
26. *Forestry and Irrigation.* Monthly Magazine of the American Forestry Association.
27. *Fungus Diseases of the Stone Fruit Trees in Australia.* By D. M'Alpine, Government Vegetable Pathologist.
28. *The Field Naturalists' Quarterly,* vol i., No. 1.
29. *Webster's Foresters' Diary and Pocket Book,* 1903.
30. From the Lloyd Library, Cincinnati, Ohio:—
    Bulletin No. 1. *Collections for an Essay towards a Materia Medica.* By B. S. Barton. Reproduction Series, No. 1.
    Bulletin No. 2. *The Indian Doctors' Dispensatory.* By Peter Smith. Reproduction Series, No. 2.
    Bulletin No. 3. *The Genera of Gastromycetes.* By C. G. Lloyd. Mycological Series, No. 1.
    Bulletin No 4. *References to Capillarity to the end of* 1900. By J. N. Lloyd. Pharmacy Series, No. 1.
    Bulletin No. 5. *The Geastræ.* By C. G. Lloyd. Mycological Series, No. 2.
    Mycological Notes. By C. G. Lloyd. Nos 5, 6, 7, 8, and 9.
31. *Some European Forest Scenes.* By Dr John Gifford. A Reprint.
32. *New or Little Known North American Trees,* No. 4. By Prof. C. L. Sargent. A Reprint.
33. *The Utilisation of Waterworks' Gathering Grounds by Afforestation.* By W. B. Crump, M.A., and Wm. G. Smith, B.Sc., Ph.D. A Reprint.
34. *A Botanical Survey of Scotland.* By Wm. G. Smith, B.Sc., Ph.D. A Reprint.

Royal Scottish Arboricultural Society.

INSTITUTED 16th FEBRUARY 1854.

PATRON—HIS MOST EXCELLENT MAJESTY THE KING.

PRESIDENT.

W. STEUART FOTHRINGHAM of Murthly, Perthshire.

1.—FORMER PRESIDENTS.

YEAR.

1854. JAMES BROWN, Deputy-Surveyor of the Royal Forest of Dean.
1855. Ditto, Wood Commissioner to the Earl of Seafield.
1856. Ditto, ditto.
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 ATHOLE.
1861. JOHN J. CHALMERS of Aldbar.
1862. The Right Hon. THE EARL OF AIRLIE.
1863. The Right Hon. T. F. KENNEDY.
1864. ROBERT HUTCHISON of Carlowrie, F.R.S.E.
1865. Ditto, ditto.
1866. Ditto, ditto.
1867. Ditto, ditto.
1868. Ditto, ditto.
1869. Ditto, ditto.
1870. Ditto, ditto.
1871. Ditto, ditto.
1872. HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie.
1873. Ditto, ditto.
1874. JOHN HUTTON BALFOUR, M.D., M.A., F.R.SS. L. & E., Professor of Botany in the University of Edinburgh.
1875. Ditto, ditto.
1876. The Right Hon. W. P. ADAM of Blairadam, M.P.
1877. Ditto, ditto.
1878. Ditto, ditto.
1879. The Most Hon. THE MARQUESS OF LOTHIAN, K.T.
1880. Ditto, ditto.
1881. Ditto, ditto.
1882. ALEXANDER DICKSON, M.D., F.R.S.E., of Hartree, Regius Professor of Botany in the University of Edinburgh.

YEAR.

1883. HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie.
1884. Ditto, ditto.
1885. Ditto, ditto.
1886. The Right Hon. Sir HERBERT EUSTACE MAXWELL, Bart. of Monreith, M.P.
1887. Ditto, ditto.
1888. The Right Hon. THE MARQUESS OF LINLITHGOW, Hopetoun House, South Queensferry.
1889. Ditto, ditto.
1890. ISAAC BAYLEY BALFOUR, M.D., Sc.D., F.R.S., Professor of Botany in the University of Edinburgh.
1891. Ditto, ditto.
1892. Ditto, ditto.
1893. Ditto, ditto.
1894. R. C. MUNRO FERGUSON, M.P., of Raith and Novar.
1895. Ditto, ditto.
1896. Ditto, ditto.
1897. Ditto, ditto.
1898. Colonel F. BAILEY, R.E. (retired), F.R.S.E., Lecturer on Forestry, University of Edinburgh.
1899. The Right Hon. THE EARL OF MANSFIELD.
1900. Ditto, ditto.
1901. Ditto, ditto.
1902. Ditto, ditto.

2.—LIST OF MEMBERS.

Corrected to March 1903.

HONORARY MEMBERS.

Date of Election.

1886. AVEBURY, The Right Hon. Baron, D.C.L., High Elms, Down, Kent.
1873. BRANDIS, Sir Dietrich, K.C.I.E., Ph.D., *Ex*-Inspector General of Forests in India, Bonn, Germany.
1886. CAMPBELL, Sir James, Bart. of Aberuchill, Redhill, Lydney, Gloucestershire.
1901. GAMBLE, J. Sykes, C.I.E., F.R.S., M.A., ex-Director of the Indian Forest School, Highfield, East Liss, Hants.
1886. HOOKER, Sir Joseph D., M.D., K.C.S.I., The Camp, Sunningdale, Berks.
1886. JOHORE, The Maharajah of, Johore, Malay Peninsula.
1894. LOGAN, Sir Charles B., W.S., 23 Queen Street, Edinburgh.
1901. MENZIES, Sir Robert, Bart. of that Ilk, Castle Menzies, Aberfeldy.
1886. MICHAEL, General, C.S.I., Bangor Lodge, Ascot, Berkshire.
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.

Date of Election.

1889. SCHLICH, Dr William, Professor of Forestry in the Engineering College for India, Coopers Hill, Surrey.
1895. SCHWAPPACH, Dr Adam, Professor of Forestry, Eberswalde, Prussia.
1886. TAKEI, Morimasa, 58 Mikumicho, Ushima, Tokio, Japan.

HONORARY ASSOCIATE MEMBERS.

Date of Election.

1901. BRUCE, William, College of Agriculture, India Buildings, Edinburgh.
1901. CROMBIE, T. Alexander, Forester, Colesborne, Cheltenham, Gloucestershire.
1902. GILBERT, W. Matthews, The *Scotsman* Office, Edinburgh.
1902. SMITH, Fred., Highfield Mount, Brook Street, Macclesfield.
1901. STORY, Fraser, Assistant Factor, The Glen, Innerleithen.
1901. USHER, Thomas, Courthill, Hawick.

LIFE MEMBERS.

Date of Election.

1883. ADAM, Sir Charles Elphinstone, Bart. of Blairadam, 5 New Square, Lincoln's Inn, London, W.C.
1874. ADDINGTON, The Right Hon. Lord, Addington Manor, Winslow, Bucks.
1883. ALEXANDER, John, Elephants Nook, 43 Ampthill Street, Bedford.
1883. ATHOLE, His Grace the Duke of, K.T., Blair Castle, Blair Athole.
1887. BAILEY, Colonel F., R.E., F.R.S.E., Lecturer on Forestry, Edinburgh University, 7 Drummond Place, Edinburgh.
1896. BAIRD, J. G. A., M.P., of Adamton, 89 Eaton Square, London, S.W.
1884. BALFOUR OF BURLEIGH, The Right Hon. Lord, K.T., Secretary for Scotland, Kennet House, Alloa.
1900. BALFOUR, Charles B., of Newton Don, Kelso.
1886. BALFOUR, Edward, of Balbirnie, Markinch, Fife.
1877. BALFOUR, Isaac Bayley, LL.D., Sc.D., M.D., F.L.S., Professor of Botany, Edinburgh.
1866. BARRIE, James, Forester, Stevenstone, Torrington, North Devon.
1889. BARRON, John, Elvaston Nurseries, Borrowash, Derby.
1877. BARRY, John W., of Fyling Hall, Fylingdales, Scarborough, Yorks.
1871. BAXTER, Robert, Forester, Dalkeith Park, Dalkeith.
1897. BEGG, James, The Gardens, Lanrick Castle, Doune, Perthshire.
1871. BELL, William, of Gribdae, 293 Lordship Lane, London, S.E.
1897. BLACK, Alexander, The Gardens, Carton, Maynooth, Co. Kildare.
1877. BOLCKOW, C. F. H., of Brackenhoe, Marton Hall, Marton R.S.O., Yorks
1895. BOORD, W. Bertram, Land Agent, Bewerley, Pateley Bridge, Yorks.
1857. BORTHWICK, Wm., Forester, Dunnichen, Forfar.
1902. BRAID, William Wilson, Tossville, 12 Milton Road, Craigmillar Park, Edinburgh.
1900. BROWN, Charles, Factor, Kerse, Falkirk.
1896. BROWN, Rev. W. Wallace, Minister of Alness, Ross-shire.

Date of Election.

1867. Bruce, Thomas Rae, Old Garroch, New Galloway.
1873. Brydon, John, Forester, Rothes, Elgin.
1879. Buccleuch, His Grace the Duke of, K.T., Dalkeith Palace, Dalkeith.
1879. Buchanan, Charles, Overseer, Penicuik Estate, Penicuik.

1897. Campbell, James Arthur, Arduaine, Lochgilphead, Argyleshire.
1903. Capel, James Carnegy, 34 Roland Gardens, London, S.W.
1896. Carmichael, Sir Thos. D. Gibson, Bart. of Castlecraig, Malen House, Balerno.
1882. Chowler, Christopher, Gamekeeper, Dalkeith Park, Dalkeith.
1883. Christie, William, Nurseryman, Fochabers.
1872. Clerk, Sir George D., Bart. of Penicuik, Midlothian.
1898. Coats, Sir Thomas Glen, Bart., Ferguslie Park, Paisley.
1879. *Colquhoun, Andrew, 75 Buchanan Street, Glasgow.*
1887. Cook, James, Land Steward, Arniston, Gorebridge, Midlothian.
1897. Coupar, Wm., Overseer, Balgowan, Perthshire.
1876. Cowan, Charles W., of Logan House, Valleyfield, Penicuik.
1892. Cowan, George, 1 Gillsland Road, Edinburgh.
1874. Cowper, R. W., Gortanore, Sittingbourne, Kent.
1901. Craig, Sir James H. Gibson, Bart. of Riccarton, Currie.
1875. Craig, Wm., M.D., C.M., F.R.S.E., 71 Bruntsfield Place, Edinburgh.
1898. Crawford, Francis C., 19 Royal Terrace, Edinburgh.
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.
1901. Cunningham, Captain John, Leithen Lodge, Innerleithen.
1893. Curr, W. S., Factor, Ninewar, Prestonkirk.
1884. Currie, Sir Donald, K.C.M.G., M.P., of Garth Castle, Aberfeldy.

1867. Dalgleish, John G., of Ardnamurchan, Brankston Grange, Stirling.
1876. Dalgleish, Laurence, of Dalbeath, Rutland Square, Edinburgh.
1900. Dalhousie, The Right Hon. the Earl of, Brechin Castle, Forfarshire.
1892. Davidson, William, Forester, Margam Park, Port Talbot, Wales.
1901. Dewar, John A., M.P., Perth.
1898. Digby, The Right Hon. Baron, Minterne, Cerne, Dorsetshire.
1896. Douglas, Alex., Abbey Gardens, Wykeham R.S.O., Yorks.
1883. Dundas, Charles H., of Dunira, Dalchonzie, Crieff, Perthshire.
1872. Dundas, Sir Robert, Bart. of Arniston, Gorebridge, Midlothian.
1895. Dundas, Lieut.-Colonel Robert, Yr. of Arniston, Kirkhill, Gorebridge.
1902. Durham, Right Hon. the Earl of, Lambton Castle, Durham.

1876. Edwards, William Peacock, S.S.C., 21 Hill Street, Edinburgh.
1881. Elliot, Walter, Manager, Ardtornish, Morvern, Oban, Argyle.
1899. Ellison, Francis B., Bragleenbeg, Kilninver, Oban.

1879. Falconer, Dr John, St Ann's, Lasswade, Midlothian.
1900. Ferguson, James Alex., Ardnitb, Partickhill, Glasgow.
1888. Ferguson, R. C. Munro, M.P., of Raith and Novar, Raith, Fife.

Date of Election.

1901. FINDLAY, John Ritchie, of Aberlour, Aberlour House, Aberlour.
1902. FITZWILLIAM, Right Hon. the Earl of, Wentworth, Rotherham.
1881. FORBES, Arthur Drummond, Millearne, Auchterarder, Perthshire.
1896. FORBES, James, The Gardens, Overtown, Dumbartonshire.
1878. FORBES, Robert, Estate Office, Kennet, Alloa.
1873. FORBES, William, Forester, Swinton, Masham, Yorkshire.
1869. FORGAN, James, Forester, Bonskeid, Pitlochry, Perthshire.
1897. FOTHRINGHAM, W. Steuart, of Murthly, Perthshire.
1866. FRANCE, Charles S., 7 Belmont Place, Aberdeen.
1901. FRASER, Alexander, Solicitor and Factor, 63 Church Street, Inverness.
1892. FRASER, George, Factor, Dalzell, Motherwell, Lanarkshire.
1892. FRASER, Simon, Land Agent, Hutton in the Forest, Penrith.

1893. GALLOWAY, Robert, S.S.C., *Secretary*, 48 Castle Street, Edinburgh.
1899. GARRIOCH, John E., Factor, Lovat Estates, Beauly.
1903. GASCOIGNE, Lieut.-Col. Richard French, D.S.O., Craignish Castle, Ardfern, Argyleshire.
1881. GILCHRIST, Wm., Kemback Saw-mills, Cupar.
1900. GLADSTONE, Sir John R., Bart. of Fasque, Laurencekirk.
1901. GODMAN, Hubert, Land Agent, Ginsborough, Yorkshire.
1868. GOSSIP, James A., of Howden & Co., The Nurseries, Inverness.
1897. GOUGH, Reginald, Forester, Wykeham, York.
1884. GRAHAM, Wm., 6 Royal Crescent, W., Glasgow.
1874. GRANT, John, Overseer, Daldowie, Tollcross, Glasgow.
1880. GRANT, Sir George Macpherson, Bart., Ballindalloch Castle, Banffshire.

1900. HALDANE, William S., of Foswell, W.S., 55 Melville Street, Edinburgh.
1882. HAMILTON, Donald C., Forester, Knowsley, Prescot.
1899. HAMILTON, The Right Hon. Baron, of Dalzell, Dalzell House, Motherwell.
1903. HARDIE, David, Factor, Errol Park, Errol.
1880. HARE, Colonel, Blairlogie, Stirling.
1880. HAVELOCK, W. B., The Nurseries, Brocklesby Park, Lincolnshire.
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.
1902. HOOD, Thomas, Land Agent, Birdbrook, Halstead, Essex.
1871. HOPE, H. W., of Luffness, Drem, Haddingtonshire.
1876. HORNE, John, Director, Forests and Gardens, Mauritius.
1876. HORSBURGH, John, Aberdour House, Aberdour, Fife.
1869. HUTH, Louis, of Possingworth, Hawkhurst, Sussex.

1884. *Inglis, Alex., Greenlaw Dean, Greenlaw, Berwickshire.*

1901. JOHNSTON, James, F.S.I., Factor, Alloway Cottage, Ayr.
1883. JOHNSTON, Robert, Forester, Bon Ryl Estate, Duns, Berwickshire.
1882. JONAS, Henry, Land Agent and Surveyor, 23 Pall Mall, London, S.W.

1870. KEIR, David, Forester, Ladywell, Dunkeld, Perthshire.
1901. KENNEDY, Frederick D. C.-Shaw-, Dyroch, Maybole.

Date of Election.

1890. KENNEDY, James, Doonholm, Ayr.
1892. KERR, John, Farmer, Barney Mains, Haddington.
1898. KINROSS, John, Architect, 2 Abercromby Place, Edinburgh.
1902. KIPPEN, William James, Advocate, B.A., LL.B., Westerton, Balloch, Dumbartonshire.

1890. LAIRD, David P., Nurseryman, Pinkhill, Murrayfield, Edinburgh.
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.
1896. LANSDOWNE, The Most Hon. the Marquess of, K.G., 54 Berkeley Square, London, S.W.
1876. LEICESTER, The Right Hon. the Earl of, Holkham Hall, Wells, Norfolk.
1868. LESLIE, Charles P., of Castle-Leslie, Glaslough, Ireland.
1874. LESLIE, The Hon. George Waldegrave, Leslie House, Leslie, Fife.
1893. LEVEN, George, Forester, Auchencruive, Ayr.
1881. LEYLAND, Christopher, Haggerston Castle, Beal, Northumberland.
1883. LONEY, Peter, Estate Agent, 6 Carlton Street, Edinburgh.
1881. LONSDALE, Claud, Rose Hill, Carlisle.
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.
1900. LOW, William, B.Sc., Tighnamuirn, Monifieth.
1891. LUMSDEN, Hugh Gordon, of Clova, Lumsden, Aberdeenshire.
1875. LUTTRELL, George F., of Dunster Castle, Taunton, Somersetshire.
1900. LYELL, Sir Leonard, Bart. of Kinnordy, Kirriemuir.

1901. M'CALLUM, Thomas W., Retired Ground Officer, Dailly, Ayrshire.
1870. M'CORQUODALE, D. A., Bank of Scotland, Carnoustie, Forfarshire.
1900. MACDONALD, Harry L., of Dunach, Oban.
1894. MACDONALD, James, Forester, Kinnaird Castle, Brechin.
1874. MACDONALD, Ranald, Factor, Cluny Castle, Aberdeenshire.
1895. MACDOUGALL, Professor Robert Stewart, M.A., D.Sc., New Veterinary College, Edinburgh.
1884. MACDUFF, Alex., of Bonhard, Perth.
1901. M'GIBBON, Donald, Forester, Hawthornden.
1902. MACGREGOR, Alasdair Ronald, Edinchip, Lochearnhead.
1885. MACINTOSH, William, Fife Estates Office, Banff.
1879. M'INTOSH, Dr W. C., Professor of Natural History, University of St Andrews, 2 Abbotsford Crescent, St Andrews.
1872. MACKENZIE, Donald F., F.S.I., Estate Office, Mortonhall, Edinburgh.
1893. MACKENZIE, James, Forester, Cullen House, Cullen.
1897. M'KERROW, Robert, Manager, Carton, Maynooth, Co. Kildare.
1898. MACKINNON, A., The Gardens, Scone Palace, Perth.
1895. MACLACHLAN, John, of Maclachlan, 12 Abercromby Place, Edinburgh.
1879. M'LAREN, John, 12 Findhorn Place, Edinburgh.

Date of Election.

1898. M'Laren, John, Gardener, Ballencrieff, Drem, East Lothian.
1898. Maclean, Archibald Douglas, J.P., Harmony, Balerno.
1899. Macrae-Gilstrap, Major John, of Ballimore, Otter Ferry, Argyleshire.
1879. MacRitchie, David, C.A., 4 Archibald Place, Edinburgh.
1880. Malcolm, Lieut.-Col. E.D., R.E., Achnamara, Lochgilphead.
1895. Mann, Charles, Merchant, Lumsden, Aberdeenshire.
1896. Mansfield, The Right Hon. the Earl of, Scone Palace, Perth.
1895. Margerison, Samuel, English Timber Merchant, Calverley, near Leeds.
1901. Marshall, Archd. M'Lean, Estate Office, Portpatrick, Wigtown.
1876. Martin, James, Forester, Knipton, Grantham, Lincolnshire.
1884. Massie, W. H., of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1894. Maughan, John, Estate Agent, Jervaulx Abbey, Middleham R.S.O., Yorks.
1893. Maxwell, Sir John Stirling, Bart. of Pollok, Pollokshaws.
1879. Meikle, R. A., Ri Cruin, Lochgilphead, Argyleshire.
1880. Mesham, Captain, Pontryffydd, Bodvari, Rhyl, Denbighshire.
1881. Michie, John, Factor, Balmoral, Ballater, Aberdeenshire.
1896. Miller, Sir James Percy, Bart. of Manderston, D.S.O., Duns, Berwickshire.
1892. Milne, J. K., Kevock Tower, Lasswade, Midlothian.
1897. Milne-Home, J. Hepburn, Caldra, Duns, Berwickshire.
1882. Mitchell, Francis, Forester, Woburn, Beds.
1902. Mitchell, John, jun., Timber Merchant, Leith Walk Saw-mills, Leith.
1895. Moncreiffe, Sir Robert D., Bart. of Moncreiffe, Perth.
1897. Morgan, Alex., Timber Merchant, Crieff, Perthshire.
1899. Morgan, Andrew, Assistant Factor, Glamis.
1895. Morgan, Malcolm, Timber Merchant, Crieff, Perthshire.
1902. Munro, Hugh Thomas, Lindertis, Kirriemuir.
1898. Murray, Hon. Alan David, Scone Palace, Perth.
1896. Murray, William Hugh, W.S., 48 Castle Street, Edinburgh.

1899. Nairn, Michael B., of Rankeillour, Manufacturer, Kirkcaldy.
1901. Nicolson, Edward Badenach, Advocate, 4 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.Sc., Department of Agriculture, Cape Town.

1894. Orkney, William C., Surveyor's Office, Montrose Royal Asylum.
1899. Orr-Ewing, Archibald Ernest, Ballikinrain Castle, Balfron.
1902. Orr-Ewing, Charles Lindsay, M.P., Dunskey, Portpatrick, Wigtownshire.

1879. Paton, Hugh, Nurseryman, Kilmarnock, Ayrshire.
1898. Paton, Robert Johnston, Nurseryman, Kilmarnock.
1902. Paton, Tom W., Nurseryman, Kilmarnock.
1900. Perrins, C. W. Dyson, of Ardross, Ardross Castle, Alness.
1897. Philip, Alexander, Solicitor, Brechin, Forfarshire.

Date of Election.

1878. PITCAITHLEY, Alexander, Forester, Jeanie Bank, Scone.
1896. PITMAN, Archibald Robert Craufurd, W.S., 48 Castle Street, Edinburgh.
1856. PORTSMOUTH, The Right Hon. the Earl of, Eggesford, North Devon.
1878. PUNCHARD, Frederick, Underley Estate Office, Kirkby Lonsdale, Westmoreland.

1876. RAE, William A., Factor, Murthly Castle, Perthshire.
1855. RAMSDEN, Sir John, Bart., Byrom Hall, Ferrybridge, Normanton.
1873. RICHARDSON, Adam D., 7 West Catherine Place, Edinburgh.
1876. RITCHIE, William, Dalawoodie, Dumfries.
1897. ROBERTSON, A. Barnett, Forester, The Dean, Kilmarnock, Ayrshire.
1879. ROBERTSON, Donald, Forester, Dunrobin, Golspie.
1866. ROBERTSON, Jas., Wood Manager, Panmure, Carnoustie, Forfarshire.
1890. ROBINSON, William, Gravetye Manor, East Grinstead, Sussex.
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.

1894. SANDERSON, Wm., Talbot House, Ferry Road, Leith.
1867. SCOTT, Daniel, Wood Manager, Darnaway, Forres.
1902 SCRIMGEOUR, James, Gardener, Manor House, Donaghadee.
1890. SCRIMGEOUR, John, Overseer, Doune Lodge, Doune.
1896. SHAW-STEWART, Michael Hugh, M.P., of Carnock, Larbert, Stirlingshire.
1898. SHEPPARD, Rev. H. A. Graham-, of Rednock, Port of Menteith, Stirling.
1893. SMITH, Charles G., Factor, Haddo House, Aberdeen.
1895. SMITH, Thomas, Overseer, The Nursery, Tring Park, Wiggington, Tring, Herts.
1877. SMITH, Thomas Valentine, of Ardtornish, Morvern, Argyleshire.
1896. SMITH, William G., Ph.D., Professor, Yorkshire College, Leeds.
1882. SMYTHE, David M., of Methven Castle, Perth.
1893. SMYTHE, Francis Henry, Strathearn, Nottingham Road, Natal.
1889. SOMERVILLE, Dr William, M.A., D.Sc., D.Œc., F.R.S.E., Board of Agriculture, 4 Whitehall Place, London, S.W.
1883. SPROT, Major Alexander, of Garnkirk, Chryston, Glasgow.
1873. STAIR, The Right Hon. the Earl of, Lochinch, Castle Kennedy, Wigtownshire.
1899. STEWART, Duncan D., Factor, Rossie Estate, Inchture.
1892. STEWART, Sir Mark J. M'Taggart, Bart., M.P., of Southwick, Kirkcudbrightshire.
1880. SUTHERLAND, Evan C., Highland Club, Inverness.
1883. SUTHERLAND, His Grace the Duke of, K.G., Dunrobin Castle, Golspie.

1865. TALBERT, Peter, Forester, David Street, Blairgowrie, Perthshire.
1891. TENNANT, Edward P., 31 Lennox Gardens, London, S.W.
1877. TERRIS, James, Factor, Dullomuir, Blairadam, Kinross-shire.
1855. THOMSON, John Grant, Wood Manager, Grantown, Strathspey.
1902. THOMSON, Peter Murray, S.S.C., 5 York Place, Edinburgh.

Date of Election.

1901. THOMSON, Spencer Campbell, of Eilean Shona, 10 Eglinton Crescent, Edinburgh.
1871. TOMLINSON, Wilson, Forester, Clumber Park, Worksop, Notts.
1902. TREFUSIS, Hon. C. Forbes, Fettercairn House, Fettercairn.
1902. TROTTER, A. E. C., of Bush, Milton Bridge, Midlothian.
1883. TROTTER, Major-General H., of Mortonhall, Edinburgh.
1903. TULLIBARDINE, The Marquis of, Blair Castle, Blair Athole.

1872. URQUHART, B. C., of Meldrum, Aberdeenshire.
1902. URQUHART, Farquhar, Nurseryman, Inverness.

1878. WALKER, Colonel I. Campbell, Newlands, Camberley, Surrey.
1897. WALLACE, John A. A., of Lochryan, Cairnryan, Stranraer.
1900. WARWICK, Charles, Land Steward, Clandeboye, Co. Down.
1893. WATSON, John T., 6 Bruntsfield Gardens, Edinburgh.
1891. WELSH, James, of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1871. WEMYSS, Randolph Gordon Erskine, of Wemyss and Torrie, Fife.
1898. WHITE, J. Martin, Balruddery, near Dundee.
1899. WHYTE, John D. B., Factor, Castlecraig, Dolphinton.
1869. WILD, Albert Edward, Conservator of Forests, Darjeeling, India.
1898. WILSON, David, Timber Merchant, Troon, Ayrshire.
1889. WILSON, David, jun., of Carbeth, Killearn, Glasgow.

1898. YOUNGER, Henry J., of Benmore and Kilmun, Greenock.
1899. YULE, Amy Frances, L.A., Tarradale House, Muir of Ord.

ORDINARY MEMBERS.

The Names printed in italics (in this and preceding list) are those of Members whose present Addresses are unknown. Any information regarding those Members will be gladly received by the Secretary.

Law V. Members in arrear shall not receive the *Transactions* while their Subscriptions remain unpaid. Any Member whose Annual Subscription to the Society remains unpaid for three years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till he shall have paid up his arrears.

Date of Election.

1895. Abbot, Thomas, Forester, Firknowe, Peebles.
1902. Acland, Sir Charles Thomas Dyke, Bart., M.A., D.L., etc., Killerton, Exeter.
1900. Adair, David Rattray, S.S.C., 24 Castle Street, Edinburgh.
1902. Ainslie, Thomas, Lynmore, Penicuik.
1900. Aitchison, John, Glenmuick Estate, near Ballater.
1902. Aitchison, William, Assistant Forester, Weirburn Cottage, Grant's House.
1878. Aitken, Andrew Peebles, M.A., Sc.D., Professor of Chemistry, Veterinary College, Clyde Street, Edinburgh.
1903. Allan, James, Wood Merchant, Bieldside, Aberdeen.
1865. Allan, John, Forester, Dalmeny Park, Edinburgh.
1898. Allaway, William, 13 St Andrew Square, Edinburgh.
1901. Anderson, Daniel, Overseer, Nisbet, Duns.
1895. *Anderson, Duncan, Assistant Agent, Hutton Estate Office, near Preston.*
1897. *Anderson, John, Forthbank,* 18 *Mentone Terrace, Edinburgh.*
1899. *Anderson, Robert, Assistant Forester, Chatsworth, Derbyshire.*
1901. Anderson, Robert, Bailiff, Phœnix Park, Dublin.
1900. Angus, Alexander, Gardener, Dalzell, Motherwell.
1887. Annand, John F., Overseer, Haystoun Estate, Woodbine Cottage, Peebles.
1899. Annandale, William, Land Steward, Kincaldrum, Forfar.
1902. Anstruther, Sir Windham Carmichael, Bart., Carmichael House, Thankerton.
1897. Armit, James, The Gardens, Heywood, Abbeyleix, Queen's Co.
1902. Armstong, John, Saughton Vale, Murrayfield.
1898. Armstrong, Thos. J. A., Factor, Glenborrodale, Salen, Fort William.
1860. Austin & M'Aslan, Nurserymen, 89 Mitchell Street, Glasgow.

1892. Ballingall, Niel, Sweet Bank, Markinch, Fife.
1898. Bannan, Andrew, Forester, Glenfarg Estate, Abernethy.
1897. Barclay, Robert Leatham, Banker, 54 Lombard Street, London, E.C.
1900. Barker, Arthur, Assistant Forester, Pollok Estate, Pollokshaws.
1903. Barnes, Nicholas F., Head Gardener, Eaton Hall, Chester.

Date of Election.

1867. Barrie, David, Forester, Comlongan Castle, Annan, Dumfries.
1895. Barrie, James Alexander, Forester, Harlestone, Northampton.
1874. Barton, James, Forester, Hatfield House, Herts.
1903. Battiscombe, E., Hinton Court, Hereford.
1899. Beatson, David J., Crown Office, Parkend, near Lydney, Gloucestershire.
1883. Bell, Andrew, Forester, Forglen, Turiff, Aberdeenshire.
1901. Bell, Andrew, Forester, Bridgend, Montgreenan, Kilwinning.
1898. Bell, David, Seed Merchant, Coburg Street, Leith.
1900. Bell, Robert, Land Steward, Baronscourt, Newtown-Stewart, Ireland.
1898. Bell, R. Fitzroy, of Temple Hall, Coldingham.
1900. Bell, William, Assistant Forester, Balthayock, Perth.
1895. Bennet, J. B., C.E., A.M.I., 12 Hill Street, Edinburgh.
1889. Berry, Francis, Forester, Minto, Hawick.
1903. Binning, The Lord, Mellerstain, Kelso.
1901. Bisset, Alexander, Assistant Forester, Altyre, Forres.
1901. Bisset, John, Wood Merchant, Maryculter, Aberdeen.
1899. Bissett, Alexander, Assistant Forester, Dunrobin, Golspie.
1854. Boa, Andrew, Great Thurlow, Suffolk.
1872. Boa, Andrew, jun., Estate Agent, Great Thurlow, Suffolk.
1892. Bond, Thomas, Forester, Lambton Park, Fence Houses, Durham.
1876. Booth, John, 39 Mozartstrasse Gross-Lichterfelde, Berlin.
1898. Borthwick, Albert W., B.Sc., Royal Botanic Garden, Edinburgh.
1898. Borthwick, Francis J. G., W.S., 9 Hill Street, Edinburgh.
1887. Boulger, Professor, 11 Onslow Road, Richmond Hill, London, S.W.
1896. Bowles, William A., The Gardens, Adare Manor, Adare, Co. Limerick.
1883. Boyd, John, Forester, Wood Cottage, Kennishead, Thornliebank.
1897. Braid, J. B., Assistant Forester, The Park, Great Witley, Stourport.
1899. Braid, Thomas, Factor, Durris, Drumoak, Aberdeenshire.
1889. Britton, Horatio A., Timber Merchant, Shrewsbury.
1900. Broom, John, Wood Merchant, Bathgate.
1896. Brown, David, Manager, Wollaton Offices, Nottingham.
1901. Brown, David, Factor, Danure, etc., Royal Bank, Maybole.
1900. Brown, Gilbert, Assistant Forester, Stormontfield, Perth.
1878. Brown, J. A. Harvie-, of Quarter, Dunipace House, Larbert.
1899. Brown, John, C.A., 10 Royal Exchange, Edinburgh.
1899. Brown, John, Forester and Ground Officer, Craighall, Rattray, Perthshire.
1898. Brown, John C., West Gardens, Abercairney, Crieff.
1893. Brown, Robert, Forester, Boiden, Luss.
1895. Brown, Walter R., Forester, Park Cottage, Heckfield, near Winchfield, Hants.
1900. Brown, William, Assistant Forester, c/o Mrs Tickle, Top Naut, Prestatyn, North Wales.
1901. Bruce, David, Forester, Ingmire Hall, Sedbergh, Yorks.
1895. Bruce, Peter, Manager, Achnacloich, Culnadalloch, by Connel.
1897. Brydon, John, Seed Merchant and Nurseryman, Darlington, Co. Durham.

Date of Election.

1873. Buchan, Alexander, A.M., F.R.S.E., LL.D., Secretary of the Scottish Meteorological Society, 42 Heriot Row, Edinburgh.
1895. Buist, Robert, Overseer, Newbyth, Prestonkirk, East Lothian.
1899. Burn-Murdoch, John, of Gartincaber, Doune.

1887. Cadell, George, National Club, 1 Whitehall Gardens, London, S.W.
1902. Cadell, Henry Moubray, of Grange and Banton, B.Sc., F.R.S.E., F.A.S., J.P., etc., Grange, Bo'ness.
1896. Cairns, Richard, The Gardens, Balruddery, near Dundee.
1896. Callander, Henry, of Prestonhall, Dalkeith.
1901. Cameron, Alex., Land Steward, Caledon Demesne, Caledon, Tyrone.
1900. Cameron, Dr James, The Fountain, Loanhead.
1902. Cameron, Ewan, of Rutherford, West Linton.
1899. Cameron, John J., Clydesdale Iron Works, Possilpark, Glasgow.
1895. Campbell, Alexander, Land Steward, Rosemill Cottage, Strathmartin, by Dundee.
1899. Campbell, Alexander, Hilton Cottage, Stanley, Perthshire.
1902. Campbell, Buchanan, W.S., 7 Lansdowne Crescent, Edinburgh.
1896. Campbell, James Alex., M.P., of Stracathro, Brechin.
1900. Campbell, James S., Assistant Forester, Luffness, Aberlady.
1894. Campbell, John, Timber Merchant, Inverness.
1902. Campbell, Lieut.-Col. J. C. L., Royal Engineers, of Achaladar, c/o Claude Ralston, Glamis.
1901. Campbell, Peter Purdie, Factor, Estate Office, Mertoun, St Boswells.
1903. Canch, Thomas Richard, B.Sc., P.A.S.I., Craigard, St Andrews.
1902. Carnegie, W. C., Land Agent, Sarsden, Chipping Norton, Oxon.
1900. *Carrie, William, Assistant Forester, Drumpelier, Coatbridge.*
1903. Carruthers, Major Francis John, of Dormont, Lockerbie.
1898. Carson, David Simpson, C.A., 209 West George Street, Glasgow.
1900. Cavers, Walter, Timber Merchant, 12 East Brighton Crescent, Portobello.
1897. Chalmers, James, Overseer, Gask, Auchterarder, Perthshire.
1898. Chalmers, James, Forester, Ayton House, Abernethy.
1898. Chalmers, Thomas, c/o Messrs Pennick & Son, Kendalston Nurseries, Delgany, Co. Wicklow.
1892. Chapman, Andrew, Breckonhill, Lockerbie, Dumfriesshire.
1892. Chapman, Mungo, Torbrix Nurseries, St Ninians, Stirling.
1901. *Charteris, John, Seedsman, 4 India Buildings, Edinburgh.*
1899. *Chirnside, Robert, Woodman, Wynyard Park, Stockton-on-Tees.*
1897. Chisholm, Colin, Forester, Lundin and Montrave Estates, Hattonlaw, Lundin Links.
1884. Christie, Alex. D., The Gardens, Ragley, Alcester, Warwickshire.
1890. Clark, Charles, Forester, Cawdor Castle, Nairn.
1902. Clark, Francis Ion, Estate Office, Haddo House, Aberdeen.
1896. *Clark, George Fraser, C.A., 24 St Andrew Square, Edinburgh.*
1891. Clark, John, Forester, Haddo House, Aberdeen.
1892. Clark, John, jun., Forester, Bawdsey, Woodbridge, Suffolk.
1892. Clark, William, 66 Queen Street, Edinburgh.

Date of Election.

1902. Clark, William, Assistant Factor, Raith, Kirkcaldy.
1901. Clayton, Thomas Lill, Under Forester, Manby Lodge, Broughton Brigg.
1902. Clough, C. H., Oldcroft, Stanwix, Carlisle.
1896. *Cockburn, Alex. K., Assistant Forester, Bowland, Stow.*
1900. Collie, Alexander, Knowsley, Prescot, Lancashire.
1893. Collins, Frederick, Forester, West Mill, Ware, Herts.
1882. Collins, Robt. T., Forester, Trentham, Stoke-on-Trent, Staffordshire.
1895. Connor, George A., Factor, Craigielaw, Longniddry.
1858. Cowan, James, Forester, Bridgend, Islay, Argyleshire.
1899. Cowan, Robert, Chisholm Estates Office, Erchless, Strathglass.
1901. Cowan, Robert Craig, Craigiebield, Penicuik.
1903. Cowper, John R. B., Market Gardener and Potato Merchant, Gogar House, Corstorphine.
1900. Crabbe, Alfred, Assistant Forester, Bredisholm House, Baillieston, Lanarkshire.
1875. Crabbe, David, Forester, Byreburnfoot, Canonbie, Dumfriesshire.
1867. Crabbe, James, Forester, Glamis Castle, Forfarshire.
1893. Craig, John, Loxington, Saltcoats.
1899. Crerar, David, Land Steward, Methven Castle, Perth.
1898. Crichton, William, Manager, Castle Ward, Downpatrick.
1900. Crombie, David, The Gardens, Curraghmore, Portlaw, Ireland.
1898. Crombie, James, Forester, North Lodge, Lethen, Nairn.
1900. Cumming, John H., The Gardens, Grantully Castle, Aberfeldy.
1898. Cunningham, George, Advocate, 21 Royal Circus, Edinburgh.
1899. Curtis, Professor Charles E., Woodlands, Brockenhurst, Hants.
1891. Daglish, John, Rothley Lake, Cambo R.S.O., Northumberland.
1897. Dailly, James, Forester, Errol Estate, Errol, Perthshire.
1900. Dale, Thomas, Nurseryman, Millport, Cumbrae.
1900. Dalgliesh, J. Edward, Nurseryman, Market Weighton, Yorkshire.
1901. Dalrymple, Hon. Hew H., Lochinch, Castle Kennedy, Wigtownshire.
1901. Dalziel, Henry, Assistant Forester, Royal Botanic Garden, Edinburgh.
1884. Dalziel, James, Forester, Culzean Castle, Maybole, Ayrshire.
1894. Darling, David C., Nurseryman, Corn Exchange Buildings, Aberdeen.
1865. Davidson, John, Agent, Greenwich Hospital Estates, Haydon Bridge-on-Tyne.
1892. Davidson, John, Forester, Dalzell, Motherwell, Lanarkshire.
1901. Davie, George, Overseer, Glencurse, Perth.
1902. Dewar, H. P., Forester, Beaufort Castle, Beauly.
1897. Digby, Reginald, Land Agent, Geashill Castle, King's County.
1895. Dingwall, Alexander, Glendoig Villa, Perth.
1903. Dobson, Thomas, M.D., Knott End, Windermere.
1901. Donald, James Alexander, Assistant Forester, 102 Dean Street, Kilmarnock.
1893. Donaldson, James, Timber Merchant, Tayport, Fife.
1897. Dorman, Arthur John, of Grey Towers, Newby, Nunthorpe R.S.O., Yorks.

Date of Election.

1882. Douglas, Captain Palmer, of Cavers, Hawick.
1897. Douglas, James, The Gardens, Charleville, Enniskerry, Co. Wicklow.
1887. Douglas, Robert, 64 Princes Street, Edinburgh.
1892. Dow, R., Forester, Douglas Castle, Douglas, Lanarkshire.
1867. *Dow, Thomas, Forester, Belvedere Road, Woodville, near Burton-on-Trent.*
1898. Dow, Thomas, Assistant Forester, Weekley, near Kettering.
1900. Drummond, Dudley W., Commissioner, Cawdor Estate Office, Ferryside, South Wales.
1862. Drummond & Sons, William, Nurserymen, Stirling.
1873. Durward, Robert, Manager, Blelack, Dinnet, Aberdeenshire.
1900. Duthie, James A., Traveller, 1 Waterloo Place, Edinburgh.

1898. Eadson, Thomas G., Assistant Forester, Whaley, Mansfield.
1885. Eddington, Francis, Overseer, Monk Coniston Park, Lancashire.
1898. Edminson, Wm. D., Tweed View, Berwick-on-Tweed.
1899. Edwards, Alex. W. B., Assistant Forester, Durris, Drumoak.
1893. Elder, William, Forester, Cholmondeley Park, Malpas, Cheshire.
1898. Elder, Wm., Engineer, Berwick-on-Tweed.
1902. Ellice, Captain Edward Charles, Invergarry.
1901. Elrick, John, Forester, Glenkindie, Aberdeenshire.
1901. Elwes, John Henry, F.R.S., of Colesborne, Cheltenham.
1901. Erskine, Richard Brittain, Oaklands, Trinity, Edinburgh.
1898. *Ewan, Peter, Assistant Forester, Halfway, Balquharn, Bankfoot.*
1873. Ewing, David, Forester, Strichen House, Aberdeen.

1898. Farquharson, Dr Robert, of Finzean, M.P., Aboyne, Aberdeenshire.
1894. Farquharson, James, Forester, Ardgowan, Inverkip.
1901. Farquharson, Sir John, K.C.B., Corrachree, Tarland, Aberdeenshire.
1899. Fawcett, Thos. G., Land Agent, Yarm-on-Tees.
1900. Feaks, Matthew, c/o Mrs M'Donald, Bridgend, Liberton.
1899. Ferguson, J. E. Johnson, M.P., of Springkell, Ecclefechan.
1903. Fergusson, John Blackburn, Barrister-at-Law, J.P., LL.B. Camb., Balgarth, Ayr.
1880. Fergusson, Sir James Ranken, Bart., Spitalhaugh, West Linton.
1893. Finlayson, Alexander, Forest Cottage, Newbattle, Dalkeith.
1893. Finlayson, Malcolm, Solicitor, Crieff, Perthshire.
1869. Fisher, William, Estate Agent, Wentworth Castle, Barnsley, Yorkshire.
1899. Fisher, W. R., Assistant Professor of Forestry, Coopers Hill, Surrey.
1899. Fleming, John, Timber Merchant, Albert Saw-mills, Aberdeen.
1897. Flett, John Smith, M.A., M.B., B.Sc., Geological Survey, 28 Jermyn Street, London, S.W.
1890. Forbes, Arthur C., Wood Manager, Longleat, Horningsham, Warminster.
1898. Forbes, James, Factor, Blair Castle, Blair Athole.
1891. Foreman, Frederick, Nurseryman, Eskbank, Dalkeith.

Date of Election.

1892. Forgan, James, Sunnybraes, Largo, Fife.
1892. Forgan, William, Forester, Bowood, Calne, Wiltshire.
1889. Forster, William A., Forester, Belgrave Lodge, Pulford, Wrexham.
1898. Foster, James, jun., Kennet Village, Alloa.
1900. Fraser, Alexander, Factor, Lundin and Montrave Estates Office, Leven.
1902. Fraser, George M., Land Agent, Hopewell House, Tarland, Aberdeenshire.
1898. Fraser, James, Assistant Forester, Cahir Park, Cahir, Co. Tipperary.
1899. Fraser, James, Estate Manager, Aldowrie, Dores, Inverness.
1895. Fraser, J. C., Nurseryman, Comely Bank, Edinburgh.
1901. Fraser, John M'Laren, of Invermay, Forgandenny, Perthshire.
1857. Fraser, P. Neill, of Rockville, Murrayfield, Edinburgh.
1901. Fraser, William, Assistant Forester, Murthly, Perthshire.
1896. Frater, John, Foreman Forester, Ardross Mains, Alness, Ross-shire.
1902. Frater, John, Head Forester, Ardross Castle, Alness, Ross-shire.
1899. Fulton, William, Overseer, Robertland, Stewarton, Ayrshire.
1899. Fyshe, Peter, Newtoulees, Dunbar.

1874. Galloway, George, Estate Offices, Woodhouses, Whitchurch, Salop.
1896. Gammell, Sydney James, of Drumtochty, Drumtochty Castle, Fordoun.
1898. Gauld, William, Assistant Forester, Binley Village, Coventry.
1902. Gavin, George, Overseer, Falkland Estate, Falkland.
1899. Geekie, C. W., 24 St Andrew Square, Edinburgh.
1900. Gellatly, John, Forester, Newhall, West Mains, West Linton.
1897. Gellatly, Thomas, Forester, Meggernie Castle, Gallin, Glenlyon.
1897. Gemmill, Wm., Farmer, Greendykes, Macmerry, East Lothian.
1901. Gifford, John C., Assistant Professor of Forestry, Cornell University, Ithaca, N.Y., U.S.A.
1870. Gilbert, James, Forester, Gallovie, Kingussie.
1897. Gillanders, A. T., Forester, Park Cottage, Alnwick, Northumberland.
1894. Gillespie, James, Forester, Blairmore, Braco.
1894. Gilmour, Major Robert Gordon, of Craigmillar, The Inch, Midlothian.
1880. Glen, David A., Forester, Bedgebury Park, Goudhurst, Kent.
1893. Goldie, George, Eskdale Lodge, Dalkeith, Midlothian.
1899. Gordon, George, C.E., Queensgate, Inverness.
1893. Gordon, John G., N.P., 48 Castle Street, Edinburgh.
1900. Gordon, Thomas, County Buildings, Edinburgh.
1897. Gow, Peter, Land Steward, Laggan, Ballantrae, Ayrshire.
1897. Gow, Peter Douglas, Farmer, Bonaly, Colinton, Midlothian.
1902. Graham, Andrew, M.D., Currie.
1887. Grant, Alexander, Forester, Rothie-Norman, Aberdeenshire.
1867. Grant, Donald, Forester, Drumin, Ballindalloch, Banffshire.
1893. Grant, John B., Forester, Downan House, Glenlivet.
1893. Grant, Peter, Land Steward, Kilmeade Farm, Athy, Co. Kildare.

Date of Election.

1902. GRAY, Robert, Timber Merchant, Fraserburgh.
1902. GRAY, Walter Oliver, Foreman Woodman, North Lodge, Minto.
1902. GREIG, Hugh Gorrie, Coltness Estate Office, Wishaw.
1898. GREY, Sir Edward, Bart., M.P., of Falloden, Chathill, Northumberland.
1903. GRIFFITHS, Sir Richard Waldie, of Hendersyde Park, Kelso.

1879. HADDINGTON, The Right Hon. the Earl of, K.T., Tyninghame, Prestonkirk.
1880. HADDON, Walter, Solicitor, Royal Bank, Hawick.
1897. HALLIDAY, Geo., Timber Merchant, Rothesay, Bute.
1901. HALLIDAY, John, Timber Merchant, etc., Rothesay.
1899. HAMILTON, James, The Gardens, Manderston, Duns.
1897. HAMILTON-OGILVY, H. T. M., of Beil, Prestonkirk, East Lothian.
1892. HANNAH, George, Overseer, Over House, Over, Almondsbury, Bristol.
1903. HANNAH, Thomas, Assistant Forester, Raith, Kirkcaldy.
1890. HARDIE, James F., Factor, Skibo, Dornoch.
1896. HARLEY, Andrew M., Forester, Betterton Farm House, Wantage, Berks.
1895. HARROWER, David K., Timber Merchant, Elm Park, Bo'ness.
1897. HARROWER, William, Forester, Garth, Aberfeldy, Perthshire.
1897. HART, John, Factor, Mains of Cowie, Stonehaven, Kincardineshire.
1894. HARVEY, James, The Gardens, Mortonhall, Liberton.
1897. HAY, Alexander, of Benjamin Reid & Co., Nurserymen, Aberdeen.
1892. HAY, John, Overseer, Dollars Estate Office, 2 The Glebe, Riccarton, Kilmarnock.
1896. HAY, Wm. P., Merchant, Rosebank, Loanhead, Midlothian.
1889. HAYES, John, Overseer, Dormont, Lockerbie, Dumfriesshire.
1869. HAYMAN, John, Glentarff, Ringford, Kirkcudbrightshire.
1897. HEGGIE, James George, Factor, The Burn, Inch of Arnhall, Edzell.
1866. HENDERSON, Arch., Forester, Clonad Cottage, Tullamore, King's County.
1871. HENDERSON, John, Overseer, Vogrie, Gorebridge.
1901. HENDERSON, Peter, Factor, Ballindalloch.
1893. HENDERSON, R., 4 High Street, Penicuik, Midlothian.
1899. HENDERSON, Robert, Assistant Forester, Scone, Perth
1893. HENDERSON, William, Forester, Gosford Demesne, Markethill, Co. Armagh, Ireland.
1898. HENDRY, James, 5 Thistle Street, Edinburgh.
1900. HEWITSON, William, Assistant Forester, Lanes Barr, Girvan.
1895. HILL, Claude, of Messrs John Hill & Sons, Spot Acre Nurseries, Stone, Staffordshire.
1902. HINCHES, Ralph Tichborne, J.P., D.L., Foxley, Hereford.
1900. HISLOP, William, Assistant Forester, Ravenswood, near Melrose.
1895. HOARE, Sir Henry Hugh Arthur, Bart. of Stourhead, Bath.
1866. HOGARTH, James, Forester, Culhorn, Stranraer, Wigtownshire.
1897. HOGG, Thos., The Gardens, Woodside, Paisley.
1874. HOME, Edward, Assistant Forester, Whiterig, Ayton, Berwickshire.
1902. HOWE, John Arnold, Assistant Forester, Kingswood, Murthly.
1876. HULL, Frank, Forester, Lilleshall, Newport, Salop.
1900. HUNTER, David, of Ahlbottn & Co., 5 Nelson Street, Edinburgh.

Date of Election.

1901. Imrie, James, Assistant Forester, Garscube, Maryhill, Glasgow.
1901. Imrie, William, Timber Merchant, Oakwood, Ayr.
1895. Inglis, A. M., Nurseryman, Forres.
1897. Inglis, George Erskine, Estate Agent, Campbeltown, Argyleshire.
1891. Inglis, William, Forester, Brodick, Isle of Arran.
1895. Innes, Alexander, Forester, Drummuir, Keith.
1896. *Innes, Alexander, Forester, Stourhead, Bath.*
1902. Innes, Colonel F. N., of Learney, Torphins, Aberdeenshire.
1901. Innes, George, Assistant Forester, Cothall Cottage, Altyre, Forres.
1901. Irvine, John, Assistant Forester, Colesborne, Cheltenham, Gloucestershire.

1893. Jack, George, S.S.C., Dalkeith, Midlothian.
1902. Jack, Thomas, Farmer, Hermiston, Currie.
1898. Jackson, James, The Gardens, Methven Castle, Perth.
1895. Jamieson, Andrew, Overseer, Carnbroe, Bellshill.
1898. Jamieson, James, Forester, Ffairfach Nurseries, Golden Grove Estate, Llandilo, South Wales.
1896. Jardine, R. W. B., Yr. of Castlemilk, Lockerbie, Dumfriesshire.
1901. Jefferies, Wm. J., Nurseryman, Cirencester.
1901. Johnston, Andrew Reid, Assistant Forester, Cluny Square, Cardenden, Fife.
1900. Johnston, David, Manager, Charlestown Limeworks, Fife.
1899. Johnston, Edward, Forester, Dalquharran, Dailly, Ayrshire.
1878. Johnstone, Adam, Forester, Coollattin, Shillelagh, County Wicklow.
1900. Johnstone, William, Head Forester, Beil, Prestonkirk.
1902. Jonas, Robert Collier, Land Surveyor, 23 Pall Mall, London.
1888. Jones, James, Wood Merchant, Larbert, Stirlingshire.
1893. Jones, Thomas Bruce, Wood Merchant, Larbert.

1867. Kay, James, Wood Manager, Bute Estate, Rothesay, Bute.
1896. Keir, David, jun., Assistant Forester, The Nursery, Knowsley, Prescot.
1876. Kelman, John, Forester, Esslemont, Ellon, Aberdeenshire.
1897. Kemp, David, 22 Young Street, Edinburgh.
1899. Kennedy, Thomas, Assistant Forester, Lambton Park Fence Houses, Durham.
1901. Kent, William, Forester, Crossford, Dunfermline.
1902. Kerr, Rev. John, The Manse, Dirleton.
1896. Kettles, Robert, Assistant Forester, Craigend, Perth.
1894. Kidd, Wm., Forester, Harewood, Leeds.
1879. Kincairney, The Hon. Lord, 6 Heriot Row, Edinburgh.
1900. King, David, Nurseryman, Osborne Nurseries, Murrayfield.
1901. Kinloch, Sir John G. S., of Kinloch, Meigle.
1898. Kyllachy, The Hon. Lord, of Kyllachy, 6 Randolph Crescent, Edinburgh.

1899. Laidler, George, Assistant Factor, Ivy Cottage, Brodick.
1898. Laird, James W., Nurseryman, Monifieth.

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Date of Election.

1899. LAMOND, Alexander, Forester, Freeland, Forgandenny.
1899. LAMOND, William, Assistant Forester, Beechhill Nursery, Murrayfield.
1901. LAUDER, William, Assistant Gardener, Baronscourt, Ireland.
1897. LAURISTON, John, Assistant Forester, c/o A. Gowan, Woodend, Winchburgh.
1900. LAWRIE, James, The Gardens, Murthly Castle, Perthshire.
1903. *Lawson, Alexander R., Forester, Glenmuick, Ballater, Aberdeen.*
1902. LEARMONT, John, Nurseryman, Larchfield Nurseries, Dumfries.
1874. LEIGH, William, of Woodchester Park, Stonehouse, Gloucestershire.
1880. LEISHMAN, John, Manager, Cavers Estate, Hawick, Roxburghshire.
1898. LEYS, Wm. B., Forester, 28 Hay Terrace (c/o Moss), Edinburgh.
1903. LIDDALL, William John Norbray, Advocate, 26 Great King Street, Edinburgh.
1898. LIGHTFOOT, Francis P., Land Agent, Hafod, Devil's Bridge R.S.O., Cardiganshire.
1879. LINDSAY, Robert, Kaimes Lodge, Murrayfield, Midlothian.
1880. LINLITHGOW, The Most Hon. the Marquess of, Hopetoun House, South Queensferry.
1897. LOCK, Hampton C., Greenwich Park, London, E.C.
1898. LOW, James, Temple, Gorebridge, Midlothian.
1898. LOW, James, Forester, Innes Estate, Elgin.
1894. LUMSDEN, Fredk. R., Newburn, Largo, Fife.
1900. LUMSDEN, Robert, jun., 316 Morningside Road, Edinburgh.

1902. MACARTHUR, William, Assistant Forester, Royal Botanic Garden, Edinburgh.
1892. MACBEAN, Simon, Overseer, Erskine, Glasgow.
1896. M'BEATH, David, Forester, Cruchmore Lodge, Drumcliffe, Sligo.
1894. M'CALLUM, Edward, Overseer, Kerse Estate, Falkirk.
1898. M'CALLUM, James, Forester, St Ann's Cottage, Lockerbie.
1893. M'COUBRIE, M. S., Land Steward, Tullamore, King's County, Ireland.
1899. M'DIARMID, Hugh, Assistant Forester, Dalmeny Park, Edinburgh.
1900. MACDIARMID, Hugh, Factor, Island House, Tiree, Oban.
1902. MACDONALD, Daniel, 35 Park Road, Trinity, Edinburgh.
1902. M'DONALD, Donald M'Intosh, Assistant Forester, Tower Cottage, Durris.
1893. MACDONALD, George U., Forester, Raith, Kirkcaldy.
1897. M'DONALD, James, Forester, Powerscourt, Enniskerry, Co. Wicklow.
1895. MACDONALD, John, Forester, Skibo, Dornoch.
1901. MACDONALD, Mrs Eleanor E., The Manse, Swinton.
1897. M'DONALD, William, Forester, Hornby Castle, near Lancaster.
1894. M'DOUGALL, Alex., Forester, Tuncombe Park, Helmsley R.S.O., Yorks.
1902. MACDOUGALL, John, 16 St Andrew Square, Edinburgh.
1901. MACEWEN, Alexander, Overseer, Castle Lachlan, Strachur, Inveraray.
1898. MACFADYEN, Donald, Assistant Forester, Drumlanrig, Thornhill.
1901. M'GARVA, Gilbert Ramsay, Factor, Estate Office, Innes, Elgin.
1901. M'GHIE, John, Assistant Overseer, Kelburne Estate, Fairlie.
1890. M'GREGOR, Alex., The Schoolhouse, Penicuik, Midlothian.

Date of Election.

1902. M'Gregor, Alexander, Assistant Forester, Durris, Drumoak, Aberdeenshire.
1896. M'Gregor, Angus, Forester, Craigton, Butterstone, Dunkeld.
1899. M'Gregor, Archibald, Forester, Airthrey Castle, Bridge of Allan.
1901. *MacGregor, James, Assistant Forester, Lynedoch, Almond Bank, Perth.*
1896. Macgregor, John C., Assistant Forester, Perlethorpe, Ollerton, Notts.
1901. M'Gregor, Robert, Assistant Forester, Law Muir, Methven.
1899. M'Hardy, Alexander, The Castle, Inverness.
1901. MacHattie, John W., City Gardener, City Chambers, Edinburgh.
1895. Machray, Frank, Ground Officer, Culloden, Inverness.
1894. M'Ilwraith, Wm., Forester, Egton, Grosmont R.S.O., Yorks.
1895. *Macintosh, D. L., The Gardens, Castle Wemyss, Wemyss Bay.*
1901. Macintosh, William, Forester, New Chapel, Boncath R.S.O., South Wales.
1899. M'Intyre, James, Foreman Forester, Cordon, Lamlash, Arran.
1898. M'Intyre, Malcolm, The Gardens, The Glen, Innerleithen, Peeblesshire.
1898. Mackay, Æneas J. G., LL.D., Advocate, 2 Albyn Place, Edinburgh.
1892. M'Kay, Allan, c/o Park & Co., Ltd., Timber Merchants, Fraserburgh.
1865. Mackay, John, Lauderdale Estate Office, Wyndhead, Lauder.
1899. M'Kay, John, Assistant Forester, Golspie Saw-mills, Golspie.
1887. Mackay, Peter, Forester, Taymouth Castle, Aberfeldy.
1900. M'Kechnie, Angus, Assistant Forester, c/o Mrs Hope, Bailifgate, Alnwick.
1891. Mackendrick, James, Forester, Pallas, Loughrea, Co. Galway.
1867. Mackenzie, Alex., Warriston Nursery, Inverleith Row, Edinburgh.
1901. Mackenzie, Charles, Assistant Factor, Mortonhall, Liberton.
1901. M'Kenzie, Daniel, Forester, Wynyard Estate, Stockton-on-Tees.
1899. M'Kenzie, James, Wood Merchant, Inverness.
1897. Mackenzie, John, Forester, Arbigland, Kirkbean, Dumfries.
1900. Mackenzie, Sir Kenneth John, Bart. of Gairloch, 10 Moray Place, Edinburgh.
1892. Mackenzie, W. A., Factor, Faskally, Pitlochry.
1896. Mackenzie, Wm., Forester, Novar, Evanton, Ross-shire.
1901. Mackenzie, William, 102 Dean Street, Kilmarnock.
1883. MacKinnon, George, The Gardens, Melville Castle, Lasswade.
1902. MacKinnon, John, Gardener, Terregles, Dumfries.
1892. MacKinnon, William, Nurseryman, 144 Princes Street, Edinburgh.
1878. Mackintosh, The, of Mackintosh, Moy Hall, Inverness.
1879. M'Laren, Charles, Land Steward, Cally Lodge, Dunkeld.
1901. M'Laren, Donald, Overseer, Sundrum, by Ayr.
1897. M'Laren, Patrick M., Assistant Forester, Altyre, Forres.
1893. M'Laren, William, Forester, Altyre, Forres, Morayshire.
1902. Maclean, Peter, Forester, Invergarry.
1898. M'Lennan, John, The Gardens, Castle Boro, Enniscorthy, Co. Wexford.
1901. M'Leod, Peter, Nurseryman, Perth.
1895. Macmillan, John D., Forester, Oriel Temple, Collon, Co. Louth.
1902. Macnicol, D., Land Agent, F.S.I., Derwas, Abergele.
1902. M'Omish, John, Nurseryman, Crieff.

Date of Election.

1902. M'Pherson, Alexander, Assistant Forester, Royal Botanic Garden, Edinburgh.
1901. Macpherson, Duncan, Assistant Forester, Scone, Stormontfield, Perth.
1900. Macpherson, John, Manufacturing Forester, Novar, Evanton.
1896. M'Queen, John, Proprietor of the *Scottish Border Record*, Galashiels.
1890. M'Rae, Alexander, Forester, Castlecomer, Ireland.
1900. M'Rae, Henry, Assistant Forester, Coedrighan Park, near Cardiff, South Wales.
1895. M'Tavish, John, Assistant Forester, The Poles, Dornoch.
1884. Main, Adam, Forester, Loftus R.S.O., Yorkshire.
1894. Malloch, William, 50 South Street, Perth.
1896. Mar and Kellie, The Right Hon. the Earl of, Alloa House, Alloa.
1897. *Marshall, Alexander*, 150 *Leadenhall Street, London, E.C.*
1902. Marshall, George, Broadwater, Godalming, Surrey.
1901. Marshall, Harley, of Dunduff, Dunfermline.
1898. Marshall, John, Wood Merchant, Killiecrankie, Perthshire.
1899. Marshall, John, Timber Merchant, etc., Maybole.
1893. Marshall, J. Z., Timber Merchant, 2 Dean Terrace, Bo'ness.
1895. Martin, David, Overseer, Fettes College, Edinburgh.
1893. Mather, R. V., of Laing & Mather, Nurserymen, Kelso.
1901. Matthews, Robert, Land Steward, Duncrub Park, Dunning.
1896. Maxtone, John, Forester, Duff House, Banff.
1891. Maxwell, James, Forester and Overseer, Ruglen, Maybole.
1886. Maxwell, The Right Hon. Sir Herbert E., Bart. of Monreith, M.P., Port William, Wigtownshire.
1896. Meiklejohn, John J. R., Factor, Novar, Evanton, Ross-shire.
1901. Meldrum, David, Nurseryman and Seed Collector, Arbroath Road, Forfar.
1899. Melville, David, The Gardens, Dunrobin Castle, Golspie.
1889. Melville, The Right Hon. Viscount, Melville Castle, Lasswade.
1901. Menzies, James, Assistant Forester, Townholm, Kilmarnock.
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, The Gardens, Blythswood, Renfrewshire.
1895. Michie, James, Forester, The Nurseries, Orwell Park, near Ipswich.
1893. Michie, William, Forester, Welbeck, Worksop, Notts.
1893. Middlemass, Archibald, Forester, Tulliallan, Kincardine-on-Forth.
1882. Milne, Alex., of James Dickson & Sons, 32 Hanover Street, Edinburgh.
1899. Milne, Alexander, Factor, Urie Estate Office, Stonehaven.
1902. Milne, Alexander, Assistant Forester, Albury, Surrey.
1895. Milne, James, Land Steward, Carstairs House, Carstairs.
1899. Milne, Ritchie, Assistant, Annandale Estate Office, Hillside, Lockerbie.
1900. Milne, Robert Anderson, Solicitor, Peebles.
1898. Milne, Robert P., Spittal Mains, Berwick-on-Tweed.
1891. Milne, R. W., Forester, 26 Etterby Street, Stanwix, Carlisle.

Date of Election.

1890. Milne, William, Farmer, Foulden, Berwick-on-Tweed.
1902. Milne, William, Forester, Huntly Hill, Stracathro, Brechin.
1901. Milne-Home, David William, Yr. of Wedderburn, Caldra, Duns.
1894. Milsom, Isaac, Gardener and Steward, Claydon Park, Winslow, Bucks.
1898. Mitchell, David, Forester, Drumtochty, Fordoun.
1869. Mitchell, James, Factor, Ardallie, Fossoway.
1897. Mitchell, Wm., Forester, Lough Cutra, Gort, Co. Galway.
1901. Mitchell, William Geddes, Estate Agent, Doneraile, Co. Cork.
1903. Moffat, James, Land Steward, Riccarton, Currie.
1902. Moffat, John, Forester, Blackwood, Lesmahagow.
1901. Moffat, William, Overseer, Possil, Maryhill, Glasgow.
1897. Moon, Frederick, Forester, Garden Cottage, Mount Trenchard, Foynes, Co. Limerick.
1902. Morgan, David, Douglasleigh, Carnoustie.
1898. Morgan, Hugh, Timber Merchant, Crieff, Perthshire.
1899. Morrison, Alexander, Assistant Forester, Jerviston Lodge, Motherwell.
1895. Morrison, Hew, Librarian, Edinburgh Public Library.
1903. Morrison, William, Manufacturer, Clydesdale Iron Works, Possilpark, Glasgow.
1902. Morton, Alexander, of Gowanbank, Darvel.
1896. Mossman, Robert C., F.R.S.E., F.R.Met.Soc., 10 Blacket Place, Edinburgh.
1890. Muirhead, George, F.R.S.E., Commissioner, Speybank, Fochabers.
1901. Mullin, John, Forester, Eglinton Castle, Irvine.
1895. Munro, Donald, Assistant Forester, Holkham Hall, Norfolk.
1902. Munro, George A., S.S.C., 6 Rutland Square, Edinburgh.
1897. Munro, Hugh, Teacher, Penicuik, Midlothian.
1892. Murray, Alexander, Forester, Murthly, Perthshire.
1902. Murray, Bailie John, J.P., 11 Strathearn Road, Edinburgh.
1901. Murray, David, Gardener, Culzean Gardens, Maybole.
1902. Murray, Donald, Assistant Forester, Altyre, Forres.
1900. Murray, George J. B., Assistant Forester, Holylee, Walkerburn.
1896. Murray, Hon. A. W. C. O., M.P., Master of Elibank, Juniper Bank, Walkerburn.
1900. Murray, John C., F.S.I., Factor and Commissioner, Haggs Castle, Glasgow.
1900. Murray, William, of Murraythwaite, Ecclefechan, Dumfriesshire.
1894. Neil, Archibald, Forester, Warkton, Kettering, Northamptonshire.
1893. Nelson, Robert, Assistant Forester, Kinmount Estate, Cummertrees, Dumfriesshire.
1885. Newbigging, John, Nurseryman, Dumfries.
1895. Newton, George, 28 Charlotte Square, Edinburgh.
1893. Nicol, James, Forester, Aird's Mill, Muirkirk, Ayrshire.
1895. Nicol, James, Forester, Croxteth, Liverpool.
1891. Nicoll, John, Solicitor, 10 Shandwick Place, Edinburgh.
1901. Nicoll, William Peter, Assistant Forester, Royal Botanic Garden, Edinburgh.

Date of Election.

1898. Nisbett, J. L. More, The Drum, Liberton, Midlothian.
1899. Noble, Charles, Forester, Elie House, Elie, Fife.
1897. Normand, Patrick Hill, Whitehill, Aberdour, Fife.

1900. Oliphant, Joseph, Assistant Forester, Chapelhill, Methven.
1902. Oswald, Richard Alexander, of Auchencruive, Ayr.

1875. Page, Andrew Duncan, Land Steward, Culzean, Maybole, Ayrshire.
1893. Page, Walter, Farmer, Myregornie, Kirkcaldy, Fife.
1902. Paget, Leopold Cecil, Land Agent, Harewood, Leeds.
1900. Paterson, George, Timber Merchant, 8 Albyn Terrace, Aberdeen.
1902. Paterson, Peter, Commission Agent, 12 Maygate Street, Dunfermline.
1894. Patterson, George, Forester's Office, Leinster Street, Athy, Co. Kildare, Ireland.
1897. Patterson, James P., Nursery Manager, Dollardstown Nursery, Athy, Ireland.
1898. Patterson, Thomas L., Hardengreen, Dalkeith.
1895. Paxton, George, Richardland, Kilmarnock.
1897. Pearson, James, Forester, Sessay, Thirsk, Yorks.
1899. Pearson, James, Assistant Factor, Colinsburgh, Fife.
1869. Peebles, Andrew, Estate Office, Albury, Guildford, Surrey.
1897. *Peebles, James, Assistant Forester, c/o Mrs Rennie, The Cross, Douglas, Lanarkshire.*
1897. Peebles, Philip, Estate Office, Syon House, Brentford.
1898. Peirson, George B., Land Agent, Baldersby Park, Baldersby S.O., Yorks.
1898. Peirson, George H., Assistant Land Agent, Baldersby Park, Baldersby S.O., Yorks.
1895. Philip, William Watt, Factor, Estate Office, Gigha, Argyleshire.
1896. Philp, Henry, jun., Timber Merchant, Campbell Street, Dunfermline.
1896. Philp, John, Timber Merchant, Campbell Street, Dunfermline.
1874. Platt, Colonel Henry, Gorddinog, Llanfairfechan, Carnarvonshire.
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.
1901. Portal, Maurice, Sandhoe, Hexham.
1899. Porteous, Colonel James, of Turfhills, Kinross.
1899. Porteous, George, Merchant, Poltonhall, Lasswade.
1899. Power, David F., Forester, The Gardens, Keith Hall, Inverurie, Aberdeenshire.
1896. Prentice, George, Strathore, Kirkcaldy, Fife.
1899. Price, Aaron W., Forester, Bolstone, Ross-on-Wye.
1898. Price, W. M., Factor, Minto, Hawick.
1895. Priest, W., The Gardens, Eglinton Castle, Irvine.

Date of Election.

1903. Rae, Robert T., Land Steward, Sunlaws, Roxburgh.
1901. Raffan, Alexander, Foreman Forester, Fairburn, Ross-shire.
1898. Raffan, James, Estate Steward, Granston Manor, Abbeyleix, Queen's Co.
1899. Rafn, Johannes, Tree-Seed Merchant, Skovfrökontoret, Copenhagen, F.
1902. Ralph, William, Forrester Road, Corstorphine.
1897. Ralston, A. Agnew, Factor, Philipstoun House, West Lothian.
1870. Rattray, Thos., Forester, Westonbirt House, Tetbury, Gloucestershire.
1902. Reid, Charles S., Factor and Accountant, 8 Duke Street, Kilmarnock.
1901. Reid, Hugh, Assistant Forester, Ashton Court, Long Ashton, near Bristol.
1894. Reid, James S., Forester, Balbirnie, Markinch, Fife.
1900. Reid, John, Estate Overseer, The Mains, Lochgelly.
1897. *Reid, William, Forester, Lydney Park, Lydney, Gloucestershire.*
1901. Rennie, Joseph, Forester, Marywell Lodge, Cullen House, Banffshire.
1902. Rider, William H., Editor *Timber Trades Journal*, 164 Aldersgate Street, London.
1892. Ritchie, Alexander, Overseer, Harvieston and Castle Campbell Estates, Dollar.
1896. Ritchie, Thomas, Nurseryman, Callander, Perthshire.
1898. Ritchie, Wm., Assistant Forester, Moss-side Cottage, Lynedoch, Perth.
1900. Robb, John, Road Surveyor, County Buildings, Edinburgh.
1897. Robertson, Andrew N., Forester, Craigbarnet, Campsie Glen, by Glasgow.
1899. Robertson, Charles, Assistant Forester, Fulford, Raith, Kirkcaldy.
1896. Robertson, Duncan, Forester, Strathord, Stanley, Perthshire.
1896. Robertson, George, Assistant Forester, Theobald's Park, Waltham Cross, Herts.
1894. Robertson, George D., Assistant Forester, Carolside, Earlston.
1896. Robertson, James, Assistant Forester, Dalzell, Motherwell.
1900. Robertson, James, Assistant Forester, Ardgilzean, Scone.
1896. Robertson, John, Forester, Altyre, Forres.
1902. Robertson, John, Assistant Forester, Royal Botanic Garden, Edinburgh.
1902. Robertson, John, 136 George Street, Edinburgh.
1902. Robertson, R. A., M.A., B.Sc., Lecturer on Botany, University, St Andrews.
1895. Robertson, Thomas, Forester and Bailiff, Woodlawn, Co. Galway.
1883. Robertson, William, Assistant Forester, Ringwood, Birnam, Perth.
1902. Robinson, Stewart, Lynhalls, Kingston, Herefordshire.
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, Assistant Forester, Baronscourt, Co. Tyrone.
1893. Rodger, James, Forester, Morton Hall, Ringland, Norwich.
1897. Rodger, James, Factor, Keir, Dunblane, Perthshire.
1898. Rodimer, Charles S., Factor, Benmore, Kilmun, Argyleshire.

Date of Election.

1893. Romanes, James, C.A., Harewood Glen, Selkirk.
1898. Ross, Charles D. M., Factor, Abercairney, Crieff.
1887. Ross, John, Forester, Hopetoun, South Queensferry, Linlithgowshire.
1899. Rough, Edward D., Manure Merchant, Broxburn.
1903. Rule, John, Forester, Huntly.
1893. Rutherford, James A., Land Agent, Highclere Park, Newbury, Berks.
1870. Rutherford, John, Forester, Linthaugh, Jedburgh, Roxburghshire.
1901. Ryan, Thomas, The Gardens, Castlewellan, Co. Down.

1894. Samson, David T., Seafield Estates Office, Grantown, Strathspey.
1875. Sang, Edmund, of E. Sang & Sons, Nurserymen, Kirkcaldy.
1895. Sclater, Alexander, Seed Manager, 15 Princes Street, Edinburgh.
1870. Scott, Adam, Forester, Southwick Park, Fareham, Hants.
1892. Scott, David, Overseer, Dumfries House, Cumnock, Ayrshire.
1901. Scott, Frank, Assistant Forester, Temple Hill, Selborne, Alton, Hants.
1881. Scott, James, Forester, Wollaton Hall, Nottingham.
1903. Scott, John, Forester, Hartrigge, Jedburgh.
1890. Scott, John D., Land Steward, Estate Office, Brushford, Dulverton, Somerset.
1902. Scott, Malcolm William, Registrar, etc., Currie.
1900. Scott, Robert, Police Constable, Lauder.
1897. Sharpe, Thomas, Forester, Monreith, Port William, Wigtownshire.
1893. Shaw, Andrew, Victoria Saw-mills, Perth.
1903. Shoolbred, Walter, of Wyvis, Evanton, Ross-shire.
1887. Simpson, Anthony, Dropmore, Maidenhead, Bucks.
1902. Simpson, George, Timber Merchant, Kirkcaldy.
1894. Simpson, James, Nurseryman, Dundee.
1898. Sinclair, William, Forester, Donibristle, Aberdour, Fife.
1900. Singer, John G., Forester, Newe Estates, Strathdon, Aberdeenshire.
1868. Slater, Andrew, Estate Office, Osborne, Cowes, Isle of Wight.
1899. Sleigh, Charles W., M.A., Factor, Blackwood Estate Office, Lesmahagow.
1902. Smart, John, Merchant, 18 Leith Street, Edinburgh.
1901. Smith, Allan, Land Steward, Dunira, Comrie.
1873. Smith, G. B., Wire Fence Manufacturer, Craighall Ironworks, Glasgow.
1871. Smith, James, The Gardens, Mentmore, Leighton-Buzzard, Bucks.
1883. Smith, James, The Gardens, Hopetoun, South Queensferry.
1901. Smith, James, Forester, Woodville Cottage, Birr, King's County.
1895. Smith, John, Cabinetmaker, Peebles.
1901. Smith, John C., Assistant Forester, Moss-side, Lynedoch, Almond Bank, Perth.
1901. Smith, Matthew, Manager for Dyer & Co., Peebles.
1902. Smith, Robert, Factor, Cranstoun Riddel, Dalkeith.
1901. Smith, Sydney, Factor, Drummuir Estates Office, Keith.
1901. Smith, Thomas, Factor, The Castle, Maybole.
1896. Smith, William, Forester, Camperdown, Dundee.
1898. Smith, William, The Gardens, Oxenford Castle, Dalkeith.
1899. Smith, William, Forester, Thirladean, Philiphaugh, Selkirk.
1898. Spence, William, Assistant Forester, Clunie Square, Kirkcaldy.

Date of Election.

1899. Spiers, Adam, Timber Merchant, Warriston Saw-mills, Edinburgh.
1885. Spiers, David, Overseer, Mugdrum, Newburgh, Fife.
1901. Spiers, David, Assistant Forester, Altyre, Forres.
1903. Sprunt, David, Assistant Forester, Murdostoun Castle, Newmains.
1899. Stalker, Wm. J., Nurseryman, Nairn.
1902. Stevenson, Allan, Architect, 14 Cathcart Street, Ayr.
1899. Stewart, Alex., Forester, Shadwell Court, Thetford.
1901. Stewart, Alistair D., c/o Mrs Robertson, 79 Scott Street, Garnethill, Glasgow.
1897. Stewart, Charles, Assistant Forester, Waulkmill, Scone, Perth.
1898. Stewart, James, Land Steward, New Buildings, Sandbeck Park, Tickhill, Rotherham.
1901. Stewart, James, Forester, Fothringham, Forfar.
1901. Stewart, John M., Forester, Dunsinnan, Perthshire.
1902. Stewart, Rev. Daniel Caldwell, The Manse, Currie.
1876. Stewart, Robert, Forester, Stonefield, Tarbert, Lochfyne, N.B.
1899. Stewart, William, Land Steward, Dalhousie Castle, Dalkeith.
1897. Stoddart, James, Builder, Bonnyrigg, Midlothian.
1898. Stoddart, William, Land Steward, Dartrey, Co. Monaghan.
1902. Stone, Alfred William, Clerk of Works, Ashton Court Estate, Bower, Ashton, Bristol.
1893. Storie, William, Forester, Gulworthy, Tavistock, Devon.
1893. Storie, W., Whitway House, Newbury, Berks.
1899. Stuart, J. Windsor, Factor, Bute Estate Office, Rothesay.
1902. Stunt, Walter Charles, Lorenden, Ospringe, Kent.
1892. Sutherland, John D., Solicitor and Estate Agent, Oban, Argyle.
1903. Swan, Andrew R., Farmer, Craiglockhart Farm, Slateford.

1901. Tainsh, John, Estates Office, Ochtertyre, Crieff.
1869. Tait, David, Overseer, Owston Park, Doncaster, Yorkshire.
1892. Tait, James, Builder, Penicuik, Midlothian.
1900. Tait, James, jun., Woodsbank, Penicuik.
1898. Tait, William, Assistant Seedsman, 144 Princes Street, Edinburgh.
1895. Tait, Wm. A., 13 Brandon Terrace, Edinburgh.
1900. Taylor, Alexander, Overseer, Kildrummy, Mossat, Aberdeenshire.
1902. Taylor, John, Assistant Forester, Dalgety, Donibristle Park, Aberdour.
1897. Taylor, William, Forester, Sandside, Kirkcudbright.
1895. Terras, Alexander, Forester, Dalgetty Castle, Turiff.
1893. Thomson, David, Mavisbank, Oakley, by Dunfermline.
1893. Thomson, David W., Nurseryman, 24 Frederick Street, Edinburgh.
1869. Thomson, Lockhart, S.S.C., 114 George Street, Edinburgh.
1901. Thomson, Major W. Anstruther, Kilmany, Cupar-Fife.
1901. Tivendale, William D., Head Forester to Duke of Portland, Burnhouse, Galston.
1903. Tod, Mrs J. W., Rosebank, Roslin.
1900. *Tully, James B., Assistant Forester, Skibo, Dornoch.*
1900. Turnbull, Andrew, Assistant Forester, Abberwick, Alnwick.
1901. Turner, Joseph Harling, Agent for Duke of Portland, Cessnock Castle, Galston.

Date of Election.

1898. TWEEDIE, Alexander, Forester, Faskally, Pitlochry.
1900. TWEEDIE, John M., Forester, Foulden, Berwick.
1902. TYTLER, J. W. Fraser, W.S., of Woodhouselee, Roslin.

1883. UNDERWOOD, Henry E., Sub-Agent, Fornham, St Martin, Bury St Edmunds, Suffolk.
1903. UNWIN, Arthur Harold, D.Œc., Department of Interior, Forestry Section, Ottawa, Canada.

1893. WADDELL, James, 2 Springbank, Leven.
1903. WALKER, Captain George Lawrie, of Crawfordton, Thornhill.
1894. WALKER, Henry H., Factor, Monreith, Port William, Wigtownshire.
1870. WALL, G. Y., Land Agent, Grange House, Darlington, Durham.
1893. WALLACE, David P., Forester, The Saw-mills, Filleigh, Molton, S. Devon.
1893. WALLACE, Robert B. P., Timber Merchant, 12 Morton Street, Leith.
1899. WANDESFORDE, R. H. Prior, of Castlecomer, Co. Kilkenny.
1898. WANN, James J., The Gardens, Kennet, Alloa.
1899. *Ward, Edward, Assistant Forester, Altyre, Forres.*
1901. WASON, Eugene, M.P., of Blair, Dailly, Ayrshire.
1901. WATSON, James, Manager, Moy Hall, Inverness-shire.
1893. WATSON, John, Timber Merchant, Annandale Street, Edinburgh.
1872. WATT, James, J.P., of Little & Ballantyne, Nurserymen, Carlisle.
1893. WATT, James W., Knowefield Nurseries, Carlisle.
1889. WATTERS, Dennis, Forester, Wester Elchies, Carron, Strathspey.
1902. WEBSTER, Thomas, Overseer, Burdie House, Gilmerton.
1899. *West, Robert, Assistant Forester, East Lodge, Glencarn, Bridge of Earn.*
1902. WHILLINS, Henry, Assistant Forester, Albury, Surrey.
1895. WHITE, William, Farmer, Edgefield, Loanhead.
1884. WHITTON, James, Superintendent of Parks, 249 George Street, Glasgow.
1901. WHYTOCK, James, The Palace Gardens, Dalkeith.
1901. WIGAN, Lewis Davis, of Glendaruel, Argyle.
1895. WIGHT, Alexander, Overseer, Thurston, Innerwick.
1895. WIGHTON, John, Forester, Newstead Abbey, Nottingham.
1883. WILKIE, Charles, Assistant Forester, Lennoxlove, Haddington.
1891. WILKIE, G., Architect, Hayfield, Peebles.
1902. WILKINSON, John, Factor, The Grange, Kirkcudbright.
1882. WILLIAMSON, A., Wood Manager, The Warren, Eridge Hamsell, Tunbridge Wells, Kent.
1903. WILLIAMSON, James, Overseer, Over Rankeillour, Cupar, Fife.
1895. WILLIAMSON, John, Bank Agent, Loanhead, Midlothian.
1899. WILSON, Gilbert, Timber Merchant, Dailly, Ayrshire.
1896. WILSON, James, M.A., B.Sc., Royal College of Science, Stephens Green East, Dublin.
1900. WILSON, James, jun., Nurseryman, St Andrews.
1902. WILSON, John, M.P., Airdrie House, Airdrie.
1901. WILSON, John Currie, Factor, Tullyallan Estate Office, Kincardine-on-Forth.

Date of Election.

1897. WILSON, John H., D.Sc., F.R.S.E., St Andrews.
1903. WILSON, Thomas, Head Gardener, Glamis Castle, Glamis.
1897. *Wilson, William, Forester, Dingley, Market Harborough, Leicestershire.*
1901. WILSON, William G., Overseer, Dalquharran, Dailly.
1899. WILSON, William, Timber Merchant, Auchenleck, Ayrshire.
1893. WISEMAN, Edward, Nurseryman, Elgin.
1895. WISEMAN, William, Nurseryman, Forres.
1894. WOOD, William, The Gardens, Newton Don, Kelso, Berwickshire.
1868. WYLLIE, George, Ballogie, Aboyne, Aberdeenshire.
1899. *Wyllie, Robert, Assistant Forester, Knowsley, Prescot.*

1897. YEATS, Alexander, Land Steward, Dunnottar Estate, Stonehaven.
1875. YOUNG, William, Forester, Morriston Cottage, Earlston, Berwickshire.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON.

HIS MOST EXCELLENT MAJESTY THE KING.

PROCEEDINGS IN 1903—*Continued.*

MEETING AT DUMFRIES.

An informal meeting of Members of the Society and others attending the Forestry Exhibition in the Highland and Agricultural Society's Show at Dumfries, was held in the Committee Room in the Showyard, on Thursday, 23rd July, at 2 P.M. The Right Hon. the EARL OF MANSFIELD was called to the chair.

The CHAIRMAN referred to the notice calling the Meeting, which stated that a discussion would take place on the best means for improving the Exhibition, and he invited suggestions from those present to help the Council to insure that there would be a larger and better exhibition next year.

Captain WALKER of Crawfordton said the list of prizes was in some respects unsatisfactory, for instance, some conifers, such as *nobilis* and *Menziesii*, were of too recent introduction to be cut down as timber Exhibits. They were looked upon as specimen trees, and proprietors would not cut them down. He thought the list should be confined to the fir tribe in common use, such as the Scotch fir, larch, spruce, and probably silver. He thought, also, that the timber asked for was too heavy.

Mr JOHN HAY, Kilmarnock, said it was discouraging for Exhibitors, in the section for articles for estate and farm purposes, to have such different articles as carts and gates competing against each other.

The SECRETARY said the Committee might remodel the Prize Schedules and Classification of Exhibits before another Show.

Mr JOHN ANNAND, Haystoun Estate, Peebles, said he thought

the Society should aim at Exhibits of commercial timber, rather than of timber of specimen trees, and suggested that reports should be submitted, giving particulars of the conditions under which the timber was grown.

Mr George Leven, Auchencruive, Ayr, expressed disappointment at the smallness of the Exhibition. He complained of the scanty way in which prizes were awarded by the Society, remarking that, so far as he was aware, no Gold Medal had been awarded during the past six or seven years. He pointed out that the Prize Schedule stated the classes of medals and their converted values, and he thought Exhibitors with the best Exhibits might fairly expect to be awarded gold medals. The Society should give more encouragement to Exhibitors, and help to draw them out.

The Chairman pointed out that by the Schedule the Judges were empowered to award such prizes as they considered suitable for the Exhibits.

He said the Meeting had been a very useful one, and he hoped the Council would reconsider the Schedules early, so as to give Exhibitors time to prepare their Exhibits for next year.

Captain Walker remarked that he thought slip-planting was the cause of most of the damage done by wind, etc., and suggested that the Society should investigate the matter.

On the motion of Mr Wm. Mackinnon, Edinburgh, a hearty vote of thanks was accorded to the Highland and Agricultural Society for providing accommodation for the Exhibition and the Meeting, and for their contribution to the Prize Fund.

Votes of thanks to the Local Secretaries and the Chairman concluded the business.

THE GENERAL MEETING.

A General Meeting of the Society was held in No. 18 George Street, Edinburgh, on Monday, 27th July 1903, at 11.30 a.m. W. Steuart Fothringham, Esq. of Murthly, President, in the chair.

Apologies for Absence.

Apologies for absence were intimated from Lord Lovat, Sir Kenneth Mackenzie, Colonel Bailey, and Mr John Boyd.

Minutes.

The Minutes of the Fiftieth Annual Meeting, held on Wednesday, 28th January 1903, were held as read and approved of.

Chairman's Remarks.

Mr Fothringham said this was the first opportunity he had had of thanking the Members for electing him President of the Society. He hoped to carry out the traditions of the office. He was glad to say that the Society was in a flourishing condition, the finances were sound, and the Membership was steadily increasing. They expected to announce a Membership of over 1000 at their Jubilee Meeting next year. Their Members were very representative of the whole country, and the wider the Society was known, the greater would be its influence for good. The Annual Excursions were of great value, in allowing Members to see the work of their neighbours. It was good for the Members to visit foreign countries also, and to get foreign foresters to visit this country, as in these ways each had an opportunity of learning from the other. He regretted his inability to go with them on their Excursion to England, but hoped they would have a good time, and get both instruction and enjoyment.

Election of an Honorary Associate.

On the recommendation of the Lecturer on Forestry at Edinburgh University, Mr Edward Battiscombe, Hinton Court, Hereford, senior student at the Forestry Class during Session 1902-3, was elected an Honorary Associate.

Judges' Report on Model of a Shear Fence.

The Report was not received in time for the Meeting, and the matter was remitted to the Council, with powers.

Judges' Report on Essays.

The Report of the Judges on the Essays received in competition was submitted, and the following awards were made, in terms of their recommendations :—

Class I.

(1) "Forestry in Ireland."

Award—No. 2 Silver Medal, to David M'Beath, Cruchmore Lodge, Drumcliffe, Sligo.

(2) "Forestry in Ireland."

Award—Bronze Medal, to W. M. Mitchell, Lough Cutra, Gort, Co. Galway.

CLASS II.

(1) "Diseases, Insects, and Animals Injurious to Trees."

Award—No. 1 Silver Medal, to GILBERT BROWN, Forester, Beaufort, Beauly.

(2) "The Propagation of Trees and Shrubs."

Award—Bronze Medal, to D. M. MACDONALD, Assistant Forester, Alnwick Castle.

(3) "The Propagation of Trees and Shrubs."

Award—Bronze Medal, to ALEX. M'GREGOR, Assistant Forester, Durris, Drumoak.

FORESTRY EXHIBITION AT THE HIGHLAND AND AGRICULTURAL SOCIETY'S SHOW.

The SECRETARY reported that the Exhibition at Dumfries was smaller than those held at Aberdeen and Inverness. The quality of the Exhibits was, however, very good, and the Exhibition had attracted a great deal of attention. He mentioned that a Report on the Exhibition would be published in the *Transactions*, and submitted the following awards by the Judges of the articles sent in competition:—

Four Varieties of Timber of Conifers Grown in Scotland, viz., Scots Fir, Spruce, Silver Fir, and Larch.

1st prize £3, D. Crabbe, Byreburnfoot, Canonbie.
2nd prize £2, W. Macalpine Leny of Dalswinton.
V.H.C., Sir John Gilmour, Bart. of Lundin and Montrave.

Model of Portable Saw-mill.

No. 2 Silver Medal, to John Macpherson, Novar, Ross-shire.

Best Article for Estate or Farm Use manufactured from Home-grown Timber.

No. 1 Silver Medal, to N. S. Hattersley, Maryfield, Dalswinton, for a farm cart.
No. 2 Silver Medal, to D. Crabbe, Byreburnfoot, for a field gate.
V.H.C., George Leven, Auchencruive, for an estate gate.

Best Collection of Furniture Made of Home-grown Timber.

No. 1 Silver Medal, to Alex. Pollock, Tarbolton, for suite of rustic oak furniture worked in stag-horn design.

Examples showing Best Methods of Utilising Small Wood in Manufacture of Small Wood Articles, Turnery, Woodwork, etc.

No. 2 Silver Medal, to Alex. Pollock, Tarbolton, for a fancy rustic oak seat.

Instrument or Method for Expeditiously Obtaining the Diameter of Trees at a Given Height.

No. 1 Silver Medal, to John M'Tavish, Forester, The Poles, Skelbo, Sutherlandshire, for a pole instrument for obtaining the length and diameter of standing timber.

The awards were approved of, and a hearty vote of thanks was accorded to the Judges and to the Local Secretaries for their services.

St Louis Exhibition in 1904.

The President explained that the Society had been invited to send Exhibits of Scottish Forestry to the Exhibition at St Louis. The Council had, however, decided that it was impossible to send any large Exhibits, but had offered to provide photographs of American conifers grown in this country, and of specimen park trees. The matter was remitted to the Council, with powers.

Register of Foresters and Others.

The Secretary mentioned that the Register was now in operation, and that he had a number of men on his list desiring places.

The President commended the Register to the attention of Proprietors desiring men, and hoped it would prove useful.

The Society's Jubilee, 16th February 1904.

The Secretary reported that, in connection with the Society's Jubilee, the following recommendations had been submitted to and approved of by the Council, viz., (1) that the Annual Meeting and Dinner and a Conference be held in Edinburgh in February; (2) that a Forestry Exhibition be held in the Highland and Agricultural Society's Showyard at Perth; (3) that an Excursion be made to France; and (4) that a special Number of the *Transactions* be prepared.

A discussion took place as to whether the Conference should be held in Edinburgh in February, or at the same time as the

Exhibition at Perth, and as the majority of Members appeared to be in favour of the former place and time, the whole matter was remitted to the Council, with powers to carry out the recommendations, it being understood that the Conference would be held in Edinburgh in February if it could be conveniently so arranged.

Vote of Thanks.

A vote of thanks to the Chairman for presiding concluded the business of the Meeting.

Royal Scottish Arboricultural Society.

SYLLABUS OF SUBJECTS FOR ESSAYS.

The following subjects are offered for competition in 1904 :—

[*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 31st May 1904. Each Essay, Report, Model, or Article must bear a MOTTO, *and be accompanied by a sealed envelope bearing outside the* SAME MOTTO, *and the Class to which the Competitor belongs, and containing inside, 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.

Judges cannot compete during their term of office.

Successful Competitors may either have the medals or their converted values, which are as follows:—Gold, £5; No. 1 *Silver,* £3; No. 2 *Silver,* £2; *Bronze,* 10s.]

CLASS I.—FOR OPEN COMPETITION.

I. Contrast the position of the United Kingdom as a Field for Timber-Growing on a commercial scale with that of other European countries, and show how a considerable proportion of the Timber which we now import could be produced at home. (*Five Guineas* offered by W. H. MASSIE, Esq., of Messrs Dicksons & Co., Nurserymen, Edinburgh.)

II. The Output of an acre of Home Nursery. (*Two Guineas* offered by WM. MACKINNON, Esq., of the firm of John Downie, Nurseryman, Edinburgh.)

The essayist will assume that the trees are raised from seed or cuttings, and that they are moved to the woods when four years old. He will indicate what amount of seed and area of seed-beds will be needed, and what area of plant-beds will be required to receive the transplanted seedlings. He will show what number of trees of various kinds may be expected annually from such a nursery.

III. On the best methods of utilising or marketing Forest Products. (*Two Guineas* offered by D. P. LAIRD, Esq., Pinkhill Nurseries, Murrayfield, Edinburgh.)

IV. The results obtained by various methods of Planting, with various Species, Sizes, and Descriptions of Plants.

The Report to be based on actual experience; soil and other local conditions to be fully described.

V. The durability and comparative values of the Timber of British Grown Exotic Trees (European Larch excepted) when used for estate and building purposes.

VI. Measures that have been adopted to prevent the destructive effects of Gales. (*A Medal.*)

VII. The Natural Regeneration of Woods, and the subsequent Treatment as regards Artificial Assistance, should such have been rendered necessary owing to the Natural Sowing having been irregular, insufficient, or too dense. (*A Medal.*)

The author must cite some particular case, and give the results of a systematic attempt at natural regeneration, bearing in mind the fact that a patchy, imperfect restocking cannot be regarded as satisfactory or successful.

VIII. The Valuation of Woods or Plantations for the purpose of Transfer. (*A Medal.*)

The writer to describe the method (*a*) of valuing matured woods, (*b*) middle-aged woods, (*c*) park trees and others that may be, in addition to their value as timber, considered as ornamental, (*d*) young woods, and (*e*) coppice.

IX. For an approved Report on the Woods of which the competitor is Forester. Reporter to state the extent of the woods, the kinds of timber grown, soil, situation, age, management, etc. [A standing subject.] (*A Medal.*)

X. An account of the Present State and Future Prospects of Forestry in the North of Scotland. (*A Medal.*)

XI. On the best method of growing a continuous Crop of Timber. (*A Medal.*)

The Essay should deal with the different kinds of Woods, the ages, and proportion per acre of the trees at different stages, and whether these have been raised by natural or artificial means. Reference may be made to any system practised abroad which might prove applicable in this country.

XII. The Sylvicultural Advantages of Under Planting, with specified examples. (*A Medal.*)

XIII. The best method of Preventing Damage by the Pine Saw-fly—*Lophyrus pini* of Curtis. (*A Medal.*)

XIV. Any Disease incidental to Forest Trees. [A standing subject.] (*A Medal.*)

XV. The most advantageous methods of Transporting Timber. (*A Medal.*)

The writer specially to describe any means of moving felled timber from the interior of woods to their margins, or to roads.

XVI. For accurate Measurements of Height and Cubic Contents of pure groups of the following species, viz.:—*Pseudotsuga Douglasii*, *Picea sitchensis* or *Menziesii*, *Pinus Strobus*, *Pinus Laricio*, *Abies pectinata*, and *Thuja gigantea*. The method of measurement, the age, and number of trees, the system of planting and thinning, and particulars of soil, situation, and elevation of localities to be given in the case of each group. (*A Medal.*)

XVII. Report on damage to trees caused by lightning, describing its effects, and showing the kinds of trees most liable to be struck. (*A Medal.*)

XVIII. The erection and maintenance of a Saw-mill and other Wood-working Machinery suitable for Estate purposes. (*A Medal.*)

The writer should fully describe the saw-mill or other machinery to which his Essay relates, giving estimates of outturn and of cost.

XIX. For an approved Essay or Report on any other subject connected with Forestry. (*A Medal.*)

Class II.—For Assistant Foresters only.

I. The Propagation of Forest Trees and Shrubs, based on personal experience. (*A Medal.*)

II. Any disease affecting Trees, or injuries caused to Trees, by fungi, insects, or animals. (*A Medal.*)

III. The Peeling and Harvesting of different kinds of British Bark used in Tanning. (*A Medal.*)

IV. The best method of protecting Trees from injury by Ground Game. (*A Medal.*)

V. The extraction of Chemicals from Wood or Bark.

VI. For an approved Essay or Report on any other subject connected with Forestry. (*A Medal.*)

The Council invite the attention of young Foresters to the foregoing subjects, as they wish to encourage their literary efforts.

ROBERT GALLOWAY,
Secretary.

12 York Buildings,
Edinburgh,
January 1904.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

JOHN NISBET, D.Œc.,
HONORARY EDITOR.

A. D. RICHARDSON,
ASSISTANT EDITOR.

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

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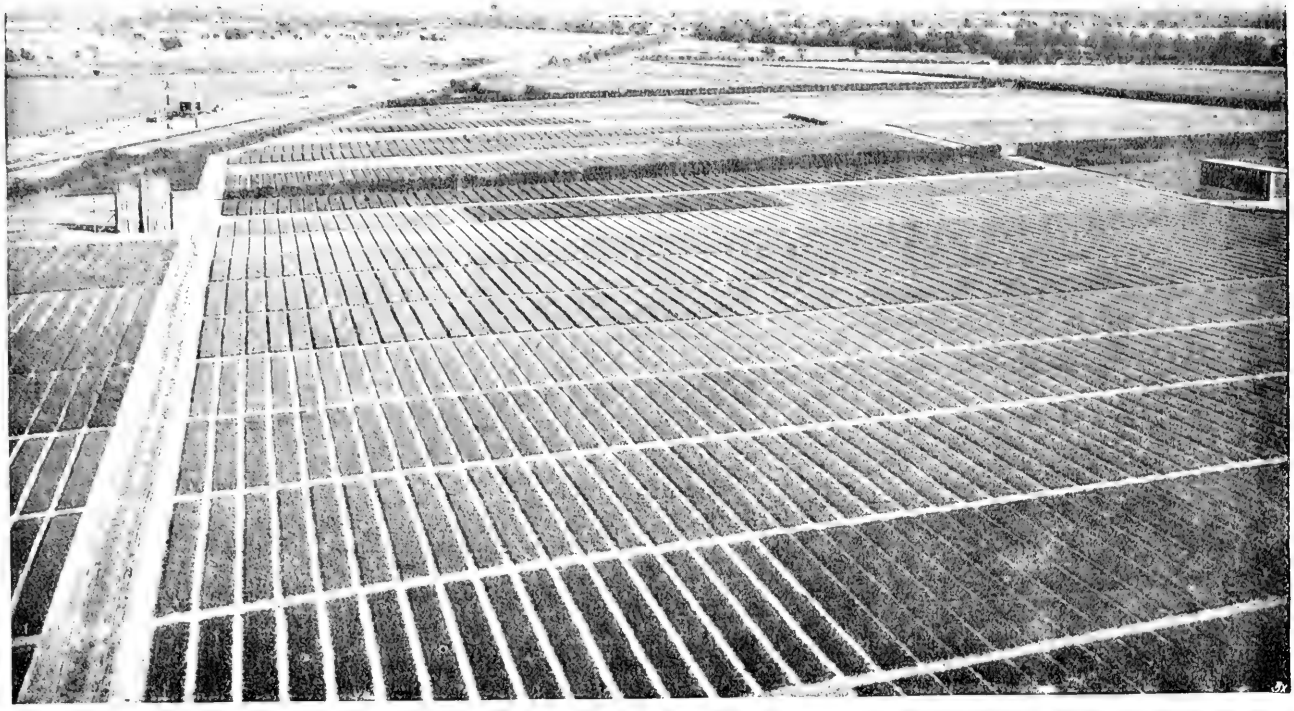

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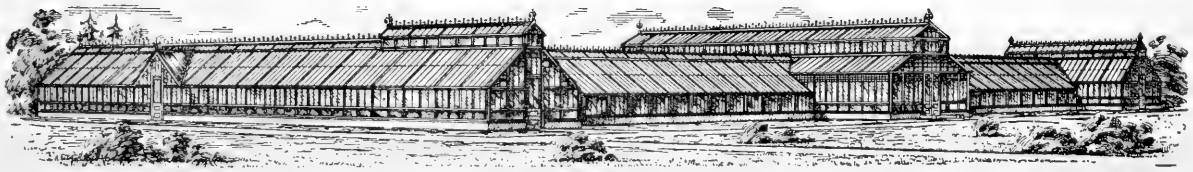

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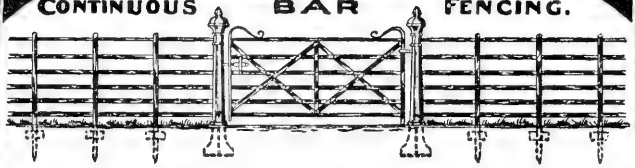

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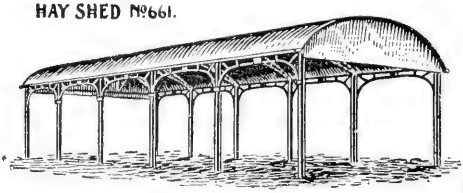

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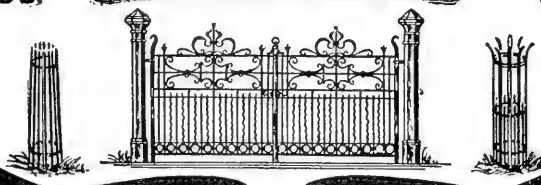

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Royal Scottish Arboricultural Society.

INSTITUTED 1854.

Patron—HIS MOST EXCELLENT MAJESTY THE KING.

Permission to assume the title "Royal" was granted by Her Majesty Queen Victoria in 1887.

FORMER PRESIDENTS.

1854-56. James Brown, 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 Marquis of Lothian, K.T.
1882. Alexander Dickson, M.D., F.R.S.E., of Hartree, 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, M.P.
1888-89. The Most Hon. The Marquis of Linlithgow.
1890-93. Isaac Bayley Balfour, M.D., Sc.D., F.R.S., LL.D., Professor of Botany in the University of Edinburgh.
1894-97. R. C. Munro Ferguson, M.P.
1898. Colonel F. Bailey, R.E.
1899-02. The Right Hon. The Earl of Mansfield.

OFFICE-BEARERS FOR 1905.

President.

W. STEUART FOTHRINGHAM of Murthly, Perthshire.

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LEXANDER PITCAITHLEY, Forester, Jeanie Bank, Scone.
HAS. BUCHANAN, Overseer, Penicuik Estate, Penicuik.
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Council.

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OBERT FORBES, Estate Office, Kennet, Alloa.
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. F. MACKENZIE, F.S.I., Estate Office, Mortonhall, Liberton.
. H. MASSIE, Nurseryman, 1 Waterloo Place, Edinburgh.
OHN BOYD, Forester, Pollok Estate, Wood Cottage, Kennishead, Thornliebank.
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ADAM SPIERS, Timber Merchant, Warriston Saw-mills, Edinburgh.
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JAMES JOHNSTONE, F.S.I., Factor, Alloway Cottage, Ayr.
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JOHN SCRIMGEOUR, Overseer, Doune Lodge, Doune.
DAVID W. THOMSON, Nurseryman, 113 George Street, Edinburgh.

Hon. Editor.

Dr JOHN NISBET, Royal Societies Club, 63 St James Street, London, S.W.

Assistant Editor.

A. D. RICHARDSON, 8 Sciennes Gardens, Edinburgh.

Auditor.

JOHN T. WATSON, 16 St Andrew Square, Edinburgh.

Hon. Secretary.

R. C. MUNRO FERGUSON, M.P., of Raith and Novar, Raith House, Kirkcaldy.

Secretary and Treasurer.

ROBERT GALLOWAY, S.S.C., 5 St Andrew Square, Edinburgh.

Membership.

THE Roll contains the names of over 1000 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.

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 Forest for Scotland which might serve the above-named objects. Copies of this Scheme were laid before the recent 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.

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.

Excursions.

During the past twenty-six 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, and in 1902 a Tour extending over seventeen days was made in Sweden. During the past summer the Forest School at Nancy and Forests in the north of France were visited. 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.

The Society's *Transactions*.

The *Transactions* of the Society are published annually, and 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. Copies of the *Transactions*, which now extend to seventeen volumes, are to be found in the principal Libraries of the United Kingdom, as well as in those of the British Colonies and of America.

Honorary Consulting Scientists.

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

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

Consulting Chemist.—ALEXANDER LAUDER, B.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., Royal Veterinary College, Clyde Street, Edinburgh.

Consulting Geologist.—JOHN SMITH FLETT, M.A., B.Sc., M.B., C.M., Geological Survey, 28 Jermyn Street, London, S.W.

Consulting Meteorologist.—ROBERT COCKBURN MOSSMAN, F.R.S.E., F.R.Met.Soc., 10 Blacket Place, Edinburgh.

Local Secretaries.

The Society is represented throughout Scotland, England, and Ireland by the Local Secretaries whose names will be found on page 28 of the *Proceedings* appended. 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 Foresters, Etc.

A Register of Foresters and others desirous of obtaining situations is now in operation. 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.

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, 5 St Andrew Square, 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, and others, subscribing annually . . . . . Half-a-Guinea.
3. Foresters, Gardeners, Land-Stewards, 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.**

V. Members in arrear shall not receive the *Transactions*. Any Member whose Annual Subscription remains unpaid for three years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till all his arrears are 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, and others, . 5 5 0
3. Foresters, Gardeners, Land-Stewards, 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 *new* Life Members.

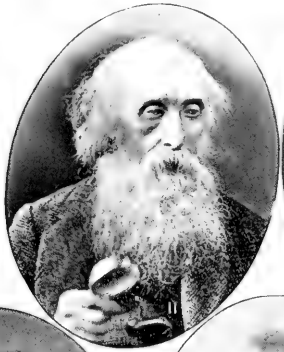
XII. Every Proposal for Membership shall be made on the FORM provided for the purpose, which must be signed by two Members of the Society as Proposer and Seconder, and delivered to the Secretary to be laid before the next meeting of the Council. The Proposal shall lie on the table till the following meeting of the Council, when it shall be accepted or otherwise dealt with, as the Council may deem best in the interests of the Society. The Proposer and Seconder shall be responsible for payment of the new Member's first Subscription.

His Majesty King Edward, Patron of the Society.

PRESIDENTS OF THE SOCIETY, 1854-1904.

1. James Brown, LL.D., 1854-57.
2. The Right Hon. The Earl of Dudhe, 1857-58.
3. The Right Hon. The Earl of Stair, 1858-59.
4. Sir John Hall, Bart. of Dunglass, 1859-60.
5. His Grace The Duke of Atholl, 1860-61.
6. John I. Chalmers of Aldbar, 1861-62.
7. The Right Hon. The Earl of Airlie, 1862-63.
8. The Right Hon. T. F. Kennedy of Dunure, 1863-64.
9. Robert Hutchison of Carlowrie, 1864-72.
10. Hugh Cleghorn, M.D., LL.D., etc., of Stravithie, 1872-74, 1883-86.

PRESIDENTS OF THE SOCIETY, 1854-1904.











11. John Hutton Balfour, M.D., etc., 1874-76.
12. The Right Hon. W. P. Adam of Blairadam, M.P., 1876-79.
13. The Most Hon. The Marquis of Lothian, K.T., 1879-82.
14. Alexander Dickson, M.D., LL.D., etc., of Hartree, 1882-83.
15. The Right Hon. Sir Herbert E. Maxwell, Bart. of Monreith, M.P., 1886-88.
16. The Most Hon. The Marquis of Linlithgow, 1888-90.
17. Isaac Bayley Balfour, M.D., LL.D., etc., 1890-94.
18. R. C. Munro Ferguson of Raith and Novar, M.P., 1894-98.
19. Colonel F. Bailey, R.E., 1898-99.
20. The Right Hon. The Earl of Mansfield, 1899-1903.
21. W. Stecart Fothringham of Murthly, 1903-

THE OLDEST MEMBERS OF THE SOCIETY.

Sir John Ramsden, Bart.

Mr J. Grant Thomson.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

I. *Address delivered at the Fifty-first*[1] *Annual Meeting, 16th February* 1904. By W. STEUART FOTHRINGHAM, Esq., President of the Society.

This being our Jubilee Meeting, I think it is only right that we should, in some shape or form, draw attention to the history of the Society. Presidents before me have drawn attention, and very ably, to various points in connection with the more practical aspects of forestry, but on this particular occasion I think it would be only right that we should take some little survey of our past history and progress. In 1854 the Society was founded, under the Presidency of James Brown, who was then Deputy-Surveyor in the Forest of Dean, and with a Committee of nineteen Members. As far as the records of the Society show, there were few other Members, so that evidently it was a small Society to start with. Two years later the Society commenced to publish their *Transactions*. It was not until 1866 they began, like most Societies, to have an Annual Dinner, and it was not a bad way of bringing the Members of the Society together. The next event of great interest occurred in 1869, when Queen Victoria was pleased to give to the Society her patronage. This was a sign that the Society was getting on, and that its position was well established, because it is well known that the Sovereign does not give his or her patronage to a Society which is not properly founded. Her Majesty continued her patronage to the end of her life, and King Edward has been pleased to give the Society his patronage since that time. It was not till 1873 that the discussions on forestry were inaugurated at the Annual Meetings, and people at large began to take an interest in what the Society was doing.

[1] See footnote, page 6.

In 1875 Prof. J. H. Balfour, then President of the Society, suggested, at one of those discussions, the formation of a British Forestry School. As you know, the Society has been trying since that time to get a British, and preferably a Scottish, Forestry School established. This was the object of the Society in 1875, and since then the Society has continually pressed it on the authorities, and I hope we will continue to press that object until our efforts are crowned with success. In 1885 a Select Committee of the House of Commons was instituted, partly, if not entirely, at the instigation of the Society, and that Select Committee in 1887 recommended the establishment of a Board of Forestry. The Committee did not do anything, but perhaps in time we may see a Board of Forestry, or, at any rate, a Government Department interested in that particular branch of industry. Mr Hutchison, who was a distinguished Member of the Society, and was President for eight years, suggested in 1885 both a Forest Area and a Lectureship on Forestry in Scotland, and, I suppose, as a result of that Dr Somerville was appointed first Lecturer on Forestry in Edinburgh University. Then there was a motion to have a regular Chair of Forestry endowed in Edinburgh, and a Chair of Forestry Endowment Fund was started in 1890. Since that time the Society has continued by all the means in its power to try and press upon the Government, and upon the proprietors of land and others interested, the importance of education in matters relating to forestry. In 1902 a Departmental Committee was appointed by Mr Hanbury, and a large amount of evidence was taken. Their Report has been published in our *Transactions*, and that Committee reported absolutely in favour of all the objects which the Society has always pressed—the establishment of a forest area and of forestry instruction. I hope we will continue to try and get the recommendations in that Report given effect to, and I hope that the resolution we have passed to-day will have some effect in getting them carried out.[1] The Society, in continuing its efforts to promote education on forestry matters, adopted a scheme of Excursions. In 1878 the first Excursion took place to Scone, and others have been made there once or twice since; and Excursions have been annually undertaken to various places in Scotland, England, Ireland, North Germany, and Sweden, and now we are going to France, all with the view of

[1] Since the above Address was delivered, some progress has been made in this direction, see page 18.

educating ourselves, and learning what we can from our neighbours. I hope we shall not be long in the position of having to go and learn from our neighbours, but that we shall have deputations from other countries coming to Scotland to see what we can show them.

This has been a very brief resumé of the history of the Society. I have tried to show you that the objects of the Society have always been to further the interests of forestry in Scotland and the education of the forester, and we have got to press these still, so that, by its influence, forestry may be so developed in Scotland that pupils will come to it to learn forestry instead of going to Germany or France or elsewhere. I think we have also forwarded the cause of technical education by publishing annually in our *Transactions* valuable papers on practical work in various forms. We do not profess to be entirely theoretical.

We are quite in favour of encouraging practical work. Further, the Society, as stated in the Report, has started a Register of Foresters. It is kept by the Secretary, and I am sure it will be of great advantage if it were more widely known throughout the country. It should tend to bring together the foresters in one place who want situations, and the employers in another who have situations to fill.

As for the Membership of the Society, I am able to say that, for the first time in our history, we have more than a thousand Members. Our numbers are now 1016. That is very gratifying, and we have to thank all those who have been recruiting recently on behalf of the Society. I hope they will not cease their efforts now, for the larger number our Society represents, the more likely will we be to get our wants attended to by the Treasury and the other Government departments.

Our position is, I think, a pretty good one. We started, as has been said, with a few Members fifty years ago, and now we have a Membership of over a thousand. That shows a record of success which probably few societies are able to equal. I hope all the Members will spread abroad the objects of the Society, so that people generally, and proprietors of land in particular, may understand that we are convinced that, with proper attention, plantations and woods can be made remunerative. If we can do this, and if we can get a State Forest Area carried out on proper lines—if we can induce Government to take up that question, I think we shall have gone very far towards securing the objects

for which the Society exists. When Lord Mansfield was here, he remarked that young foresters in this country were not employed in a proper way, and he suggested the introduction of the apprentice system. That, I am quite sure, is a step in the right direction, and the head foresters who have tried it bear witness to the fact that the young men engaged in this way take a more intelligent interest in their work. These, Gentlemen, are all the remarks I shall offer you at present, but I would conclude by again congratulating the Society on having reached the jubilee year of its existence.

Mr John Methven, Edinburgh,—Gentlemen, I have to propose that we give our thanks to our President for his excellent and interesting historical sketch of the Society. To the many kindnesses that he has extended to foresters, he has added another to-day. We also thank him for his kind invitation to us to come and see his beautiful estate at Murthly in the month of July.

At the close of the President's Address, Mr Fraser Story, Lecturer on Forestry to the Edinburgh and East of Scotland College of Agriculture, delivered a lecture on "German Forestry." The lecture, with the discussion thereon, is reproduced at page 138.

II. *The Royal Scottish Arboricultural Society*, 1854-1904.

In the *Transactions* for 1884,[1] the year in which the International Forestry Exhibition was held at Edinburgh, a brief account of the formation and rise and progress of the Society is given, together with an enumeration of the principal events with which it was identified from the time of its foundation down to that year.

In this account it is stated that:—"At a meeting held in Edinburgh on the 16th[2] of February 1854, at which Mr William M'Corquodale, Forester, Scone Palace, Perth, presided, for the purpose of presenting a testimonial to Mr James Brown on the occasion of his appointment to the office of Deputy-Surveyor of Dean Forest, Gloucestershire, a suggestion was made by Mr William Thomson, Deputy-Surveyor, Chopwell Wood, Co. Durham, that, as Agriculture and Horticulture had derived much benefit from Associations designed to promote their respective interests, 'something of a similar kind should be done for Forestry.' The suggestion was at once adopted by the Meeting, and the Scottish Arboricultural Society there and then originated.

"A Committee was immediately formed to carry out the proposal, the Members of which were:—James Brown, Deputy-Surveyor, Dean Forest, *President;* William M'Corquodale, Forester and Wood-Surveyor, Scone, *Vice-President;* James Alexander, Nurseryman, Edinburgh, *Secretary;* John Anderson, Nurseryman, Perth, *Treasurer;* James Balden, Forester, Lennoxlove; John Balden, Forester, Bywell Castle; Mr Campbell,

[1] Vol. XI. p. 114.

[2] There is a curious discrepancy between the date given here and that of the first minute of the meeting. The first minute, written by the *Secretary*, Mr James Alexander, on a sheet of note paper, bears date 17th February; but the transcript of this minute in the Minute-Book bears date 16th February. In all the other documents of the Society, and in all references to its institution, the date 16th February, so far as is known, occurs, with the single exception of Mr M'Corquodale's reference in his Address delivered at the Thirty-sixth Annual Meeting, 6th August 1889 (Vol. XII. p. 375), where he speaks of it as 17th February, a singular error, if error it was, on the part of the Chairman of the Meeting at which the Society was formed, and who had all through been closely identified with its work. The original minute is reproduced at page 43.

Alloa; Robert Cowan, Forester, Arniston; James Dickson, Forester, Charlton; Thomas Forbes, Forester, Whittinghame; Robert Gardiner, Forester and Land Steward, Eglinton Castle; John M'Donald, Forester, Bargany; John M'Laren, Forester, Hopetoun; Hugh M'Laren, Forester, Shaw Park; Alexander M'Leish, Forester, Alnwick Castle; James Rutherford, Forester, Buckden; John Thomson, Forester, Culhorn; William Thomson, Deputy-Surveyor, Chopwell; and Thomas Taylor, Forester, Camperdown, Members of *Committee*.

"Several Meetings of the Committee were held during the year 1854, at which the Constitution and Laws were drawn up, and various matters of importance discussed and arranged for the formal institution of the Society. The results of the labours of the Committee were submitted to the first 'Annual General Meeting' of the Society, held at 6 York Place, Edinburgh, on 31st January 1855,[1] Mr James Brown, *President*, in the chair, and after full consideration were unanimously approved of."

Mr Brown continued in the Presidency for three years, and was succeeded by the Earl of Ducie; and since that time the Presidential Chair has been filled by many eminent Arboriculturists. The Society does not seem to have been long in making headway, for by the time it had been four years in existence, its Membership had risen to 167, and about this number it oscillated for the next eight years; but at the close of this period the Membership again took an upward tendency, and in 1877 it reached 750. After this time the Membership again seems to have become practically stationary, and it is not till 1895 that any marked increase appears. From this time onwards, however, there has been a steady increase, and on the Jubilee Anniversary the Roll of Membership stood at 1016.

So far as can be ascertained, the Founders of the Society and those who subsequently became Members in the first year of its existence have passed away, and the oldest Members of the Society are now Sir John Ramsden, Bart., and Mr John Grant Thomson, Wood Manager, Grantown, Strathspey, both of whom joined the Society in 1855.

[1] Two Annual General Meetings, the first and second, were held in 1855 (in January and November), so that from this year onwards the number of the Annual General Meeting appears throughout the *Transactions* as one in advance of the actual number of years in the Society's existence, and the Jubilee Meeting therefore appears as the fifty-first instead of the fiftieth.

There seems to be an impression in some quarters that prior to the foundation of the Scottish Arboricultural Society a local Arboricultural Society was in existence at Brechin, in Forfarshire; but while there is ample evidence of its existence,[1] there is nothing to show that the Brechin Society was antecedent to the Scottish Society. On the contrary, the evidence is all the other way. From a paper on "Local Arboricultural Societies" by Mr Robert Philip, Forester, Aldbar, Brechin, read at the Annual General Meeting of the Scottish Arboricultural Society on 14th November 1855, and subsequently published in the *Transactions*,[2] it seems quite clear that the Brechin Society had not then been formed, for Mr Philip states that, "As we have not met as a Society, I cannot state in this paper what our constitution will be, but I consider that the subscription should be as low as possible, in order to embrace all who may feel inclined to be members of the local, and not preclude any from remaining or becoming members of the Scottish Arboricultural Society." Mr Philip, it is true, does not mention the local Society by name, but there can be no doubt that it is the Brechin Society to which he refers. The first reference to this Brechin Society in the records of the Scottish Society occurs in the Minutes of the Annual General Meeting held on 12th November 1856, where it is stated that, "On a statement by Mr Philip, it was agreed to publish in the *Transactions* such Essays of the Brechin Arboricultural Society as might be approved of, and to furnish the Society with copies of the *Transactions* for their members at half-price;" and in the first volume of the *Transactions* three essays appear which had been awarded prizes by the Brechin Society in 1856 and 1857.[3] Mr Philip was elected a Member of the Scottish Society at the meeting at which he read his paper on local Societies, and in the list of Members as it stood at 12th November 1856 he is designated "Secretary to the Brechin Arboricultural Society." It is quite evident, therefore, that the Brechin Society came into existence in the interval between 14th November 1855 and 12th November 1856, but as to the actual date of its formation no record seems to be obtainable. How long the Society continued to exist is not known, but it seems to have been still in existence in 1858, for in the Minutes

[1] A copy of the Laws will be found at page 237.
[2] Vol. I. p. 38.
[3] Vol. I. pp. 96, 207, and 210.

of the Annual General Meeting of the Scottish Society held on 6th October of that year the following entry occurs:—"It was agreed that all Essays read before the Brechin Arboricultural Society, or other local Societies, shall be submitted to a Special Committee of the Scottish Arboricultural Society, and sanctioned by them, previous to being published in the Society's *Transactions;*" and in an essay on "Thinning and General Management of Forest Trees," by a writer who signed himself "Justitia," which was awarded a silver medal at the meeting on 6th October 1858, and was subsequently published in the *Transactions*,[1] the writer states that "Arboricultural Societies are now instituted in Edinburgh, Brechin, and Peebles, and from these I hope much good may emanate." These are apparently the last references to the Brechin Society which occur in the records of the Scottish Society, and it is probable that soon after this time it came to an end.

Of other local Arboricultural Societies, with the solitary exception of that at Peebles, referred to by "Justitia" in his essay, no record seems to exist. How long the Peebles Society continued to exist is not known, but it is probable that, as in the case of the Brechin Society, its career was not of long duration.

Principal Events in the History of the Society.

1854. The Society founded. James Brown, author of *The Forester*,[2] elected first *President.*

1855. Constitution and Laws adopted at Annual Meeting. Addresses on the Aims and Objects of the Society delivered by the President and Wm. Thomson. Subscriptions fixed at—Foresters, 10s. 6d.; Under Foresters, 5s. Medals offered for Essays. Five *Vice-Presidents* first elected. Members admitted on payment of first Subscription. E. J. Ravenscroft appointed *Auditor.*

1856. *Transactions* first published. First issue of complete List of Members. Subscriptions fixed at—Amateurs and

[1] Vol. II. p. 3. This essay must, of course, have been written before 1st August 1858, the date on which essays for competition were to be sent to the Secretary.

[2] The first edition of *The Forester* was published in 1847, Mr Brown then being forester at Arniston, Midlothian.

others, 10s. 6d.; Foresters, 5s.; Under Foresters, 2s. 6d. Specimens illustrative of Pruning exhibited by Wm. M'Corquodale at General Meeting.

1857. Earl of Ducie elected *President.* Returns of Prices of British Forest Produce first obtained. Silver Medals first awarded for Essays. Proposal to hold itinerary Annual Meetings disapproved of. Thomas Methven appointed *Auditor* in place of E. J. Ravenscroft, resigned.

1858. Earl of Stair elected *President.* Honorary Members first elected, viz., Dr J. H. Balfour, Sir Wm. J. Hooker, Dr Lindley, Prof. George Lawson (*Assistant Secretary* of the Society 1854-58), James M'Nab, and Peter Clark.

1859. Sir John Hall, Bart., of Dunglass, elected *President.* Six *Vice-Presidents* elected. Robert M. Stark appointed *Secretary* in place of James Alexander, first *Secretary* of the Society, resigned.

1860. Duke of Atholl elected *President.* Subscriptions fixed at —Proprietors, Nurserymen, etc., 10s. 6d.; Factors, etc., 5s.; Foresters, 3s.; Under Foresters, 2s.

1861. John I. Chalmers of Aldbar elected *President.* The *Secretary*, Robert M. Stark, resigned office. Nurserymen's subscriptions fixed at 5s. Proposal to start Forestry periodical discussed. Five prizes of £5 each offered by Society to stimulate Foresters to contribute Essays on special subjects.

1862. Earl of Airlie elected *President.* John Sadler appointed *Secretary.* General Meeting decided that in Essay Competitions the decisions of the Judges were to be final.

1863. Right Hon. T. F. Kennedy of Dunure elected *President.* Committee appointed to test and report on M'Glashan's Transplanting Machine.

1864. Robert Hutchison of Carlowrie elected *President.* Society's Motto suggested by the *Secretary*, and adopted. Committee reported favourably on M'Glashan's Transplanting Machine.

1866. The first Annual Dinner held. Committee appointed to establish, in Edinburgh, a Forester's "Registry Office." Presentation to *Treasurer*.

1867. Education and Training of Foresters discussed at Annual Meeting. The *President* presented Medal Dies to the Society.

1868. Deputation appointed to wait on British Association regarding assistance in testing the Influence of Forests on Climate. Dr Cleghorn delivered address at Annual Meeting, on "Forest Service of India and Scottish Forestry."

1869. Her Majesty the Queen became Patron of the Society. Thomas Methven appointed *Treasurer* in place of John Anderson, first *Treasurer* of the Society, resigned, and David Syme appointed *Auditor* in place of Thomas Methven. Ten Guinea Cup offered by David Mitchell,[1] Nurseryman, Edinburgh, for a practical Essay on Arboriculture. Robert Hutchison and William Thomson elected Honorary Members. Exhibition of Cones from Scotland, England, and Ireland at Annual Meeting.

1870. Committee appointed to investigate the Influence of Forests on Climate, the British Association giving a grant in aid of £20. Proposal to grant Diplomas for Efficiency in Forestry discussed and postponed. Exhibition of Cones, etc., at Annual Meeting.

1871. Subscriptions fixed at—Nurserymen, Factors, etc., 10s. 6d.; Foresters, 5s.; Under Foresters, 3s. Exhibition of Cones, Woods, Photographs, etc., at Annual Meeting.

1872. Hugh Cleghorn, M.D., of Stravithie, elected *President*. Decided to devote two days to Annual Meeting; to have discussions on selected subjects; and to appoint a Deputation to visit and report on European Forests and Forest Schools. Exhibition of large collection of Woods, etc., at Annual Meeting.

1873. Annual Meeting first held at Royal Botanic Garden, Edinburgh. Discussions on special subjects at Annual Meetings inaugurated. Museum Committee

[1] Mr Mitchell died in 1904.

appointed. John Ord Mackenzie appointed *Auditor* in place of David Syme, resigned. Sir Dietrich Brandis elected Honorary Member. Exhibition of Cones, Tools, Photographs, etc., at Annual Meeting.

1874. Prof. J. H. Balfour, M.D., elected *President.* In his Inaugural Address the *President* forcibly pointed out the advantage of planting waste land in Britain. Memorial sent to Government in favour of acquiring Arboretum. George Chrichton appointed *Treasurer* in place of Thomas Methven, resigned. Exhibition of Woods, Cones, etc., at Annual Meeting.

1875. The *President* suggested the creation of a British Forest School, and sketched a curriculum. William M'Corquodale elected Honorary Member. Death of William Thomson, originator of the Society, recorded.

1876. Right Hon. W. P. Adam of Blairadam elected *President.* New Code of Laws and Regulations submitted to Annual Meeting, and approved. Discussion on "A Journal of Arboriculture" led Messrs Rider & Son, London, to publish the *Journal of Forestry*, in May 1877. Exhibition of Woods, Cones, etc., at Annual Meeting.

1877. Local Secretaries (14) first appointed. Presentation to *Treasurer.*

1878. First Excursion of the Society — Scone, Perthshire. Council resolved to inquire and report on obtaining a Royal Charter for the Society. George Chrichton elected a Trustee in place of Prof. Balfour, resigned. Exhibition of Cones, Seeds, Fibres, Photographs, etc., at Annual Meeting.

1879. Marquis of Lothian, K.T., elected *President.* John M'Laren, jun., appointed *Secretary* in place of John Sadler, resigned, and also *Treasurer* in place of George Chrichton, deceased. (David Mitchell, *Interim Treasurer.*) W. P. Adam elected a Trustee in place of George Chrichton. Education Committee appointed. Exhibition of Woods, Cones, etc., at General Meeting. Excursions in Perthshire and Midlothian.

1880. Charter and Education Reports approved and remitted. Hornsby's Hedge-cutting Machine exhibited in operation. J. Ord Mackenzie and Robert Hutchison elected Trustees. Presentation to William M'Corquodale. Excursions in Peeblesshire, Linlithgowshire, and Midlothian.

1881. Special Prizes for Essays offered to Assistant Foresters on the suggestion of the *President*. Question of Forestry Education remitted to the Council. Sir Richard Temple, Bart., delivered an Address on Forestry; elected an Honorary Member. Marquis of Lothian elected a Trustee in place of W. P. Adam, deceased. Excursions in Morayshire and East Lothian.

1882. Professor Alex. Dickson, M.D., of Hartree, elected *President*. The Council recommended the creation of a School of Forestry in Scotland. Proposal to hold International Forestry Exhibition in Edinburgh. Excursions in Fife and Dumbartonshire.

1883. Hugh Cleghorn, M.D., of Stravithie, elected *President* for second time. Preparation for International Forestry Exhibition absorbed whole attention of Society; £100 voted to Guarantee Fund. Excursions in Perthshire and Selkirkshire.

1884. International Forestry Exhibition held at Edinburgh. Numerous Exhibits by the Society and individual Members. Excursions in Midlothian and Perthshire.

1885. Select Committee of House of Commons on Forestry sat. Evidence given by *President* and other Members of the Society. Mr Hutchison suggested Lectureship on Forestry might be started at once at Edinburgh University. Forest Area also suggested. Mutual Benefit Society suggested. Subscription List revised, and Scale at present (1904) in force adopted. Marquis of Lothian, Dr Cleghorn, Sir John Lubbock, Sir James Campbell, General Michael, Hon. Robert Southey, Sir Joseph D. Hooker, Professor Dickson, Hon. Wm. Russell, Maharajah of Johore, Edward Jack, and Morimasa Tokei, elected Honorary Members. Presentation to *Secretary*. Excursion in Cumberland and Westmoreland.

1886. Sir Herbert Maxwell, Bart., M.P., elected *President.* Select Committee of House of Commons again sat. Society's Specimens illustrative of Forestry sent to Museum of Science and Art,[1] Edinburgh. Prosposal to start Forestry Periodical again discussed. Wm. J. Moffat appointed *Secretary* and *Treasurer* in place of John M'Laren, jun., resigned. Excursion in Argyll and Buteshire.

1887. Her Majesty the Queen granted permission to the Society to use the title "Royal." Paper on the proposed School of Forestry by Sir Dietrich Brandis, read by Dr Cleghorn. Proposal for Forestry Periodical again discussed, and project abandoned. Excursion in Aberdeenshire.

1888. Earl of Hopetoun elected *President.* The Council petitioned Parliament against the transference of the Royal Botanic Garden to the University of Edinburgh. Presentation to Dr Cleghorn. "Dr Cleghorn Forestry Library" founded. Visit to Arboretum. Excursion in Roxburghshire.

1889. Dr Wm. Somerville appointed first Lecturer on Forestry at Edinburgh University. Society made representation to Secretary for Scotland in favour of Select Committee's recommendation to create a Board of Forestry and Schools of Forestry. Government decided that Royal Botanic Garden and Arboretum were to remain Crown Property. Professor Sargent and Dr Schlich elected Honorary Members. Excursion in Notts.

1890. Professor I. Bayley Balfour, M.D., Sc.D., elected *President.* Society decided to memorialise University Commissioners in favour of Forestry Education. Forestry Chair Endowment Fund started. Excursion in Ross-shire.

1891. The *President* promulgated teaching scheme for Working Foresters and Gardeners at the Royal Botanic Garden, Edinburgh. Dr Somerville appointed Professor of Agriculture and Forestry at Durham College of Science. Chair of Forestry discussed. Proposed Forestry Journal again discussed. Deaths of Wm. M'Corquodale and John M'Laren, two of the founders

[1] Now the Royal Scottish Museum.

of the Society, recorded. Excursion in Dumfries, Kirkcudbright, and Wigtown shires.

1892. Classes for Working Foresters and Gardeners instituted at Royal Botanic Garden. University Commission recommended establishment of Chair of Forestry in Edinburgh University. Favourable report of University Forestry Chair Endowment Fund submitted. Forestry made optional subject for B.Sc. degree in Agriculture in Edinburgh University. Excursions in Fife and Perthshire.

1893. Creation of Edinburgh School of Rural Economy suggested by *President*. Excursion in Berks, Bucks, Surrey, and Hants.

1894. R. C. Munro Ferguson, M.P., of Raith and Novar, elected *President*. *President* made suggestion to visit Germany. Decided to hold Annual Meeting in January, and a General Meeting at date of Excursion. £433, 10s. paid to University for Forestry Chair Endowment Fund. Wm. J. Moffat, *Secretary* and *Treasurer*, resigned office. R. Galloway appointed *Interim Secretary;* G. Mill appointed *Interim Treasurer;* J. Ord Mackenzie resigned *Auditorship*. Sir Charles Logan elected an Honorary Member. Excursion in Inverness, Moray, and Banffshire.

1895. Deputation to Mr Long, President of the Board of Agriculture, on the subject of a proposed School of Forestry, etc. Professor Somerville delivered Address on "Formation of a Limited Liability Company to acquire an Estate for Sylviculture." Death of Dr Cleghorn recorded. Society's Books and Specimens handed over to Royal Botanic Garden. Cabinet of Lantern Slides, illustrating Timber-Structure, presented by D. F. Mackenzie. Paper on German Forestry read by John Michie. Robert Galloway appointed *Secretary* and *Treasurer*. John T. Watson appointed *Auditor*. Professor Schwappach elected Foreign Honorary Member. Excursion in North Germany.

1896. Motion to alter name of Society to "Royal Scottish Society of Forestry" rejected. Further sum of £150, 13s. 10d. handed over to University for Forestry Chair Endow-

ment Fund, making total of £584, 3s. 10d. Committee appointed to collect statistics as to distribution of Forest Trees in Scotland for International Board of Forestry. Honorary Consulting Scientists appointed. Professor Schwappach visited Scotland, and delivered Address on "The Importance of Density in Sylviculture." Excursions in Perthshire, Stirlingshire, and Midlothian.

1897. Address presented to the Queen on the occasion of Her Majesty's Diamond Jubilee. Prizes of £21 and £5, 5s. offered by the *President* and the Society respectively for Essays on the best Method of establishing a Forest Area in Scotland: four Essays received; £15, 15s. awarded. Lord Balvaird and R. C. Munro Ferguson, M.P., elected Trustees in place of Dr Cleghorn and Robert Hutchison, deceased. Address delivered by Professor Schlich on "Forestry Education." Resolution that Members use their influence with Local Authorities, etc., to induce them to plant trees to commemorate the Diamond Jubilee Year. Paper on "Forestry during the Queen's Reign," by Malcolm Dunn, published. Large additional number of Local Secretaries appointed. Excursions in South of Ireland and Peeblesshire.

1898. Colonel F. Bailey, R.E., elected *President*. Scheme for the Establishment of State Model Forests prepared by the President and Professor Somerville, and adopted by the Council, and copies sent to President of Board of Agriculture, Chancellor of Exchequer, Secretary for Scotland, Scottish Members of Parliament, and others. Mr Munro Ferguson appointed *Honorary Secretary*. Raith Working-Plan published. Catalogue of "Cleghorn Memorial Library" submitted by Director of Museum of Science and Art. Specimens of Douglas Fir affected by *Phoma pithya* exhibited for first time, by George Leven, Auchencruive, Ayr. Malcolm Dunn elected an Honorary Member. Excursions in Gloucestershire and Peeblesshire.

1899. Earl of Mansfield elected *President*. Reply from Board of Agriculture regarding Establishment of State Model Forest: no action to be taken meantime. Raith

Bursary of £30 per annum instituted by Mr Munro Ferguson, conditions attaching thereto published, and Alex. T. Crombie appointed Bursar for 1899-1900. Copies of Raith Working-Plan distributed amongst landowners and others. Death of Malcolm Dunn recorded. Dunn Memorial Fund started. Books presented to Society handed over to "Cleghorn Memorial Library" and to Lecturer on Forestry in the University. Jägmästare Elis Nilson, of the Swedish State Forest Department, visited Scotland in order to study condition of Larch Woods; letter to the Society embodying his views on same published. Lecture on "Pure Forests and Mixed Forests" delivered by Sir Dietrich Brandis. Section of Scots Pine, 270 years old, grown at Riccarton, Midlothian, exhibited by Sir James Gibson Craig, Bart. Proposal to visit France in 1900: proposal afterwards abandoned. Excursion in Inverness, Ross, and Sutherlandshire.

1900. Remit made to Mr Munro Ferguson and Colonel Bailey to prepare Draft Memorial setting forth the claims of Edinburgh as a centre in event of Royal Indian Engineering College at Coopers Hill being abolished; afterwards found that the Government had decided to make no change meantime. Digest of replies to Circular issued to Members of Society regarding Fires caused by Railway Engines, sent to Boards of Agriculture and Trade in connection with Sparks from Railway Engines Bill. Subscriptions from Members of Society to Dunn Memorial Fund, £112, 3s. 6d. Proposal to publish *Transactions* quarterly abandoned meantime. Motion to admit "Honorary Associate Members" adopted. Raith Bursary for 1900-1901 awarded to Matthew Feaks. Novar Working-Plan published, and copies circulated amongst landowners and others. Dr Nisbet delivered Address on "British Forestry and its Future Prospects." Excursion in North of Ireland.

1901. Death of Queen Victoria. Address presented to the King on Her Majesty's death, and on His Majesty's accession to the Throne. Royal Patronage renewed. Deputation to Mr Hanbury, President of the Board of Agriculture,

setting forth Society's views on Forestry Education, State Model Forests, and Sparks Bill. Mr Munro Ferguson also suggested to Mr Hanbury the appointment of a Departmental Committee on Forestry. International Congress on Sylviculture held at Paris. Digest of information *re* Fires caused by Railway Engines circulated amongst Members of Parliament, etc. Raith Bursary for 1901-1902 awarded to Frank Scott. Forestry Exhibition held at Inverness in connection with Highland and Agricultural Society's Show. Forestry to be one of the subjects taught in the recently founded College of Agriculture at Edinburgh. Jubilee Committee appointed. Proposal to increase number of Council from 15 to 21. J. S. Gamble, C.I.E., and Sir Robert Menzies, Bart., admitted Honorary Members. Fraser Story, T. A. Crombie, Wm. Bruce, and Thos. Usher admitted Honorary Associate Members. Discussion on Larch Disease at General Meeting at Ayr. Statistics of Prices of Home-grown Timber for 1901 collected by Committee of Council. Excursion in Ayrshire.

1902. Departmental Committee on Forestry (R. C. Munro Ferguson, M.P., Chairman) appointed by Mr Hanbury; D. Robertson, Dunrobin, appointed as Representative of the Society to give evidence before Committee. Committee visited Edinburgh in September, and were met by a Deputation of the Council. Report of Departmental Committee published in autumn. W. Steuart Fothringham of Murthly elected a Trustee in place of J. Ord Mackenzie, deceased. Colonel Bailey appointed *Honorary Editor* of *Transactions*. Raith Bursary suspended. Jubilee Committee proposed Excursion to France in 1904. Proposal to elect six additional Councillors adopted. Motion, submitted by D. F. Mackenzie, to appoint Committee to inquire into Larch Disease remitted to Council. Wm. Matthews Gilbert and Fred Smith elected Honorary Associate Members. Discussion on Damage done to Woodlands by Squirrels. Forestry Exhibition at Highland and Agricultural Society's Show at Aberdeen. Excursion in Sweden.

1903. W. Steuart Fothringham of Murthly elected *President.* Proposal to change name of Society to "Royal Scottish Society of Forestry and Arboriculture," and to hold General and Council Meetings alternately in Edinburgh, Glasgow, and Perth, rejected. Committee of Council reported in favour of Register for Foresters being kept by the Society. Decided to alter rule as to date of Annual General Meeting, so as to permit it to be held "at such time and place as the Council may determine." Dunn Memorial Fund: subscriptions and interest thereon, less expenses, £119, 14s. 6d. Society's share of expense of monument, £19, 1s. 10d.; balance invested. Six additional Councillors elected. Colonel Bailey resigned Honorary Editorship of *Transactions.* Photographs of American Conifers growing in Scotland sent to St Louis Exhibition. Jägmästare Elis Nilson elected Honorary Member. Edward Battiscombe elected Honorary Associate Member. Lecture by A. T. Gillanders on "Forest Entomology." Forestry Exhibition at Highland and Agricultural Society's Show at Dumfries. Highland and Agricultural Society voted £20 to be awarded for Exhibits of Scotch-grown Timber. Excursion in Beds, Bucks, and Herts.

1904. Jubilee Anniversary of the Society celebrated on February 16th. Large number of Delegates from other Societies present at Annual Meeting and Dinner. Resolution adopted at Annual General Meeting calling upon Board of Agriculture to take steps to give effect to recommendations of Departmental Committee on Forestry, as far as regards Scotland, by providing a State Forest Demonstration Area, and Example Plots in connection with Edinburgh University; and that until these are supplied, and a thoroughly equipped Forest School is established, Forestry Education will not be adequately provided for in Scotland. Subsequent negotiations brought out the following points, viz.: (1) that a State Forest will be provided through the office of Woods and Forests, if an area suitable for the purpose can be obtained; (2) that Forestry Education and Forest Demonstration areas, including Example

Plots, come under the control of the Scottish office; (3) that purely Experimental Work and Research fall within the province of the Board of Agriculture. A Conference was held, under the auspices of the Society, between representatives from the Universities and Agricultural Colleges in Scotland and Sir Henry Craik, on behalf of the Scottish Education Department, when Sir Henry invited the representatives to submit their schemes for Forestry Education, which he promised to investigate. The Council afterwards passed the following resolution, which was sent to the Secretary for Scotland and Sir Henry Craik:—"That, in the opinion of the Council of the Royal Scottish Arboricultural Society, the existing administrative machinery is insufficient to develop a full course of instruction in Sylviculture in Scotland, and that it is essential to make adequate provision to attain that end." Conference at Perth on 22nd July, at which Forestry Education was discussed. Forestry Exhibition held by Society in connection with Highland and Agricultural Society's Show at Perth; £20 granted in Prizes by latter Society for Timber grown in Scotland. Earl of Mansfield, Dr Wm. Somerville, Colonel F. Bailey, J. Grant Thomson, D. F. Mackenzie, and James Kay, elected Honorary Members. Dr John Nisbet appointed *Honorary Editor*, and A. D. Richardson *Assistant Editor* of *Transactions*. Excursions in Perthshire and France.

III. *A brief Survey of the History of Forestry in Britain during the last Fifty Years.* By the Honorary Editor.

In the President's Address and the preceding article the history of our Society during the last fifty years has been reviewed. But it seems at the same time appropriate to give also a brief sketch of general legal and other prominent changes that have, during this period, taken place as regards Forestry throughout the United Kingdom. The range of view is therefore wider than that taken with special regard to "Forestry in Scotland in the Reign of Her Most Gracious Majesty Queen Victoria,"[1] by the late Mr Malcolm Dunn.

During all the earlier part of the nineteenth century, the dread of a shortage of oak for shipbuilding, and for the navy in particular, acted as a constant stimulus to the planting of oak, while the improvement of land under larch and other conifers also led to these being grown extensively for timber and profit.

Despite the fact that planting was found to improve land, however, there was a decided cessation of activity in planting after 1830. Maturing plantations then already showed that the very sanguine anticipations formed about them were seldom likely to be realised, and the prospects of profit were usually too uncertain to induce great landowners to embark on permanent investments of this particular kind, and more especially at the time when railways, offering more tempting investments, began to be built extensively. The fact of the matter is that from this time onwards the economic position of the country as regards oak and most other timber was entirely different from what it previously had been. About a hundred years ago the discovery was made that the oily teak-tree of India possessed valuable properties for shipbuilding, and henceforth the country was saved from its chief anxiety in this respect. And when Britain emerged from her great Continental war with complete command of the sea, she could supply all her other wants with regard to coniferous timber from her North American Colonies and from other countries. After that, the re-plantation of the Royal woods and forests no longer seemed of vital importance; and some of them were subsequently turned into national parks for recreation.

The effect of the Continental wars was that large areas of

[1] Vol. XV. p. 109.

woodland were converted into arable land, the stiff soil on which the oak thrived best being also that most suitable for corn. And fresh land was seldom planted to replace the woodlands cleared away. Still, the planting of oak on the better woodland soil, and of larch, pine, and fir on inferior land and exposed situations, went on fairly extensively until about 1850, when the whole position was revolutionised by steam communication on land and water, and by the use of iron in shipbuilding, which now enabled foreign timber to be imported at a low price. Other economic changes have also gradually taken place since then, greatly affecting the once very profitable woodland portions of estates; and as timber, bark, and coppice-wood gradually sank in value as the result of free import trade, the existing woodlands have gradually come to be mainly game preserves and ornaments to large estates. One sign of the times had been shown very clearly by the exemption of our two largest Crown woodlands, the New and the Dean Forests, from the *Act to facilitate the Enclosure and Improvement of Commons*, in 1845.

The manner in which the great economic changes caused by railway and steamship communications affected the Royal forests can be easily understood by a very brief summary of events. In 1848 a House of Commons' Committee considered the questions affecting the Crown forests, but never delivered any complete Report, though an interim Report was issued in 1849, and the draft of a Report was also discussed. A Royal Commission was appointed in 1850, with Lord Portman as chairman, to inquire into the rights and claims over the New Forest and Waltham Forest (Essex), which resulted in what is generally known as *The Deer Removal Act* of 1851. It did not affect the Forest of Dean, but it empowered the enclosure of up to 10,000 acres in the New Forest, instead of the right to keep deer (and in addition to 6000 acres which were enclosable under older Acts of 1698 and 1808), such enclosures to belong to the Crown, free of all common and other rights. When these enclosures had outgrown danger from cattle, they were to be opened to grazing, and new enclosures made; and a register was to be kept defining all rights of common and the owners of the same.

In 1852 the status of the Commissioners of Woods and Forests was determined more definitely than hitherto by *An Act to alter and amend certain Acts relating to the Woods, Forests, and Land Revenues of the Crown.* In 1861 the various statutes

dealing with damage to woodlands, trees, and shrubs were consolidated and amended in the *Act . . . relating to Larceny and other similar Offences* (24 & 25 Vict. cap. 96, sect. 16, referring to "any Forest, Chase, or Purlieu"; and sects. 31 to 33 and 35, referring to "trees and woods"), while protection was at the same time given to ornamental trees and shrubs under the Act relating to *Malicious Injuries to Property* (cap. 97, sects. 20 to 22 and 53). Under these it was made felony to steal any tree, shrub, or underwood, or to destroy or maliciously injure the same with intent to steal, if the value be £1 in parks, avenues, or pleasure-grounds, or £5 elsewhere; and even if the value be only over 1s., on a third offence the larceny becomes a felony, and the malicious injury becomes punishable with two years' imprisonment with hard labour. Such is the present law.

The Deer Removal Act of 1851 created so much bitter feeling locally, and such a public outcry for æsthetic reasons, that a Committee of the House of Commons was appointed to consider the whole question of the New Forest; and an amending Act was passed in 1877, by which the work of planting was stopped when only about 5000 acres had been planted, the enclosures were limited to 16,000 at any given time, and it was laid down that only plantations made since 1700 can be enclosed and replanted. This is the law now in force; and under it the older woods are being destroyed by gales and the decay of old age, without permission being given under the Act to replace the old trees by new growth. Thus, while the unwooded parts are barren wastes and moors, the old woods are also gradually being destroyed by unrestricted commonage.

The woods in the New Forest are now—From 30-40 years, 5705 acres; 40-65 years, 4278 acres; 65-90 years, 4080 acres; 90-115 years, 2230 acres; over 115 years, 1377 acres,—total, 17,670 acres. Of the remaining 47,067 acres belonging to the Crown, 40,478 acres are open heath and pasture, the enclosure and planting of which is absolutely prohibited by the Act of 1877.

In the Forest of Dean, too, there had been so much friction with the mining population that, in 1874, a Select Committee of the House of Commons had also been appointed to inquire into and report on it.

In the meantime, while less attention was now being given to the growth of timber in the Crown forests, there were many private landowners, especially in Scotland, who planted largely

about the middle of last century. After about 1845, drainage was better understood and practised, so that timber crops had a fairer chance of doing well. The Highland and Agricultural Society of Scotland did much to encourage Arboriculture, and a further stimulus to Forestry was given in 1854 by the formation of the (now Royal) Scottish Arboricultural Society for the advancement of Forestry in Scotland. In England this lead was not followed till 1881, when the English Arboricultural Society was formed; and it was not till 1901 that the Irish Forestry Society was established. For a full generation, however, these two Scottish societies were the only bodies that continuously and consistently urged the claims of Forestry to receive more attention than hitherto, and with an assiduity that now at length seems to be achieving something like substantial progress.

In 1855 a *Quarterly Review* article, entitled "The Forester," reviewed the first and second reports of the Commissioners of Woods and Forests under the new Act of 1851, and several well-known works then recently published. This article dealt with planting for profit on waste lands, and in situations where agricultural crops did not pay; and it gave very sound advice concerning soil and situation, drainage, enclosure, fencing, soil-preparation, pit-planting, and notching, the number of plants per acre, and the best time for planting.

Though it contains much that is technically incorrect, yet its main outlines are thoroughly practical; and the article is just as well worth reading now as it was fifty years ago. On all of these important points much sound advice was given, while well-considered and shrewd remarks were made on the tending of plantations. It included instructions concerning the pruning of hardwoods, with a view to correct the errors of injudicious thinning, consequent on the erroneous ideas then prevailing as the result of the old national system of Arboriculture having for its main object the growth of branching oak timber for ship-building, while it also advised that "in Fir plantations . . . no pruning should be allowed, as the operation injures both the health of the individual and the quality of the wood." At that time the ideas about thinning (and consequently about the number of trees per acre allowed to remain for the mature timber crop) were extravagant, the ordinary rule-of-thumb of the forester being that the trees should stand at a distance from each other equal to one-third of their height—that is to say, a wood

of trees that had run up to a height of 90 ft. would only bear a crop of 48 or 49 trees per acre, and this quite irrespective of the fact that a shade-enduring crop of beech, sycamore, spruce, or silver fir should stand far thicker than a light-demanding crop of oak, larch, or Scots pine. And this rough rule appears to have been commonly applied in practice, because it was estimated "that it takes 2200 full-grown trees, or the matured crop of 44 acres of woodland, to furnish timber for a single 74-gun ship,"—which shows a stock of only 50 trees per acre, standing about 30 ft. apart.

The retrograde passiveness which subsequently prevailed is shown by another *Quarterly Review* article, in 1876, on "Ornamental and Useful Tree-Planting." This was an essay on landscape gardening, and dealt with the more purely ornamental side of Arboriculture, its keynote being that, "if, as was said in the outset, trees are a special passion with Englishmen, the future of our woodlands and forests demands that an interest in their culture and conservation should be spread far and wide among our countrymen, and rise superior to utilitarian calculations or the selfish pleadings of private interest." And legislation assumed very much the same careless tone. The immediate pressure about timber having been relieved, all the former concern as to the national importance of British woodlands appears to have become completely forgotten; it seems to have passed absolutely and entirely from the recollection both of the public and of their representatives in Parliament.

In Scotland, however, the necessity for instruction in Forestry was being kept in view by the Highland and Agricultural Society and the Scottish Arboricultural Society. A Forestry Exhibition was held at Edinburgh in 1884, in the hope that a surplus would be earned sufficient for the endowment of a Chair of Forestry in the Edinburgh University; but though in other respects successful, this object was not achieved. This example has often since been followed. In 1893 an Exhibition of Horticulture and Forestry was held at Earl's Court (London); in 1901 the Irish Exhibition at Cork had a section for Forestry; and since 1902 the Forestry exhibits have formed a regular part of the Highland and Agricultural Society's Show in Scotland. In 1904 the Royal Agricultural Society of England also formed a Forestry Exhibition at their annual Show in London. One effect, however, of the action of these Societies was to revive an interest in Forestry, and this found its expression in the appoint-

ment of a Select Committee of the House of Commons in 1885, to consider "*whether, by the establishment of a Forest School, or otherwise, our woodlands could be rendered more remunerative.*"

The Report of this Committee (1887) was given in full in the Society's *Transactions* (1888), and all that need here be remarked is that it thought the management of our woodlands might be much improved; "that the establishment of forest schools, or, at any rate, of some organised system of forest instruction, would be very desirable; . . . that the establishment of a Forest Board would be a wise step; and . . . that, apart from any immediate pecuniary benefits, there would be considerable social and economical advantages in an extensive system of planting in many parts of the kingdom, especially on the west side of Ireland and in the Highlands of Scotland."

These recommendations were, to a slight extent, given effect to, by power being conveyed, under the *Board of Agriculture Act* of 1889, to the Board to undertake the collection of statistics relating to Forestry; to aid any system of lectures or instruction connected with Forestry; to inspect and report on any examinations in Forestry; and to make or assist in inquiries, experiments, and research for the purpose of promoting Forestry. But these powers were limited, and when interrogated on the subject in Parliament on 23rd March 1891, the President of the Board of Agriculture intimated that he had "no power of giving effect directly to the recommendations of the Select Committee, either as regards the establishment of a school or schools of Forestry or the creation of a Board of Forestry." Under such powers as were conferred, however, the Board of Agriculture has, since 1891, paid £100 a year towards the Lectureship in Forestry instituted (in 1889) at Edinburgh University, and £250 a year as one-half of the salary of the Professor of Agriculture and Forestry at the Durham College of Science (founded at Newcastle-on-Tyne in 1891), and, since 1892, £150 a year towards the free instruction of foresters and gardeners at the Royal Botanic Garden, Edinburgh, and similar aid towards instruction at the Glasgow Technical Institute in the West of Scotland.

The Select Committee on Forestry had, in their Report of 1887, thought it right to call attention to the "unskilled management" of the Crown woodlands generally, and "the present unsatisfactory condition of the New Forest" in particular, owing to the Act of 1877. Accordingly, another Select Parliamentary Com-

mittee was appointed in 1889, *to inquire into the Administration of the Department of Woods and Forests and Land Revenues of the Crown.* The Crown woods and forests were found to then consist of Windsor Park and woods (15,175 acres); the New Forest (64,834 acres); the Dean Forest (18,710 acres); other woods and forests in Cheshire, Gloucestershire, Hampshire, the Isle of Wight, Northamptonshire, Surrey, and other counties (16,574 acres), and their status was as follows:—

Windsor Forest (15,175 acres).—Of this, 5355 acres are domain attached to Windsor Castle, and 9820 acres are not regarded as part of the residential property of the Sovereign. The ranger, appointed under Section 135 of 10 Geo. IV., has sole control of the deer, game, fish, and herbage.

The New Forest.—The income from this large tract of land is small, but the profitable rights of the Crown are very limited. The open forest is subject to rights of common, timber in recent enclosures is immature, and in the older woods the rights of the Crown are greatly restricted by the Act of 1877. The policy then adopted was that the New Forest should be administered principally with regard to the preservation of its ornamental character, and not with a view to profit.

The Forest of Dean.—Owing to the rights of commoners and miners, only a comparatively small income is obtained from the surface; whilst, as in the New Forest, regard is paid to the preservation of the natural beauty of the woods. By customs confirmed by Act of Parliament, the coal, ironstone, and quarry stone are "galed" (leased) to free-miners only on perpetuity leases, which are in almost all cases alienated by the original "galees."

In their Report in 1890, this Committee found the administration by the Commissioners of Woods and Forests satisfactory, but recommended that all the Acts relating to timber production in the Crown woods should be repealed, and that "the allotments set out and allotted to the Crown in severalty in Alice Holt Forest, Bere Forest, and Parkhurst Forest were by the Acts devoted to the growth of timber for the Royal Navy. As no timber is required by the Admiralty from these properties, the restriction as to their being devoted to the growth of timber, and also any similar enactments affecting the New Forest and the Forest of Dean, should be repealed."

Fortunately, this recommendation was not accepted. Though the New Forest is still being spoiled under the Act of 1877,

which ties the hands of the Commissioners of Woods and Forests and the Deputy-Surveyor, yet much has been done within the last ten years to make the Forest of Dean a good timber-producing estate and a place of instruction in Forestry.

There had apparently even been some talk of selling the Crown rights in the Forest of Dean, because the Committee remarked regarding it, that "possibly a larger income might be obtained by the sale of the surface and the reinvestment of the proceeds; but a difficult question would have to be dealt with in the purchase of the right of commonage enjoyed by tenants and freeholders of certain parishes. This would be detrimental to the welfare, and repugnant to the feelings, of the inhabitants of the district; whilst the destruction of the forest would be most regrettable."

Instead of any sale being effected, or the Acts regarding Arboriculture being repealed, a businesslike working-plan was drawn up for the Forest of Dean in 1897 (see *Transactions*, 1898), which now forms the Scheme of Management adopted. This gave a general description of the forest, with details regarding the various enclosures (in blocks and sub-blocks), and made definite proposals for the future management. This forms the first instance of a thorough and comprehensive working-plan, drawn up more or less on the lines of the modern Continental system, being applied to the management of one of the great Crown forests.

A similar scheme was at the same time drawn up for the Highmeadow Woods estate—adjacent to the Forest of Dean, and also under the charge of the Deputy-Surveyor—extending to about 3285 acres of enclosed woods, situated on both sides of the river Wye between Ross and Monmouth.

The objects with which these two working-plans were drawn up were thus described in the *Annual Report of Commissioners of Woods and Forests*, 1897:—"For some time past I have been anxious to introduce into the Forest of Dean and the Highmeadow Woods a more scientific and systematic system of forest cultivation than has hitherto been adopted. . . . It is desired not only to improve the prospective yield of the Forest, but also to establish such a system of management as may serve those who desire to study Forestry in this country with a good, practical object-lesson, such as at the present time they have to go to France or Germany to find." Long before this, however, the Forest of Dean had already served some such purpose, because "foresters entrusted with the management of private estates

come hither from all parts of the United Kingdom to take practical lessons in their art" (*Quarterly Review*, 1855, p. 457).

As the recommendations of the Parliamentary Committee of 1887 were neither acted on nor any longer met the case, the Royal Scottish Arboricultural Society in 1901 memorialised the President of the Board of Agriculture with regard to the improvement of British Forestry, and in February 1902 a Departmental Committee was appointed "to inquire into and report as to the present position and future prospects of Forestry, and the planting and management of woodlands in Great Britain, and to consider whether any measures might with advantage be taken, either by the provision of further educational facilities, or otherwise, for their promotion and encouragement." This Committee's Report is published in the Society's *Transactions*, 1903. It "endorsed the conclusions of the Select Committee of 1885-87 as regards the neglected condition of Forestry in Great Britain, the possibility of improvement, and the necessity for the provision of better means of education," and recorded the opinion "that the yield of our woodlands can be materially improved admits of no doubt, and the evidence before us unanimously favours immediate and effective provision for bringing systematised instruction within the reach of owners, agents, foresters, and woodmen. This has been on all sides emphasised as the first requisite in any project for the improvement of forestry, and consequently stands out as the cardinal point of our recommendations." These recommendations were summarised as follows:—(*a*) That two areas for practical demonstration be acquired, the one in England and the other in Scotland, of not less than 2000 acres, if possible, nor over 10,000 acres in each case. (*b*) That additional facilities for instruction be afforded, by the appointment of a lecturer on forestry in connection with each of the Universities of Cambridge and Oxford, and that example plots . . . be provided in connection with each of these centres and with Edinburgh. (*c*) That a good grounding in forestry form an integral part of the curriculum of the colleges providing instruction in agriculture in Great Britain; and that short courses of instruction, suitable for the requirements of young foresters, be also provided there. (*d*) That provision be made for the education of foresters and woodmen by employing students to work in both the demonstration forests. (*e*) That lectures be given, under the auspices of the County Councils, in neighbourhoods where there is a con-

siderable area under wood; and that scholarships be offered in such counties to enable working foresters to attend courses of lectures. (*f*) That the inequality shown to exist in the levy of the estate duty on timber be redressed. (*g*) That the Government be urged to secure the early enactment of a Bill to protect owners of woods against loss by fire caused by sparks from locomotives. (*h*) That the inquiry conducted in 1895, concerning the area of woodlands, be repeated by the Board of Agriculture, and that details concerning the character of the timber crop grown upon them be ascertained. (*i*) That the attention of Corporations and Municipalities be drawn to the desirability of planting with trees the catchment areas of their water-supply.

The serious national outlook with regard to coniferous timber was merely hinted at, without any suggestion being made to try and improve prospects by immediate extensive planting; and the Committee were unable to urge Government to form large State forests, or to recommend any encouragement being given to private landowners in the way of State loans, or even reduction of Local Rates on plantations. All the relief they were able to suggest was that irregularity in the incidence of the Estate Duties needs immediate revision. Indeed, though they are precisely matters of the first importance to landowners who may wish to plant, *Local Rates*, *Estate Duties*, *Damage by Sparks*, *Ground-Game*, *and State Loans* were classed as "minor considerations" by the Committee.

The necessity for State assistance is, however, a chronic drawback to planting for profit. Early in the last century this was just as much the case as it now is. Even then, although all the timber, bark, and small material from the copsewoods was easily sold at good prices, want of funds prevented extensive planting of waste lands. "Such lands, it must be owned, are sufficiently abundant, but the great expense and slow returns of planting are inconvenient to the majority of land proprietors. . . . The expense of planting is immediate and certain, the profit distant and precarious" (*Quarterly Review*, 1813, p. 9).

This is precisely what the recent Committee on Forestry has reiterated. The main drawback to planting is, and has always been, and probably always will be, want of funds; all the other obstacles can far more easily be removed. This is, in connection with British Forestry, the only historical fact which has remained absolutely unchanged during the last hundred years.

It is as yet far too early to expect to have the full results of the Committee's recommendations. Up to the present, however, on the part of the State, the practical outcome has been that the Commissioners of Woods and Forests have taken steps on a small scale for the instruction of woodmen in the Forest of Dean, the men each week working on four days and receiving instruction on two days; while the Board of Agriculture and Fisheries has made two grants, each of £250 per annum, for the establishment of Lectureships in Forestry at the Durham College of Science (Newcastle-on-Tyne) and the University College of Bangor, in North Wales.

Private enterprise has at the same time inaugurated a Chair of Forestry and Estate Management at the Royal Agricultural College, Cirencester, to which Earl Bathurst's adjacent woods have been made available for educational purposes; while a Lecturer on Forestry has also been appointed at the S.E. Agricultural College at Wye, in Kent. A short course of Lectures on Forestry is also given at St Andrews University.

A new departure in State policy has also been instituted with regard to woodlands in Ireland. Under Section 4 of the *Irish Land Act*, 1903, powers were given for enabling Government to make arrangements for "the planting of trees, or the preservation of . . . woods or plantations," and for retaining, in their own hands, woodlands and waste lands suitable for planting on estates acquired by purchase under the Act. And as a first step towards the improvement of Forestry in Ireland, and perhaps also towards the formation of extensive plantations, the Department of Agriculture and Technical Instruction has acquired the Avondale estate (Rathdrum, County Wicklow, formerly the residence of the late Mr C. S. Parnell, M.P.) and the adjoining Ballyfad woods as the nucleus for a Practical School of Forestry.

Several of the County Councils, both in England and Scotland, have also encouraged lectures on Forestry, and on 17th December 1904 the Irish Forestry Society resolved to inaugurate an Arbor Day for Ireland.

The future prospects of Forestry in Britain are therefore decidedly brighter and more hopeful than they were fifty years ago. The apathy and retrogression prevailing up till about 1880 have become converted, in some influential quarters, into interest and desire for real and practical progress; and our Society has, both directly and indirectly, had no small share in contributing towards the decided advance made in the last few years.

IV. *The Society's Jubilee Dinner.*

The Jubilee Dinner of the Royal Scottish Arboricultural Society took place on the evening of 16th February 1904, in the Royal British Hotel, Princes Street, Edinburgh. There was a large gathering of members; and most of the gentlemen who had represented the leading arboricultural, agricultural, collegiate, and other bodies at the business meeting were present as guests. The company numbered over a hundred. Mr W. Steuart Fothringham of Murthly, President of the Society, occupied the chair, and the croupiers were Sir Kenneth J. Mackenzie, Bart. of Gairloch, Mr John Methven, Edinburgh, and Mr Alexander Pitcaithley, Scone; and among those present were Bailie Murray; Bailie M'Michael; Treasurer Anderson, Edinburgh and District Water Trust; Dr Somerville, Board of Agriculture; Sir Ralph Anstruther, Bart., Highland and Agricultural Society; Councillor Macpherson, Edinburgh and East of Scotland College of Agriculture; Mr John Davidson, Secretary of the English Arboricultural Society; Mr I. Scott Kerr, Irish Forestry Society; Mr P. Murray Thomson, Royal Caledonian Horticultural Society; Mr Comfort, Scottish Horticultural Association; Mr William Carruthers, Royal Agricultural Society; Mr A. D. Webster, Royal Horticultural Society; Mr D. F. Mackenzie, Mortonhall; Mr J. Grant Thomson, Strathspey; Mr James Kay, Bute; Rev. D. C. Stewart, Currie; Mr Fraser Story; Mr James Macdonald, Highland and Agricultural Society; Sir Archibald Buchan-Hepburn; Major Cadell of Grange; Captain Milne-Home; and Mr H. J. Elwes, Colesborne.

The menu card was exceedingly appropriate. The badge and motto of the Society were surrounded by sprays of laurel leaves, on which all the names of the presidents were inscribed, while on the back were portraits of the first president, Dr James Brown, and the present president, Mr Fothringham, and a list of the chief events in the history of the Society.

The President, in proposing the toast of "The King," said His Majesty was good enough to grant the Society his patronage at the beginning of his reign. Long might his reign continue, and long might he be their patron.

The toast of "Queen Alexandra, the Prince and Princess of Wales, and other Members of the Royal Family," was also given from the Chair, and enthusiastically honoured.

Mr Pitcaithley proposed the toast of "The Imperial Forces."

Major Cadell of Grange, in his reply, showed in a humorous but practical way the relationship between the Imperial Forces and Arboriculture. The connection between Arboriculture and the Imperial Forces, he said, was not very obvious at first, and it required a little study to get into it. When people were in circumstances of difficulty and perplexity, the proper thing to do was to turn, as he had turned, to the Bible. He pointed to 2 Samuel xviii. and 6th verse as an illustration of how a wood became a great auxiliary force. Our first line of defence, he continued, was the navy; but the navy would be of little use without coal, and they could not have coal without first having forests. Therefore, it was necessary, from a national point of view, if our navy was to be efficient, that we ought to have efficient forests to begin with.

Mr John Methven, in proposing the toast of "The Lord Provost, Magistrates, and Town Council of Edinburgh," said he wished particularly that night, as they were sitting as an Arboricultural Society, celebrating its Jubilee, to show the connection between the Town Council and Arboriculture. The Town Council had had one great scheme. He referred to that being carried out by a department of the Town Council, the Edinburgh and District Water Trust, who were now employed in bringing to this city a bountiful supply of water from the watershed of the Peeblesshire hills. It was generally allowed that where a forest area existed, rain was carried more readily into the reservoirs than if the hills were entirely destitute of trees. He wished to say to those gentlemen of the Edinburgh Water Trust that they might be of great service, not only to them as a Society, but to the science of Arboriculture, if such a scheme as they wished the Government to take up were carried out, in planting a forest area on the hills of Peeblesshire. The Society that day had passed a resolution, and for the benefit of those gentlemen, members of the Water Trust, who were not present at the meeting, he might read part of it. It was this:—"That it is the opinion of the members of the Royal Scottish Arboricultural Society, assembled in annual meeting, that the Board of Agriculture should now take steps to give effect to the recommendation of the Departmental Committee on Forestry, as far as regards Scotland, by providing an estate to serve as a State Forest Demonstration Area." He

did not know, and he was not there to suggest, how that could be carried out, but there was no doubt that something would be done in the way of planting up the Talla water, and they might, by conferring together, manage to arrange something of the kind. He had not the slightest doubt, from what he knew of the members of the Edinburgh and District Water Trust, that they would give it their careful attention. He coupled the toast with the names of Bailie Murray, Senior Magistrate of the city, and ex-Bailie Anderson, Treasurer of the Water Trust.

Bailie Murray, in reply, said he had to express his regret that the Lord Provost was not there with them that night. He took occasion that day, knowing that he was coming there, to get some data in connection with what the Corporation had done in regard to open spaces, parks, gardens, and bowling-greens, and it might interest them to know that within the last twenty years they had acquired these different properties at Blackford Hill, Inverleith Park, Braid Hills, Roseburn Park, Portobello Park, and Saughton Park, at a total cost of £141,200. In regard to bowling-greens, twenty years ago they had only two, and now they had sixteen bowling-greens in all, costing on an average £300 each in construction. These, of course, required a considerable amount of upkeep, but it was pleasing to know that their working-class population really enjoyed them, and he was perfectly sure that the citizens did not grudge the extra rate which these parks and bowling-greens entailed upon the city. Out of 2s. 8d. in the £, he thought he was right in saying that the whole of them did not cost the ratepayers more than three farthings in the £. Mr Methven said that members of the Town Council went in with axes to grind; if their axes were very sharp they might make good foresters. That might be a very useful hint to those Town Councillors who were not members of this Arboricultural Society when they entered the Town Council. He was fortunate in being a member of the Arboricultural Society, and he had not ground any axe yet. As to the afforesting of the watershed of the Talla, this question had not been under discussion. It had been mooted, certainly, and they had had some request by the Board of Agriculture in regard to it, and by and by they would be able to give an answer to it. He was sure of this, that a number of members who had taken an interest in this question were quite of opinion that it would pay a great

deal better to have those hills covered with trees, than that they should remain as they were at the present time. If they did go in for the afforestation of their hills in the Talla district, he thought he could spot the gentleman who would be consulted as an expert as to what to plant. He would just like to say, in regard to their gardens, that they had one of the best—he might say, without fear of contradiction in an audience such as this—head gardeners that they could possibly find in the country. Everyone of them would believe him when he said that the city gardens were never more beautiful than they were at this time under Mr M'Hattie's care.

Mr W. Anderson, Treasurer of the Water Trust, said he did not anticipate, when he had the honour of being invited to the dinner, that he should require to say anything at all. With regard to the afforestation of the Talla, Bailie Murray had said all that could be said on the subject. He believed it had been remitted to a committee of the Trust to consider the whole question, and he had no doubt any representation from this Society would receive careful and earnest attention. Looking back to the history of the Trust, and to the history of the Corporation that went before it, they would only be acting in accordance with the traditions of the Trust, if they went in for tree-planting on the Talla. There were few prettier valleys than Glencorse. It was planted by the old Water Company, and it had been further embellished by the Trustees. The Trustees had planted freely at Gladhouse, and he would fain hope that the time would come when something in the same direction might be done at the Talla. Some of the hills there were very steep and very high, and he was told that they would suit admirably for tree-planting of some kind; and he had no doubt, as Bailie Murray had said, the Trustees would give their best consideration to any representation the Society might make to them. He trusted that something might come out of it.

Dr Somerville, who was cordially received on rising to propose the toast of the evening—"The Royal Scottish Arboricultural Society," said: Mr President and Gentlemen, I have now the honour to submit what may be called the toast of the evening, and I do so with very much pleasure, and with a sense of the responsibility and of the great honour that you have imposed upon me. In a manner, it is not at all difficult to propose the health of such a vigorous sapling as this Society. I call it a sapling,

because, although it is celebrating its fiftieth birthday, fifty years in the life of a society are no more than the years that go to form the period of existence of what a forester calls a sapling. I suppose if we were to compare the life of the Society with the life of an individual, we should say it has passed the period of its youth, that its wild oats are behind it, and that it is now going to enter into a vigorous inheritance. Well, gentlemen, with 1016 members in the books, and £1200 in the bank, this Society may, I think, look pleasantly out into the future. I should not like to predict what the membership may be fifty years hence, but if the rate of increase in the future is as it has been in the past, you will get a figure that will rather astonish you. Under a sense of the responsibility of proposing the toast of this Society, I endeavoured to fortify myself by looking into one or two of the earlier volumes of the *Transactions*, and if any member has got a complete set of the *Transactions* of this Society, I will take it upon me to congratulate him. I found that it was one of the most difficult tasks I have attempted, to put my hands on the first and second volumes of the *Transactions*. If I were to name the public libraries in London that I have ransacked with the view of finding these volumes, and searched for them in vain, you would, I am sure, hardly credit me. I found a great deal that was interesting in the early volumes of the *Transactions* of this Society. I found that even in those days there was an agitation for experimental areas. I found that it was being urged that the landowners in the neighbourhood of Edinburgh should place their woods under experimental treatment, and that they should allow foresters to visit their plantations, and to see what scientific management could effect. I found that those early writers were a great deal more modest than ourselves. To-day we talk glibly of thousands of acres for experiments. In those days they appeared to be satisfied with contemplating the prospect of having half a dozen trees under experiment. There is a very interesting article in one of the early volumes, which is signed "Justitia," and with regard to the writer of it, the secretary of that day could get no information, although he had done his best to find out who he was. Apparently the article so impressed him that he did not hesitate to print it. Nobody seems to know who "Justitia" was. "Justitia" gives vent to the following suggestion:—"The Town Council likewise" (after he had suggested that neigh-

bouring landowners should put their woods under proper management for the benefit of others) "might confer advantage were they to allow some of the young trees in the Meadows, say every fourth tree or so, to be so treated." I say, then, that ideas in those days were on a more modest scale than now. In the same volume I got an interesting piece of information, and it may be information to more than myself, to the effect that in the year, I think, 1858, there were Arboricultural Societies, not only in Edinburgh, but also in Brechin and Peebles; and I commend the idea to the historian of the Society, to find out what has come of the Arboricultural Societies of Brechin and Peebles. Another very interesting article[1] in an early volume dealt with a subject which I think I have heard about before. It seems that fifty years ago a great many people believed that if you wanted durability you should only fell trees when the moon was decreasing—in the wane of the moon, and that it was fatal to the life of timber to fell it in the wax of the moon. An early writer goes into the subject at great length, and he points out that it was a prevalent idea in England—he does not say that the Scotch had run away with such an idea—it was acted on in England, he says, and you found it in France, and even in Germany. He does not say you find it in Scotland. In elaborating his idea, he puts down the following observations: —"Can there, then," he says, "be anything imagined more extraordinary, anomalous, or unaccountable than this supposed correspondence between the movement of the sap and the phases of the moon? It has its parallel only in the belief, at one time generally entertained, that insanity was induced, or at least influenced, by the moon; hence the term *lunatic*. The primary idea attached to the word is now obsolete. . . . But to apply the term *lunatic* to those who entertain the belief that the ascension of the sap is influenced by the moon, in any of her phases, is to give the word its primary signification and to use it appropriately; as it is our opinion that they are truly, and in every sense of the word, *lunatic*." Now, gentlemen, you need not imagine that that much discussed subject, the larch disease, was unknown to the Founders of the Society, because I find that the early volumes of the *Transactions* contain a great many references to, and articles upon, the subject of larch disease. I

[1] "On the Felling of Timber with a View to Future Durability," by James Macneil, Abercairney, Crieff, Vol. II. p. 17.

find in the second volume there is a review of Mr M'Intosh's work on the larch disease, and I find it claimed that he has "condensed the opinion of above fifty highly respectable authorities." Now, if there were fifty authorities on the larch disease in the year 1854, we need not be surprised if there are a good many opinions at the present day. The writer of this review of M'Intosh's book, like the gentleman who had been talking about lunacy, has a shot at England. I notice it is a characteristic in the early volumes that they have to get their poke at England, and the writer says that the reason that the larch was so much diseased at that time was because it was degenerate, and its degeneracy was owing to many trees being raised from seed from certain trees "grown in the rich soil and murky atmosphere of London nurseries." Another article on larch disease is by Mr M'Corquodale, who gives expression to a sentiment which a great many of you, I am sure, would also quite willingly take into your own mouths. He says that, "After upwards of thirty years' extensive practice, and much arduous investigation as a practical forester, I am constrained to dissent from the views commonly entertained on this subject." It is only two years ago—I do not think it is as much—since a discussion on this very subject began, one very wet day, in the county of Ayr, and that discussion went on through the pages of the Press, and I am perfectly certain you will find many came to the conclusion—"I am constrained to dissent from the views commonly entertained on this subject." Well, the larch disease has been a fertile subject for writing. It may have been a serious business to those who have grown larches, but I am bound to say that the subject has been extremely valuable in developing sylvicultural polemics. I find the accounts of the early years of the Society were very modest as compared with what they are now, but they made no mistake about what they did with their balances. They did not say "Credit Bank by balance," but they put it in plain English—"Cash put into Bank." I find that a year or two after the Society started it appears to have got into somewhat low water. In one year the arrears were considerably more than the subscriptions. The sum of £10 was taken in subscriptions, and between £12 and £13 stood out in arrear, but the council, or secretary, or treasurer—treasurer, I suppose it was—was much more diffident in the way in which he reminded people that subscriptions should be paid

than is the case now. What do we find to-day? I take up a notice, and I find it states:—"Members in arrear are urged to remit at once, when their *Transactions* will be forwarded." There is no mistake about what is meant there. But in the early years I find this—"Members in arrear are requested to obtain their receipts from the treasurer without further delay." The result in those days was that they did not make a draw of quite 50 per cent. of their subscriptions. The result to-day is there is not more than 10 per cent. outlying. Then, in connection with my investigations, I did not go, like a previous speaker, to the Bible, as I ought to have done, but I went to the *Heart of Mid-Lothian*, and I wanted to look up really what the context was that gave origin to the Society's motto. The actual words of the old Laird of Dumbiedykes are these: "Jock," he said, "when ye hae naething else to dae, ye may be aye sticking in a tree; it will be growing, Jock, when ye're sleeping." This reminds me that the actual words upon our coat-of-arms are not quite the same as you will find them in the Border edition of Scott, and I commend this difference of reading to the historian of the Society.[1] On looking forward one sentence and looking back one sentence of this advice of the old Laird, I find the following words. Lying in his bed and anticipating death, he advises his son what to do. "If I pay debt," the Laird says, "to other folk, I think they suld pay it to me, that equals aquals. Jock, when ye hae naething else to dae, ye may be aye sticking in a tree; it will be growing, Jock, when ye're sleeping. My father tauld me sae forty years sin', but I ne'er fand time to mind him. Jock, ne'er drink brandy in the morning, it files the stamach sair; gin' ye tak' a morning's draught, let it be aqua mirabilis. . . ." Whether "aqua mirabilis" is the same as Talla water or not, I will refer to ex-Bailie Anderson, but, at any rate, it was the stuff that the old Laird thought was the right thing in the morning. But to what, after all, do we owe the satisfactory position we are in? It seems to me that we owe our position, first of all, to having a good object—an object the attainment of which can injure no one, and can benefit many. And, secondly, we owe our position to the unselfish and untiring efforts of certain high-minded individuals. We have only to look back upon the roll of membership to find out that, after all, the Society owes a very great deal of its prosperity to comparatively few men. You

[1] Selection of motto was left to President and Secretary (*vide* Minutes).

have had M'Corquodale, Dr Brown, the late Professor Balfour, our late lamented friend Malcolm Dunn, and many others I might mention. The Society has done a great work in the past; I trust it will do as much in the future. Its influence in fostering the objects of its existence has been far-reaching. It has stimulated Forestry through its literature, because its *Transactions* are a mine of information to all who have the subject at heart. It has fostered the subject through the encouragement that it has given to young foresters to put their best efforts into their work, to record their experience, and to publish their literary efforts for the benefit of others. It has done a great deal to stimulate the Government, by voicing public opinion, by making representations to Ministers, and by securing such Committees as that which has recently reported. I really doubt very much whether we all realise how much the Society has done in that respect. The Report of the Forestry Committee has, of course, by no means yet borne its full fruit, but, as a consequence of that Report, we have had enormous activity. We have the College of Bangor preparing a scheme showing how it is qualified to give advice to the wood-owners of North Wales, how it is prepared to establish a lectureship, to set up model plantations; we have Aberystwyth in the same condition; we have Newcastle coming to us with a scheme; we have the Midland Institute; we have the South-Eastern College at Wye. As the result of this Committee, which this Society has secured by representations to Ministers, we have had in this respect an enormous influence on education. The Committee, further, has been the means of starting a forest school in the Forest of Dean for the benefit of working foresters. We have the Woods and Forests Commissioners putting Alice Holt, one of the Government properties, under a definite working scheme, as recommended by the Forestry Committee. In these and many other ways this Society has done an enormous deal to stimulate this important subject. Now we look back on the past with pleasure, and, I may say, with satisfaction; but our eyes in future must be to the front. We, I think, may profit by what we have experienced, but, in the main, I think we should not be badly advised if we pursued the same moderate, well reasoned, and sensible course that we have pursued in the past, leaving no opportunity neglected to stimulate interest in our subject, and in every way encouraging the success of the craft that we have all so much at heart. With

these words, I give you, on this auspicious occasion, the toast of "The Royal Scottish Arboricultural Society." May it long flourish; and with it I couple the name of our respected President. The toast was drunk with all the honours.

The President, in reply, said: The toast of "Our Noble Selves" is, of course, always well received, and I am sure it is all the better received on this occasion from the very able way in which Dr Somerville has proposed it. Of course, there are one or two things that might be taken exception to. One of them is our own particular motto. Surely making a plantation would be nearer the truth than "sticking in a tree," because the days of putting in solitary trees are past. As we have risen in ambition, and I hope in importance, and as our objects have become greater and more far-reaching, the making of plantations is surely more in our line,—not that I wish for a moment to change the motto of the Society. I do not know how we are to thank Dr Somerville for the kind words he has used regarding the Society. I hope the sapling referred to by Dr Somerville, living and growing as it is at present, will continue to thrive, and that the members of the Society will do everything they possibly can to impress on the world in general, and all those in authority in particular, what our objects are. We intend to stick to those objects until we get them carried out. I think we are making progress in that direction. I made rather an omission at the beginning in not intimating a number of apologies. The following cablegram has been received by the Secretary:—

"Secretary, Arboricultural Society, Edinburgh.

"Please express to President and Society my respectful hearty congratulations on its successful past, and best wish for happy future.—Elis Nilson, Sweden."

I have also received the following communication:—

"Villa Berigo, San Remo,
"Italy, *12th February* 1904.

"W. Steuart Fothringham, Esq.

"Dear Sir, I regret very much my inability to be present at the Annual Meeting and the Jubilee Dinner of the Royal Scottish Arboricultural Society on the 16th instant. But I take this means of sending my best wishes for a pleasant and interesting re-union on Tuesday evening, and at the same time I take the

opportunity of asking the favour of your kindly delivering my greetings and a message to the Council of the Society. I have now in preparation for Messrs Blackwood a seventh edition of *The Forester*, which it is hoped will be published before the end of the year, and which will be re-arranged, altered, and added to so as to try and supply the want that still exists for a good practical text-book on *British Forestry*. If desirable to the Council and Members, it will give me great pleasure to dedicate this new work [1] to the Society on the occasion of this their year of jubilee.—Yours truly, JOHN NISBET."

I presume you will authorise me to answer the latter communication, and to thank Mr Nisbet in your name for dedicating his new book to this Society. I do not know that there is anything more I can say, excepting to thank you for the honour you have done me in re-electing me President of this Society. I hope we shall have many meetings together, both for business and pleasure. I thank you very much for coupling my name with this toast.

Mr Buchanan, Penicuik, proposed the toast of "Kindred Societies," remarking that they were all delighted to see so many kindred societies represented. There were representatives present from the Royal Horticultural Society, the Royal Agricultural Society, the English Arboricultural Society, the Irish Forestry Society, the Royal Caledonian Horticultural Society, the Scottish Horticultural Association, and the Highland and Agricultural Society of Scotland. All these societies took a great interest in the work of fostering arboriculture. They cordially thanked the representatives of these kindred societies for their presence on that interesting occasion. He coupled the toast with the names of Sir Ralph Anstruther for the Highland and Agricultural Society, and Mr John Davidson for the English Arboricultural Society.

Sir Ralph Anstruther, in reply, said they were pleased to call the Highland and Agricultural Society a kindred society. He ventured to think that the connection was even closer than kindred. They were bone and flesh of the same stock, because

[1] As, after the commencement of the revision of *The Forester*, it was found that even extensive alterations would not answer the present requirements for such a text-book as contemplated, an almost entirely new work has been prepared. This will appear during the spring of 1905, and it is hoped that it will serve the same purposes for which our Society exists.—HON. ED.

a very large number of the members of the Arboricultural Society were members of the Highland and Agricultural Society. On behalf of that Society, he might say that anything they could do to help the Arboricultural Society in the work it had in hand would be willingly and gladly done. He was not in a position of authority now, but at the same time he thought he knew enough of the feelings of his colleagues on the directorate to assure them that what he said was the truth. The work of the Arboricultural Society was practically the same as that undertaken by the Highland Society. After all, the cultivation of trees was as much a part of agriculture as the cultivation of any kind of crop, because if they thought of the matter properly, in his opinion, they would not only look upon trees as one of the ornaments of the land, but as a valuable product of the earth, which had got to be cultivated to the best commercial advantage. If it could not be done in that way, it really would not be done at all, not at any rate in the way in which it ought to be done. While agriculture was at rather a bad time just now, he rejoiced that the experience of arboriculturists had been rather different. He believed it was the case that the number of persons who took an interest in arboriculture now was twenty for one who did so twenty years ago.

Mr Davidson, of the English Arboricultural Society, said that he was just recovering from a long illness, and perhaps he should not have undertaken the duty of representing the English Arboricultural Society. But, in the circumstances, and from his long connection with the Royal Scottish Arboricultural Society, he did not like this opportunity to pass. His coming there had been a pleasure, and yet that pleasure was somewhat marred by the absence of many whose faces were very familiar to him during the early years of the Society. They were now gone to reap their reward. Well, the English Arboricultural Society had made considerable progress. He thought it commenced about twenty-two years ago with about six members, and now they numbered over seven hundred. At the same time, it must be admitted that the progress of that Society was very largely due to the Royal Scottish Arboricultural Society, because the methods, the rules, and everything connected with this Society were the guiding star of the English Society. Although the Society which he represented might be at the elementary stage, still it was exercising a quiet influence on the minds of proprietors

and politicians. It might be in the recollection of some that when they had a united excursion at Lowther Castle some sixteen or seventeen years ago, he mentioned at the dinner in Penrith that the time would come, and that very early, when the Government would have to take some interest in arboriculture, and that something would have to be done to encourage the growth of trees in our country, especially in England. He thought the Royal Scottish Arboricultural Society ought to be very cautious indeed before they established experimental forests in Scotland. It would never do to cover up with trees hills that were so historical as Arthur Seat or Ben Lomond. Then it would never do to spoil their deer forests. There were thousands of acres just along the Borders which could be much more advantageously used for forestry purposes.

Mr W. H. Massie, in giving the toast of "Our Guests," after expressing the indebtedness of the Society to the honoured and distinguished guests for their presence there that night, said they had heard a good deal from the previous speakers about the past history of the Society. Might he be allowed to add a few words on the subject? He held in his hand the first written record of the first meeting of their Society, and as it was very short, he should like to read it, as he thought it would be of interest on that occasion. It was dated 17th February 1854, and was in the handwriting of the first Secretary of the Society, James Alexander, of the firm of Dicksons & Co. It was as follows:—

"EDINBURGH, *17th February* 1854.[1]

"At a meeting of Foresters held here this day on the occasion of the presentation of a testimonial to Mr Brown, late of Arniston, present Mr M'Corquodale, Mr Balden, Mr Cowan, Mr M'Donald, Mr Forbes, Mr Thomson from Chopwell, and others—it was suggested by Mr Thomson that as Agriculture and Horticulture had much improved by associations for holding discussions on their respective branches, it would be highly beneficial that something of a similar kind should be established in connection with Forestry. It was unanimously resolved that said association should be carried into effect, and

[1] The sheet of note-paper on which this document is written bears the lithographed heading, "Regent Hotel, 14 Waterloo Place, Edinburgh," presumably the hotel in which the presentation to Mr Brown and the foundation of the Society took place; but the first part of the heading has been struck out, apparently when the minute was written.

that the following gentlemen he appointed a Committee with power to add to their number, and to draw up Rules and Regulations, viz.:

President, Mr Brown, Deputy Surveyor, Dean Forest.
Vice-President, Mr M'Corquodale, Scone.
Secretary, Jas. Alexander, Nursery & Seedsman, Edinr.
Treasurer, Mr Anderson, Perth.
Committee—Mr Taylor, Camperdown.
Mr Balden.
Mr Cowan.
Mr M'Laren, Hopetoun.
Mr Forbes.
Mr M'Donald.
Mr Thomson, Chopwell.
Mr M'Laren, Shaw Park.
Mr Gardiner.
Mr Rutherford.
Mr Balden, Bywell.
Mr Campbell, Alloa House.
Mr Thomson, Culhorn.
Mr M'Cleish, Alnwick.

It was agreed at the meeting that the objects the association has in view should be published in the *Gardeners' Chronicle* and other Horticultural periodicals, and to solicit the co-operation of all those interested in the scheme, and the meeting adjourned to meet again on an early day in May next.

JAMES BROWN, *President.*"

They would have noticed that the credit for the proposal to form this Society was given to the late Mr Thomson of Chopwell, whom a few of them remembered as a regular attender at the meetings of the Society many years ago. But he could give them still further information, and it was this, that when Mr Thomson was leaving home to attend the meeting in connection with Mr Brown's presentation, it was suggested to him by one of his own assistants, who took advantage of the opportunity, to propose the formation of such a Society as this. He thought they were extremely fortunate in having present with them that evening the young assistant, in the person of their friend, Mr Grant Thomson, who was now the father[1] of the Society.

[1] This honour is shared by Sir John Ramsden, Bart., who became a member in the same year as Mr Thomson.

They had been waiting for, and talking and dreaming about, a forest school for Scotland for the past fifty years. They seemed to have made rather slow progress, and he feared that infirmity of purpose had been a cause of this failure to realise their dreams. Government had been approached time and again—and he did not want by any means to throw cold water on this course—but surely the Society could do something for themselves. Was it not possible for them to signalise the fiftieth year of their existence by inaugurating a scheme for the formation of a Joint Stock Company to start and equip a Forest School? Surely they had as many public-spirited gentlemen in Scotland as would take up shares, even though they could not promise them any great dividend. He gave that suggestion, which he thought was worthy the consideration of every member of the Society.

Mr Thomson, in reply, said he remembered well when in 1855 he became a member of the Society. He had been a member since that time, and he looked with pride and pleasure at the progress the Society had made. Although his heart was sad when he looked back and thought of those who were with him forty-nine years ago, still, he could assure them, his heart rejoiced to think that the Society was flourishing in such a way as it was doing. As long as they had such an able President, such an indefatigable Secretary, and such a wise and thoughtful Council, the Society was bound to go on prospering and to prosper. Especially did he thank the Society for having made him and others Honorary Members. It was a pleasure to be an ordinary member of the Society, and they had enhanced that pleasure a hundred-fold by making him and others honorary members of the Society.

Mr D. P. Laird, in proposing the toast of "The Landed Interest," said that going round the country as he did, and associating a good deal with men connected with the land, he was of opinion that they in Scotland ought to be exceedingly proud of their landlords. He was certain that in every department of life the landlords did their duty well. Let them trust that they had got round all the difficulties that beset them, and with the combination of agriculture and arboriculture, let them hope that the landed interest would, in the future, be rosy in the extreme.

Sir Kenneth J. Mackenzie, Bart. of Gairloch, with whose name the toast was coupled, replied. He said that as far as his own personal experience went, the state of the landed interest in

this country at the present time might be described as somewhat decaying. He earnestly trusted, for the sake of agriculture, arboriculture, horticulture, and all the other things which were left in this country, and which made England and Scotland the finest places to live in, that no Government would pile up further burdens on the land of Great Britain. He was always glad every year he went to the Highland and Agricultural Society's show to find that the exhibition was better, and the attendance was larger. That showed, he thought, there was still some faint hope for the landed interest. The progress which the Arboricultural Society was making in its membership and in its objects also gave them hope that the landed interest in this country was not to be altogether wiped out.

Mr J. W. M'Hattie, City Gardener, Edinburgh, in proposing "Agricultural Colleges," said they had heard what Dr Somerville had said regarding the methods of their forefathers in arboriculture. That was the rule of thumb. They were very much indebted indeed to their colleges for the light they had given on many points. During the last fifty years the Royal Scottish Arboricultural Society had made very great progress indeed. That, to a great extent, he attributed to the colleges. They had eight Agricultural Colleges in England and three in Scotland; and in Ireland a very great step had been undertaken by the Government in fostering agriculture and arboriculture there.

Councillor Macpherson, one of the Governors of the East of Scotland College of Agriculture, who responded, said that the Agricultural Colleges of Scotland had a comparatively short history, but that history was a record of continual development and success. The first to be established was the West of Scotland College, which was founded in 1899, and took over the Agricultural Department of the Glasgow and West of Scotland Technical College, and the Kilmarnock Dairy School. The success of that College was such that it was considered desirable to establish in the east a college on similar lines. In Edinburgh there was already existing the Chair of Agriculture and Rural Economy, the oldest centre of advanced agricultural training in the kingdom, and the scheme was arranged to make the utmost possible use of that valuable asset, and also of the School of Rural Economy, whose progress had been hindered through inadequate financial support. Eleven County Councils and the

Edinburgh Town Council have associated themselves with this College, and its progress during the short period of its existence had exceeded the most sanguine anticipations of its founders. Last session 43 students attended its day classes and 142 the evening classes, 38 its month's courses for farmers held in Edinburgh and Forfar, and 122 its dairying classes; whilst in the counties, 283 attended systematic courses, and the attendance at the lectures and short courses reached 10,657. During the present session these numbers were likely to be considerably increased in all departments. The training of teachers in Nature Knowledge was also a branch of work undertaken by this institution. For a class of thirty that it was proposed to arrange, there had been over 170 applications. During the present session the Governors of the College had been giving attention to Forestry, the branch in which the Society under whose auspices they had met was specially interested. A conference had been held with the University Court, at which it was agreed that the central instruction should he carried out in the University, whilst the county work should be undertaken by the Agricultural Colleges. In connection with the University, it was probable that a curriculum for a degree to be instituted of B.Sc. in Forestry would be established, and this branch of education thus get its proper academic recognition. Short courses had been arranged by the Edinburgh College at Cupar, Kirkcaldy, and Earlston, and a proposal was under consideration for a fourth at Bo'ness. The Fife centres, at which the courses were nearly completed, had been most successful, over ninety students being enrolled. It was hoped that the other centres might be as successful. As the work had increased, the governors had considered it necessary to acquire central premises for the College. These had been purchased at George Square, and the attempt was now being made to raise £4000 to meet the expense. This toast could scarcely be acknowledged without reference to the third College for Scotland, which was now being established in Aberdeen. In this connection reference must be made to the fact that Aberdeenshire, which had always been noted for its interest in, and support of, higher education, was likely to show itself more generous towards agricultural education than any other county in Scotland. Its Finance Committee had recommended by a large majority that the annual subsidy to the funds of the College be £1200, whilst the minority only wished it reduced to

£1000 at the outset, with the prospect of an increase. As the interests of Education in Forestry were closely bound up with the success of the Agricultural Colleges, it was fitting that this gathering should recognise them, and the Governors of the College, recognising the help that this Society could give them in their work, wished it all success and prosperity in this its year of Jubilee.

Mr P. Murray Thomson briefly proposed the toast of "The Timber Trade."

Mr Adam Spiers, in reply, said that members of the timber trade were delighted to be members of the Arboricultural Society. The only regret, he thought, that most of them would have was that the Society was not in active operation over a hundred years ago. Had that been the case, he thought the condition of the timber trade would have been one of very much greater importance than it was to-day. Indeed, the efforts that this Society was making would, he was sure, be well rewarded in the future, for every year it was found there were greater difficulties in procuring supplies for this country. It was rather remarkable, when they thought of it, that we imported into these islands from twenty to twenty-five million pounds' worth of timber annually. They found that the prices of Baltic timber had gone up from about 10 to 15 per cent. within the last few years, and they had greater difficulty every year in getting the long lengths of good quality that were being supplied to them up till recently. The same thing was happening in America. There was no doubt they could not well do without American oak supplies for waggon building. We had to take American oak because we could not get a supply at home. American oak was got in much larger quantities, and could be delivered cut in sizes at from 2s. 6d. to 2s. 9d. a cubic foot. Some of the English railway companies were prepared to give us for home wood from 2s. 6d. to 3s. per cubic foot in the rough. Cut into sizes, that would cost at least from 4s. to 4s. 6d. a cubic foot. Ninety per cent. of the light wheels used in this country were made from American timber. The reason for that was not that our manufacturers would take American timber in preference to British, but because they could not get the latter in sufficient quantity. Recently a protest had been made in St Louis against the ruthless destruction of the hickory forests. He was of opinion that if there was sufficient ash in this country no

Scotsman would buy hickory. If we could get sufficient land planted with timber, it would be a reserve that the country could always look forward to, and he believed there was no country in the world that could produce such a variety of timber and of such good quality as Scotland.

Mr W. M'Kinnon gave the toast of "The Press," to which Mr W. M. Gilbert, of *The Scotsman*, replied.

The toast of "The Clergy" was proposed by Mr A. D. Richardson.

Mr Boa submitted the toast of "The Secretary"; and Mr Galloway, in replying, referred to the old record of the first meeting of the Society which had been exhibited by Mr Massie. He thought that record ought to be reproduced in the *Transactions* of the Society; at anyrate, it ought to be preserved. There was a copy of it in the minute-book of the Society. The only difference he knew was that the date in the minute-book was 16th February, whereas the date in the document that Mr Massie had read was 17th February. He saw the document was written in a hotel; he did not know if that made any difference. It had always been understood that the date of the foundation of the Society was 16th February 1854. That was the date given in all the records he had seen, with the exception of a statement in Mr M'Corquodale's address, which he supposed was a printer's error, and he had taken no further notice of it. Mr Massie made a suggestion, to which he thought the Society might pay some attention. It was, that they ought to start a Joint Stock Company to acquire an estate for the purpose of growing timber and establishing a Forest School for themselves. He thought it was a good idea that they should encourage private enterprise; at the same time they should not relax their efforts to get the State to do its duty, because there was no doubt afforestation was a national question as well. Dr Somerville had reminded them of the fact that at some period of its history there were local societies attached to the parent body. He remembered noticing that before. He presumed that these societies had gone the way of a great many rural industries, and had been swept away.

Mr R. V. Mather, in proposing the toast of "The Chairman," said that all who were interested in arboriculture must feel that the Society had done the right thing in electing as their President Mr Steuart Fothringham, the owner of that splendidly wooded

Murthly Estate, and they were deeply grateful to him for kindly consenting to fill the office for another term in this their year of Jubilee. During the last half-century many distinguished Scotsmen had been associated with their Society as Presidents; among these he might mention the late Lord Lothian, the Duke of Atholl, the Earl of Stair. Many members had not had the privilege of knowing these noblemen; but they all knew that their late Presidents, Mr Munro Ferguson and Lord Mansfield, were distinguished enthusiasts in arboriculture, who, along with their present President, took an up-to-date interest in all matters pertaining to the welfare of the Society, and who believed so thoroughly in the Society's motto, "Be aye sticking in a tree."

The Chairman, in acknowledging the toast, said he was very proud indeed of the position which he occupied that night, and he was extremely grateful to the company for the kind way in which they had received that toast. It showed, he hoped, that they were not dissatisfied with the way in which the evening's proceedings had been conducted. Of course, he was, comparatively speaking, a young member of this Society, and it seemed strange that a young member of this Society should be the President for the time being. But he would yield to none in his interest in the affairs of this Society and of its object, the planting and growing of trees in this country, to the general good of the whole nation. He was convinced that a good investment could be made by planting trees and by carrying out the management of them on a proper scientific basis. As for the affairs of the Society, he would do everything he could to promote its welfare, and he hoped that in the course of this year he should be able to do some small thing to promote those interests. But more of its interests lay with the Secretary than they did with him. He was quite sure that as long as the Secretary looked after the affairs of the Society as he did, all would go well.

During the evening several songs were sung, and the proceedings, which passed off in a very successful manner, ended by the company joining in singing "Auld Lang Syne."

V. *Conference on Forestry Education.*

In connection with the Society's Jubilee, a Conference was held in the Lecture Room of the Perthshire Society of Natural Science, Tay Street, Perth, on 22nd July 1904. A General Meeting of the Society was held in the same place, and after the formal business had been disposed of, the discussion was opened by Mr J. Sykes Gamble, C.I.E., who read the following paper on "Forestry Education":—

Mr Gamble said: I feel it a great compliment to have been asked to come here and open the discussion on such a very important subject as that of Forestry Education. I take the opportunity also of thanking the Society for their having so very kindly made me an Honorary Member. That was a great compliment for which I hoped three years ago to have been able to thank them in person, but circumstances prevented that being done.

I think it well to begin the remarks I have to make on the Education question by congratulating the Society again on the very foremost position it has taken up in putting forward the claims of Forestry to be recognised as a branch of education in Scotland, and of course elsewhere. I believe firmly that these efforts will in the end be fully and thoroughly successful, and I think a great deal of the success, when it comes, will be due to the work of this Society.

In talking about Forestry Education, I do not propose to go into the questions which have been already discussed, but to indicate more particularly a few points which I think it right to dwell upon, and which have come to some extent under my own personal experience. The chief point to my mind in all that has been talked about in connection with Forestry Education in Scotland, is the need of having a model or demonstration forest, in which the teaching of the lecture-room could be explained practically, and where students could familiarise themselves with the trees that compose a forest, their sylvicultural requirements, see the work going on, and know what will be expected of them when they go to business. The necessity of such a forest has been admitted practically everywhere. The reasons for it I need not further refer to, because

they were very fully set forth in the paper read to this Society in 1898.

The model or demonstration forest, when instituted, will probably not be very near to the Edinburgh University and the other colleges—not near enough for the instructors and students to use it daily. But it may be hoped that, in addition to this model forest, a few small areas for teaching purposes will be obtained, where sample plots might be planted, and where the treatment of the different species might be shown after or before the lectures are given, as the case may be. Such sample plots many of you know. Many of you have no doubt recently visited such plots at Coopers Hill. It is a great pity that, under new circumstances which have arisen, these plots at Coopers Hill will disappear. They do not take long to start; and something of the kind, I confidently hope, may be established near the teaching places in Scotland. The chief object of doing so is this. Theoretical instruction is all very good, but unless you can combine practical instruction with the theoretical, there are many students who would fail to profit by it. Here in Scotland, of course, a great many students of forestry have been brought up in the middle of the forest, have been in forests from their youth, and know all about the trees already. But there must be others who have not been in the forest, and know very little about it, and to start off to give theoretical lectures to such men before showing them what a forest is like, and what trees are like, and teaching them to distinguish the oak from the ash, the beech from the elm, and the Scottish pine from the spruce, would be rather useless; and therefore I maintain that the first work to be done is to make sure of having sample plots, and some kind of private forests at hand, whose proprietors will authorise their use for methods of instruction, so that instruction might begin in the forest as much as in the lecture-room. I think also, wherever it is possible to do so, the students themselves should be encouraged during their course to do a good deal of the forestry work. I have been myself director of a forestry educational establishment in India, and one of the points on which we prided ourselves there was that almost all our students were made to do all the work with their hands. They had to tend the nurseries themselves, learn all the parts of thinning, cleaning, pruning, planting, and so on. They were not merely taught how to do it. That is a very important thing, and I

hope means may be provided, wherever Forestry is taught in Scotland, for allowing the students to learn practically how to do the different operations. There is another point connected with my own experience which I think worth while mentioning. Some thirty years or more ago I was a student at the Forestry School at Nancy. Before going to Nancy we were sent to the forest in Alsace to learn the language, and see the trees, and see how the work was carried on, and to learn the technical terms in forestry. And I can confidently say the eight months I spent in the forests before going to the School taught me more than I learned in the School itself. At any rate, it gave me the enormous advantage of enabling me to compete on good terms with my French fellow-students when I went to the School. Many of them had scarcely ever seen a forest when they went to the School. I myself was brought up in London, and had scarcely ever seen a forest before I went there, and I do not know what I would have done without the forest experience. I want to recommend that the students be taken out for a short while, shown what forestry is like, what a forest is, taught something of the technical terms, made to recognise the principal trees, and generally get an idea of what the subject is they are going to deal with. We introduced the same system with considerable advantage in India, and all the students had to go through two or three months' teaching in the forest before they were allowed to attend a single lecture. Something of the kind will be of advantage here too. After all, we have now excellent books on forestry, and everybody can read, and those who are studying forestry can work up those books. A lecturer cannot do very much more in the class-room than tell you what is in the books. But if he is on the ground, even if only in the public park, he can illustrate his subject and make it much more comprehensible than when he is sitting daily in a class-room. I hope that when this model demonstration forest has been obtained—in fact I suppose it is the first thing to be done—steps will be taken at once to place it under a really good, well-conceived working-plan, because I do not look on a forest as a business-like property until it has a working-plan. It is as if a farmer were to go to work hap-hazard, sowing his corn, clipping his sheep, or hoeing his turnips in a happy-go-lucky manner. That working-plan should be printed, and should have a map, and every student should have a copy of the plan and the map, so that when he is taken out he can follow out

everything he sees—so that he can follow all the works, and can really learn something in a practical way about it. It will be a very difficult matter, in finding this forest, to fix on places where all the different important points can be studied, but I suppose really they will be in two or three places. Some will have to be in hardwoods, and some in conifers.

Dr Nisbet said he agreed with some of the remarks Mr Gamble had made. Like him, he went to a foreign forestry school—in Germany. Before going to the school, he and others were fourteen months in the forest, doing all sorts of manual work, thinning, lopping wood, etc. Of course, this was found of great advantage when they went afterwards to the forest school with practical work at their finger-ends. With regard to forestry education in Britain, it differed very much from forestry education in Germany. All the woods there had working-plans, and every wood there formed an object-lesson in forestry—was a model forest. He did not think, however, that the acquisition of a model forest should precede the foundation of Lectureships on Forestry at different centres. They must remember that every lectureship founded in forestry, in any part of Scotland, was an additional argument for getting a model forest. If they first asked the Government to give twenty thousand pounds for a model forest, and then came at once for lectureships, they would be told, "You have no sooner got your model forest than you want something else." He thought that would rather be putting the cart before the horse. When they bought the land for a model forest, they must not buy timber, because probably it would be badly grown, as most of our woods over thirty-five years old were far too much thinned. They should buy waste land, and make it an object-lesson to show how to plant wastes with profit. If one got the State, after endowing lectureships, etc., to buy a piece of waste land, suitable for planting with a fair chance of profit, they must first have it marked out and shelter-belts made, because in this wind-swept land successful planting was very difficult. If there were large woodlands, they would create shelter for themselves, but at present a great part of the waste land of this country was above the thousand feet contour line, and often difficult to plant in its present naked condition. Until you got a first crop on lower lands, you would often not be able to plant. No doubt the landowners of Scotland would be willing to allow the students to visit their forests. If they did not see model forestry, they would

see other forestry equally instructive in its way. He thought that, without extra expense, but with Colonel Bailey's consent, there might be a great improvement in the education given in the Edinburgh University. The forestry class was founded originally as an addendum to the agricultural class, but he thought the position forestry had now taken justified the forestry class being more independent. This had a long winter course of nearly six months. If young foresters were keen about their work, and were able to afford it, one might get them to attend a summer course of twelve weeks; and if the teaching could be relegated to the summer session, and two hours' lectures a day could be given, they would then have in these twelve weeks, with five lecture days a week, one hundred and twenty lectures, as compared with eighty-eight at present. They did not require any National Forestry School just yet—with several professors, who might perhaps make their subjects unnecessarily complex and expansive. There were nominally nine excursions in the present course at Edinburgh University, which were made to nurseries, tan-yards, saw-mills, and woods. He did not think they could see much of a wood on a short winter's day; but in the long days between 1st May and 21st July there were very few parts of Scotland in which there were not woods where you would be able to see something, and where insect life and birds abounded; and that was the very best time to seek object-lessons in the forest. You could not well do it in the leafless winter season, when the trees were asleep. A young forester might be able to afford the time and money to go through a course from 1st May to 21st July in the spring and summer, but it was a different thing when he was called on to give up his time from the middle of October till the end of March, or into April. It then meant that he had to give up the autumn planting, and part of the spring planting, whereas in summer he had usually much less to do. If Colonel Bailey, the present holder of the lectureship, consented to it, the Society might therefore well move the University to kindly relegate the teaching of forestry to the summer session, or also provide a summer course at the Botanic Garden and Arboretum.

Dr Wilson, St Andrews, said neither Mr Gamble nor Dr Nisbet had referred to degrees in forestry. One of the resolutions that was put forward when they met with Dr Craik was that degrees should be instituted in the University. The agricultural colleges were quite impotent with regard to the institution of degrees. It

was doubtful whether it was necessary, after all, to institute degrees in forestry in the four Scottish universities. They had proceeded to institute a Doctorate of Science in agriculture. This covered the possibility of higher research work in forestry. Indeed, agriculture in the wide sense covered forestry. For degree purposes it did cover forestry. That being the case, the graduate in agriculture was perfectly at liberty, in proceeding to the Doctorate of Science, to take up a purely forestry thesis. He was able to proceed to the Doctorate of Agriculture by forestry. What further degree could they wish than that? It was the only degree that the universities were prepared to give. They had spoken of the effect of the agricultural colleges in this matter. They knew the position in which these colleges were placed. In St Andrews, at the present moment, they did not form the centre of what ought to be the four agricultural colleges of Scotland. He had already remarked that the agricultural colleges were impotent unless associated with the universities in academic work. If these agricultural colleges were to do better work, they must become closer and closer associated with the universities, and finally absorbed in them. He would propose that when the Society took up anything in connection with this movement, it should go straight to the University Courts of the four universities of Scotland, and confer with them before doing anything from the outside.

Mr A. T. Gillanders, Alnwick Castle, Northumberland, said that a great deal of what had been said was inapplicable to this country. Certainly, he did not agree with the last speaker, because he thought he was beginning at the wrong end to educate the foresters. He had no sympathy with educating foresters at the university. He would welcome every suggestion that was made to educate the foresters to the highest degree. Educate them by all means to the limit of their individual capacity, but let that education act simultaneously with a practical training. With regard to a demonstration forest, what was applicable to the varied conditions of this country, or almost to one parish or county, was not applicable to another. So far as a demonstration area was concerned, they would have to follow the old methods. He would say that the good old-fashioned system of getting a well-educated boy of good physique, and putting him to work on an estate, preferably a small estate, and giving him every opportunity of pursuing

an intellectual education simultaneously with practical work, was the best education you could give a boy. It was undoubtedly a practical subject; and, as Ruskin said, when you had taught a boy to take off a straight shaving you had taught him something all the lectures could not teach, the use of his own hands. It was the same in forestry. They must teach him how to work, and to use his own hands. The present system of allowing a young forester to attend a six weeks' course at the university simultaneously with his practical work was all that they required. The agricultural professor of to-day was a very different person from what he was thirty or forty years ago. The latter took it for granted that the ordinary practical farmer knew nothing. To-day, however, he was willing to learn from the farmer. The lecturers of the colleges would have a very great deal to learn from the practical foresters. As a matter of fact, were the young foresters of to-day more enthusiastic for education than twenty years ago? He thought it was just the reverse. When they made the road too easy, the enthusiasm, to a certain extent, died. He believed that when they educated young men too much, they gave them, to some extent, false ideas of their own importance. He thought it would be a good thing, before establishing a demonstration area, to try and arrange an easy and cheap method for young foresters, and even for old ones, to get on the Continent and see the sylvicultural operations that were carried out on a large scale there; and then apply that experience, so far as applicable to this country, and no further. He believed they ruined the woods by overthinning them. The forester himself, if he were honest, would tell them he had a very great deal of his business to learn after he got into harness. He learned a great deal from his own failures, though he took care to tell no one of them, and he also took care not to repeat them. With regard to estate managers, factors, and agents, he thought it would do no harm to educate them a little more, and to educate the landlords a little more. He thought the average forester in this country was as intelligent, or more intelligent, than any artizan who got equal remuneration. When lectureships and professorships were worth going in for, they would require for the young man a different class of training than for the estate forester, because he was going to try to work out and investigate certain diseases, and in order to do that thoroughly, he must have a thorough laboratory training. The simplest method of a

working-plan for a forest they could adopt in this country was to classify the woods according to special ages, and then they could take stock. As we had private ownership, we could have no continuity, because one man would go in for woods, and the next man would cut them down for game, and so on.

Mr Pitcaithley said Mr Gillanders referred to the want of enthusiasm in young men for education, but he must distinctly say that was not his experience. The reason for education not being taken up by the young forester was generally due to lack of interest in the head forester. There were very few foresters throughout the country who took any interest in the young men under their charge. They looked on them as mere machines. He agreed with Dr Nisbet in desiring to have the university education in summer. It would suit practical foresters much better, and more would take advantage of the lectures if they were given in the summer season.

Mr Gillanders said his remarks about young foresters applied to the other side of the Border. There was not enthusiasm amongst young foresters on the other side of the Border.

Mr Leven, Auchencruive, said what he felt there was a great need of was a proper director to tell them what to study. They might lose a good few years in groping about, as it were, in the dark, trying to learn something that would be of use to them in future life, with practically no one able to guide them. They had heard a great deal about this demonstration area. Among the earliest things he recollected, when he came into that locality, was some murmurings of the time when they were all to have a demonstration area; they were, however, apparently as far from it as ever. Was there nothing they could do themselves while they were waiting for that promised forest? In a centre like Perth, could they not establish one of those lectureships which Dr Nisbet had advocated? He thought they had something that would be the nucleus of a lectureship in that very institution where they were that day. He was surprised when he went upstairs to find they had some of the best examples of forest trees laid out there. In the near future they had the prospect of a new Education Act, which was to establish a Board which would undertake the teaching of forestry. In such a county as Perthshire, which, he maintained, was the home of forestry, there should be something done to encourage young foresters.

Dr Borthwick, Edinburgh, said he had heard the subject of

Forestry discussed from two points of view. There was the necessity for a young forester learning actually what the trees were with which he was dealing. They were living things, and subject to variation, according to the treatment he gave them. This involved a certain amount of laboratory work, as well as lectures. The statement that the lecture was a repetition from a book was not generally applicable. The lecturer could bring specimens to the table, and show a piece of timber which had been properly grown, and one that had not. In the laboratory, with the aid of the microscope and proper materials, the plant could be dissected, and its structure properly explained. He thought the degree would stimulate young men to obtain the B.Sc., and then the Doctorate. He rather thought one hundred and twenty lectures in three or four months was a little more than a student could assimilate.

Dr Nisbet said he was judging by the keenness of the young foresters, and he did not think that two lectures a day for twelve weeks would be too much either for the lecturer or for the student.

Mr William Forbes, Glasgow, said he quite agreed with what Mr Gillanders said about the enthusiasm of the generality of young foresters falling off very much.

Mr C. S. France, Aberdeen, said he agreed with Mr Gamble as to combining both the scientific and the practical training. The difficulty was the difficulty of co-ordinating these two things, so that the scientific training could be carried on simultaneously with a good practical training. There was nothing could bring that about so much as the acquisition of a sufficient area, whereby all the different parts of forestry could be illustrated. There was the arboricultural aspect of forestry, and the sylvicultural aspect of forestry. Woods being mostly under private ownership, they could not be managed on sylvicultural lines. There was a difficulty in foresters getting sylvicultural education. They could not get it on the private properties where they were brought up. As to the arboricultural aspect, most of them knew how to grow a tree. But with regard to the rearing of woods, obtaining the largest amount of timber in the shortest time, that was a matter which could only be properly acquired by having experience in a demonstration area. He hoped the Society would continue to press on the necessity of doing everything in their power to acquire a certain amount of land. He would not object so much

to having some old woods that had been mismanaged before. He thought they should be on different grades. He had in his mind at present an estate which was in the market, and which would be admirably suitable, in the vicinity of one of the University towns.

The Chairman said it was absolutely necessary that the forester, to be a successful forester, must begin at the beginning, and know how to use the axe and spade, and everything else. Before he could become a successful forester, he must have gone through all the stages himself. Was there nothing they could do to help themselves before the Government produced this large forest? They could help themselves in the education of young foresters in this country. If the proprietors would institute a system of bothies, they would get the boys to come at fifteen or sixteen years of age, and they could put them through a two or three years' course under their head forester before going to the lectures. They would then go to the lectures ready to receive the full benefit. As regards the State forest, he would be very much obliged if they would give him the particulars of any place they thought the Government would buy. He had been in communication a good deal on the subject, and he found it was not very easy to please the people with whom the selection lay.

The Collection of Statistics.

On the conclusion of the discussion on Forestry Education, Dr Nisbet drew attention to the desirability of collecting useful statistics of British forestry. They wanted statistics of their own. Continental statistics were not of much use here. They required statistics of every description. They wanted co-operation of members in different counties. The moment the Government approached a landowner, he began to think there was something about income tax in it. If the foresters belonging to that Association gave their assistance, they might get out something new that would be a help to forestry in Scotland, and that would be duly recorded in the *Transactions*.

On the motion of the Chairman, a vote of thanks was passed to the speakers who had initiated and carried on the discussion, and also to the Perthshire Natural History Society for the use of the lecture-room.

VI. *Excursion to Dunkeld, Murthly, and Scone, Perthshire, July* 1904. By A. MURRAY, Forester, Murthly.

A Local Excursion having been decided upon in connection with the Society's Jubilee Conference at Perth, and permission having been granted by the respective proprietors, the estates of Dunkeld, Murthly, and Scone were visited by an Excursion party of the Society on the 20th and 21st July.

On Wednesday morning, 20th July, the Excursionists, to the number of about sixty, arrived at Dunkeld by train, and took up their quarters at the Birnam Hotel; and soon thereafter, headed by the President, Mr Steuart Fothringham, they started for Dunkeld.

A visit was first paid to the nursery at Ladywell, where Mr David Keir, head forester on the Atholl estates, who conducted the party over the nursery, pointed out everything of interest. The nursery extends to about five acres, and at the time of the visit contained a good collection of exotic trees, but the greater part was occupied by a fine crop of young larch, a tree for which the Atholl woods have long been celebrated. Here an interesting hybrid larch was seen—a cross between the Japanese species (*Larix leptolepis*) and the European one (*L. europæa*)—the Japanese species being the female parent. The inspection of the nursery over, the party repaired to the policies of Dunkeld House, and on passing through the old village of Inver, the birthplace and abode of the famous Scotch violinist, Neil Gow, the Excursionists were met by the Marquis of Tullibardine, who accompanied them through the grounds. On crossing the Tay, Dunkeld House policies were soon entered, and here many fine specimen conifers and deciduous trees were seen, including the two "Parent" larches, which, although planted in 1738, and therefore 166 years old, are still in a healthy condition. Near to these trees is a beautiful variegated Scots plane, and in proximity to the cathedral are some fine old yews. On the way to the gardens, a row of Japanese larches, about 25 feet high, with luxuriant foliage, and a number of which bore cones, arrested attention. Many other fine park and lawn trees were seen, but time would not permit of measurements of any of these being taken. On arriving at the east entrance gate, the Marquis was cordially thanked for his kindness and courtesy in conducting the party over the beautiful grounds, and thereafter the party returned to Birnam for lunch.

In the afternoon a driving tour was made through the Dunkeld property by Craig-y-barns, Dowally, and the Glack. All along

the route a great deal of heavy timber was seen. The tall, clean cylindrical boles of the trees were much admired, but the general impression was that the trees were much too thin on the ground, and that underplanting might with advantage be resorted to. These trees are chiefly larch, but spruce occupies the low moist situations, and on the high ground Scots pine seemed to be mostly in evidence. On the invitation of Lord Kincairney, the party drove to Kincairney, his Lordship's residence, where they were hospitably entertained. A visit was paid to the fine gardens and to the pinetum. The latter contains a good collection of the newer Coniferæ, including some splendid specimens of *Tsuga Mertensiana* (*Albertiana*), and a large *Pinus insignis*. By the time the inspection of the pinetum was completed, however, a dense drizzling rain had commenced to fall, and the return journey to Birnam was accomplished under somewhat disagreeable conditions, but, nevertheless, the day's outing was a most interesting and enjoyable one.

The Excursion Dinner took place in the Birnam Hotel in the evening, Mr John Methven, Vice-President, in the absence of the President, who was unable to be present, occupying the Chair.

The programme for the 21st included Murthly and Scone estates. As some additional members of the Excursion party were expected by the morning train from the south, an early start for Murthly could not be made, and it had been arranged that before their arrival a section of the party should go to the top of Birnam Hill, and that another section should pay a visit to the two historic trees growing on the banks of the Tay near Birnam, which form the last fragment of Great Birnam Wood. But though the morning broke clear and bright, the hill-tops became enveloped in thick mist, so both projects were accordingly abandoned and a visit to a larch plantation on the north-western base of the hill undertaken instead. This plantation is about forty-five years old, and the trees stand at about 10 feet apart on the average. The state of the plantation gave rise to an interesting discussion as to the advantages of underplanting a wood at this stage, the general opinion being that undoubtedly beneficial results would follow such a course, but that where a large head of ground game was kept it would be hopeless to attempt it.

On the arrival of the train, a start was made for Murthly. The party drove to the west entrance to the policies, where they were met by Mr Fothringham, who was accompanied by Mr Rae, the estate agent, and Mr Laurie, the head gardener.

Before entering the policies, a visit was paid to a young larch plantation of over 80 acres in extent. The planting of this was undertaken during the autumn of 1897; and the crop, which is of pure larch, has grown exceedingly well, the trees in many parts being over 12 feet in height; but in the less vigorous parts disease has made its appearance. A move was next made to the policies, when the Excursionists had an opportunity of seeing one of the best collections, and some of the finest specimens, of Coniferæ in the United Kingdom. Previous to the visit, Mr Fothringham had caused measurements (see below) of some of the best specimens to be made; and by comparison with former measurements, he was able to give the party some interesting information as to their rate of growth.

Name of Tree.	When Planted.	Girth, 1892.		Girth, 1900.		Girth, 1904.	
	Year.	ft.	in.	ft.	in.	ft.	in.
Abies amabilis,	1885	...		...		1	11
Abies brachyphylla,	1885	...		...		1	2
Abies grandis,	1852	4	8	6	10	7	6
Abies magnifica,	1867	2	7	3	8	4	2
Abies nobilis,	1847	6	1	6	6	7	8
Abies Nordmanniana,	1854	4	0	4	9	5	4
Abies Pinsapo,	1847	6	6	7	10	...	
Abies Veitchii,	1885	...		1	4	1	9
Araucaria imbricata,	1847	4	0	4	8	4	10
Cedrus Deodara,	1842	6	8	7	4	7	9
Cedrus Libani,	?	11	8	12	5	12	8
Cupressus Lawsoniana,	1859	...		4	2	4	7
„ „ var. *erecta viridis*,	...	...		2	8	2	11
Libocedrus decurrens,	?	3	6	4	5	4	11
Picea ajanensis,	1885	...		1	7	2	3
Picea sitchensis (*Menziesii*),	1845	9	7	11	3	12	4
Pinus monticola,	1850	5	6	6	2	6	6
Pseudotsuga Douglasii,	1847	8	10	9	10	10	2
Sequoia gigantea,	1857	9	3	10	7	11	9
Taxus baccata,	?	...		10	8	10	10
Thuya gigantea,	1862	...		3	7	4	3
Tsuga Mertensiana (*Albertiana*),	1860	5	5	6	4	6	9
Castanea vesca (Spanish Chestnut),	?	...		19	2	19	4

Note.—The measurements are taken at 5 feet from the ground.

One of the most striking trees seen was a fine *Tsuga Mertensiana*, near the Roman Bridge. It is a tree of exquisite form, and is making rapid growth. The collection of conifers is a large and varied one, and owes its existence to the sustained effort of several proprietors; and by the present proprietor, Mr Fothringham, many

of the most recently introduced species have been added to it. Much attention has also been paid to the naming of the plants, and the clear labelling of the various specimens adds much to the value of the collection from the connoisseur's point of view.

Mr and Mrs Fothringham entertained the party to luncheon in the large ball-room, and afterwards a start was made for Scone, the visitors taking their departure by way of the Dolphin Terrace, at the end of which their conveyances were in waiting. On taking their departure, the Excursionists gave three ringing cheers for Mr Fothringham, who left the party at this point, and the drive to Scone was commenced.

The first part of the Scone estate visited was Taymount, the site of the well-known Douglas fir plantation. Mr Pitcaithley now took the party under his guidance, and the first item which he had on his programme was a mixed plantation of larch, Scots pine, and a few spruce, which was planted on ground from which a mature crop of sound larch had been removed six years previously. This plantation is about eleven years of age, and, although the previous crop of larch was quite sound, the young larches are badly diseased. A move was next made to the Douglas fir plantation, which adjoins the young plantation which had just been inspected. As most of the statistics of this plantation have already been published, it is unnecessary to repeat them here; but it may be mentioned that the general impression amongst those present was that with closer planting to begin with, and less thinning in the earlier stages of its existence, the crop would now have been a much better one than it is. All the same, this unique plantation was much admired, especially by those who had not previously had an opportunity of seeing the tree growing under sylvicultural conditions.

A visit was next paid to the nursery at Jeanie Bank. Here a fine and varied stock of forest trees was found, and also many of the newer Coniferæ, including fine lots of *Cupressus Lawsoniana* and Japanese larch. The inspection of the nursery completed, the Excursionists drove to Scone Palace, where they were met by the Earl of Mansfield, and after being kindly entertained by his Lordship, a tour through the beautiful grounds of the Palace was made, and much of interest arboriculturally was seen. A cordial vote of thanks having been given to Lord Mansfield for his kindness, the party took their departure, the majority returning to Dunkeld in the evening, and an interesting and instructive Excursion was thus brought to a close.

VII. *Forestry Exhibition in connection with the Highland and Agricultural Society's Show at Perth, July* 1904. By A. MURRAY, Forester, Murthly, Perthshire.

A very successful Forestry Exhibition was held by the Royal Scottish Arboricultural Society in the show-yard of the Highland and Agricultural Society on the occasion of the latter's show at Perth, this being the fourth exhibition of the kind which the Society has organised in connection with these agricultural shows in successive years. The Highland and Agricultural Society again voted the sum of £20 to be awarded in prizes for timber grown in Scotland, and for these prizes there was keen competition, especially in the coniferous classes. Besides the four classes for timber for which the Highland and Agricultural Society's prizes were offered, the Arboricultural Society offered medals in eleven classes, and, with the exception of two, entries were made in each class. The following were the competitions, with the number of entries in each, the first four being for the Highland and Agricultural Society's prizes:—

No.		Entries.
I.	Timber of Scots pine, larch, and Norway spruce grown in Scotland, ...	12
II.	Timber of any other three conifers grown in Scotland, ...	9
III.	Timber of ash, oak, and elm grown in Scotland,	4
IV.	Timber of any other three broad-leaved trees grown in Scotland, ...	4
V.	Report on damage done by insect pests to forest trees, and the measures that have been successfully adopted for their extermination, with specimens, ...	2
VI.	A model of a portable saw-mill for estate purposes, ...	0
VII.	A gate for estate or farm use, made from home-grown timber, ...	5
VIII.	Rustic fence made from larch or other thinnings,	4

No.		Entries.
IX.	Specimens showing comparative quality of larch timber grown on different soils and situations, and the respective ages at which it reaches marketable size and maturity, . .	2
X.	Examples showing the best method of utilising small wood in the manufacture of fancy-wood articles, turnery, wood wool, etc., . .	4
XI.	Examples or photographs of the damage caused by squirrels to various kinds of trees, . .	0
XII.	A scientific instrument for expeditiously obtaining the diameter of trees at a given height, .	1
XIII.	Any other useful invention or marked improvement on any of the implements used in forestry, ...	1
XIV.	Water-gate suitable for crossing a stream 30 feet wide, ...	1
XV.	Timber preserved by any process that is practical and economical, with report, and plan or photograph of the plant used, in working order, ...	5

Among the articles sent for exhibition were part of the Society's collection of sections of British-grown trees and shrubs and photo-micrographs of plant tissues, presented to the Society by Mr D. F. Mackenzie, F.S.I., Mortonhall, Edinburgh. From Scone estate a board of home-grown Douglas fir was shown along with a board of the imported timber of the same tree, for comparison as regards growth and quality of timber. There was also exhibited from Scone a large collection of boards, planks, railway sleepers, and pit-wood from trees grown on the estate, as well as panel-doors made from larch and Scots pine; and from Scone gardens came an interesting group of conifers in pots, which formed an attractive feature of the Exhibition. From Ochtertyre and Castle Menzies there were fine collections of branches of conifers bearing fruits, and from the latter estate there was also exhibited a collection of pit-wood and railway sleepers. A neatly arranged collection of pit-wood was exhibited by Messrs Denholm & Co. of Bo'ness, and photography was

represented by eight large photographs of coniferous and other trees from Powerscourt, Wicklow. Injurious insects, animals, birds, and fungi were represented by a good collection from Murthly, and from the same estate there were exhibited a panel-door, made from Scots pine, and a water-gate. A number of other exhibits were placed, consisting of forest implements and tools, specimens of foreign woods, etc., so that altogether the Exhibition was one of great excellence, and the largest of the kind which the Society has yet held, the timber exhibits being especially noteworthy as showing the possibilities which Britain holds out as a timber-producing country.

Messrs John Boyd, forester, Pollok Estate, Pollokshaws; Colin Chisholm, forester, Lundin and Montrave Estates, Leven; and Adam Spiers, Warriston Saw-mills, Edinburgh, acted as judges: and the Exhibition arrangements were in the hands of the Local Committee, consisting of Messrs Alexander Pitcaithley, forester, Scone, Perth; James Forgan, forester, Bonskeid, Pitlochry; and Alexander Murray, forester, Murthly, Perth.

VIII. *The Twenty-seventh Annual Excursion—France, 23rd July to 6th August* 1904.

The Twenty-seventh Annual Excursion of the Society was held in the forests of France, the parts visited being the neighbourhood of Nancy, the Vosges, the vicinity of Paris, and South Normandy. The Excursion party, the majority of whom left Edinburgh on the afternoon of Saturday, 23rd July, was made up of the following Members of the Society:—Mr Steuart Fothringham of Murthly, *President;* Robert Allan, Polkemmet, Whitburn; John Annand, Peebles; Dr A. W. Borthwick, *Honorary Cryptogamist*, Edinburgh; John Boyd, Pollok Estate; John Broom, Bathgate; Charles Brown, Kerse, Falkirk; John Brydone, Rothes; J. Arthur Campbell of Arduaine; R. W. Cowper, Gortanore, Kent; John Croall, Broughty Ferry; James Crooks, Prescot; William Dick, Hamilton; Robert Douglas, Edinburgh; James Farquharson, Inverkip; Malcolm Finlayson, Crieff; Professor W. R. Fisher, Coopers Hill, Surrey; James Forbes, Overtoun, Dumbarton; Robert Forbes, Kennet, Alloa; R. G. Forbes, Hursley Park, Winchester; R. G. Forbes, jun.; George Galloway, Wellbank, Dundee; Robert Galloway, *Secretary and Treasurer*, Edinburgh; George Halliday, Rothesay; David Inglis, Kirkcaldy; George Jack, Dalkeith; Robert Johnston, Bonkyl Estate, Duns; James Johnstone, Ayr; John R. Johnstone, Ayr; Henry Jonas, London; R. C. Jonas, London; Ireton A. Jones, Dublin; James Kay, Rothesay; William Kay, Lasswade; John Learmont, Dumfries; George U. Macdonald, Raith, Kirkcaldy; Charles Mackenzie, Mortonhall, Liberton; Donald Mackenzie, Meadowhead, Liberton; William Mackenzie, Novar, Evanton; Alex. M'Rae, Castlecomer, Co. Kilkenny; George Marshall, President of the English Arboricultural Society; R. V. Mather, Kelso; Archibald Moeran, Palmerston House, Co. Galway; Fred. Moon, Mount Trenchard, Co. Limerick; Andrew Morgan, Glamis; Alex. J. Munro, Edinburgh; Jägmästare Elis Nilson, Ljungbyhed, Sweden; W. C. Orkney, Sunnyside, Montrose; Andrew D. Page, Culzean, Maybole; W. Ralph, Corstorphine; A. D. Richardson, *Assistant Editor*, Edinburgh; Donald Robertson, Dunrobin, Golspie; John Robertson, Edinburgh; R. A. Robertson, St Andrews University; David T. Samson, Grantown-on-Spey; Professor Dr Adam Schwappach, Eberswalde,

Germany; Thomas Sharpe, Monreith, Wigtownshire; James Shiel, Abbey St Bathans, Grantshouse; Dr William Somerville, Board of Agriculture and Fisheries, London; Adam Spiers, Edinburgh; Fraser Story, University College of North Wales, Bangor; Walter C. Stunt, Lorenden, Kent; James Terris, Blairadam, Kinross; John Watson, Edinburgh; James Welsh, Edinburgh; James Whytock, Dalkeith; David Wilson, Troon; James Wilson, St Andrews; Dr John H. Wilson, St Andrews University.

From Edinburgh the party travelled by the Midland Route to London, thence by Dover and Calais, Amiens, Reims, and Châlons-sur-Marne to Nancy, which was reached about 11 A.M. on the 25th. The remainder of the day was spent in exploring the town, and on the following morning a start was made with the forestry part of the programme; and as this latter has been dealt with in detail in the official statements which follow, and in the report on the Excursion by Mr Macdonald, it will be unnecessary here to allude to anything but the general features of the tour.

The first item on the programme was the far-famed Nancy Forest School. Here the party was met by M. Guyot, Directeur de l'Ecole Nationale des Eaux et Forêts; M. Larzillière, Conservateur des Eaux et Forêts, Nancy; M. Henry, Professeur d'histoire naturelle, Ecole Nationale des Eaux et Forêts, and other members of the staff, who extended to them a hearty welcome. The party was conducted over the School by Professor Henry and one of his colleagues, who pointed out and described the various teaching appliances with which it is so splendidly equipped. In the afternoon a visit was paid to the forest of Champenoux, the chief feature of which is conversion of the crop from coppice-with-standards to high forest. Here M. Cuif, Inspecteur-adjoint des Eaux et Forêts, explained the system of management which had been adopted, and described, as the woods were passed through, the various stages in the process of conversion; and other officers who accompanied the party were Professor Henry, Inspecteurs Camend and Loppinet, and Inspecteur-adjoint Pigeon. Unfortunately, before the tour of the forest had been completed, rain fell heavily, and this interfered somewhat with the arrangements. Two objects of interest seen here were the recently formed Arboretum, and the Experimental Station[1] for exotic trees. In the latter an oak,

[1] A list of the trees under test here is given at page 124.

Quercus tardissima, resembling very much in appearance *Q. pedunculata*, was observed which is said to come into leaf very late in the season, and which may, therefore, prove valuable for certain localities where early foliation is hazardous.

On Wednesday, 27th July, the State Forest of Haye was visited, and here again M. Cuif furnished all the particulars as to management, etc. As at Champenoux, the principal feature of this forest is conversion from coppice-with-standards to high forest. The party was fortunate here, thanks to the early start which was made, in escaping a heavy deluge of rain which occurred when the homeward journey was nearly completed. According to the original programme, the party was to leave Nancy for the Vosges in the afternoon, but this arrangement was departed from, and an early start next morning substituted. This rearrangement gave a further opportunity of seeing the town of Nancy, and several of the party paid a visit to Metz.

About 4 A.M. on the following morning the party left Nancy for the Vosges. Raon l'Etápe was reached after a journey by rail of about 2½ hours, and from thence, after a light breakfast, the party was conveyed by carriages to Celles. The day remained fair, though somewhat dull, and the exploration of the fine silver fir forests there was accomplished under most favourable conditions. The party was met at Celles by M. de Gail, Conservateur des Eaux et Forêts, Épinal, who gave all the explanations regarding the forests, and by Conservateur Ména, Inspecteurs Rodolphe, Müller, and Jolly, and other members of the forest staff. After lunch, which was served in an open glade in the forest, the return journey to Raon was started, and the party reached Gérardmer by rail in the evening.

Gérardmer is a popular summer resort, and with its beautiful lake, the "Pearl of the Vosges," its wooded hills, and its pretty villas dotted over the slopes in the vicinity of the town, it presents a picture not to be easily effaced from one's memory. Fortunately, too, by the time the party arrived the weather had become brighter and warmer, and the district was therefore seen under most favourable conditions.

On Friday, 29th July, parts of the Communal and State Forests, chiefly of silver fir and spruce, in the neighbourhood of Gérardmer were visited, and here the party received a very forcible reminder, in the shape of enormous quantities of blown timber, that Britain is not the only country which suffers from

severe gales. M. Ingold, Inspecteur des Eaux et Forêts, Gérardmer, conducted the party over the forests, and explained their working, etc.; and Professor Henry, who had taken part in the whole Excursion up to this time, gave an interesting resumé of the character, management, etc., of all the forests which had been visited in the course of the tour. After lunch, Professor Henry bade the party good-bye, and returned to Nancy; and in the afternoon a visit was paid to the Hohneck, an eminence of 4480 feet above sea-level, across which runs the Franco-German frontier line. From the summit of the Hohneck magnificent views are obtained, but owing to haze the Schwarzwald, which is seen in clear weather, could not be discerned. The Hohneck is reached by tramway, partly steam and partly electric; and as the ascent was made, it was interesting to observe the change which took place in the character of the forest vegetation, one striking feature of it being that the beech reaches to a higher limit than the spruce, and that it grows, though somewhat stunted, up to an elevation of over 3000 feet.

Leaving Gérardmer on the morning of Saturday, 30th July, the party journeyed to Paris by way of Nancy. The weather had now become hot, and throughout the remainder of the tour it remained so, the thermometer ranging from 90° to 95° Fahr. in the shade in Paris during the following week. Sunday was spent in Paris, and on the following day the fine beech and other forests at Villers Cotterets were visited, as well as the saw-mills and the North of France Railway Sleeper Works in the vicinity of the town. M. Sainte-Claire Déville, Conservateur des Eaux et Forêts, Amiens, and M. Gibert, Inspecteur des Eaux et Forêts, Villers Cotterets, conducted the party through the forests, and the latter explained the method of management, etc.

Tuesday, 2nd August, was spent at Compiègne, and here the party saw forest management on more familiar lines—forestry and sport, as is so often the case at home, being combined, but both yielding a good return. The Mayor of the town met and welcomed the party on arrival, and later he rejoined them at lunch. After an inspection of the fine old palace, the party repaired to the forest. M. Liddet, Conservateur des Eaux et Forêts, Paris, and M. Pieffer, Inspecteur des Eaux et Forêts, Compiègne, accompanied the party, and the latter supplied all the information as to management, etc. Lunch was served in the open at Pierrefonds, and here the healths of King Edward and

President Loubet were respectively toasted by the Mayor and Mr Fothringham. A visit was next paid to the magnificent (now restored) mediæval chateau of Pierrefonds, after which the remainder of the forest was explored. A feature of Compiègne is its fine old oaks, some of the largest trees of the kind in France being found here; and the whole forest has more of the aspect of the English park about it than was seen anywhere else in the course of the tour.

The forestry part of the Excursion was brought to a close by a visit, on Wednesday, 3rd August, to the fine oak and beech forests at Bellême, in South Normandy. The start from Paris was early, and the return late in the evening, so that the day proved a long and, being hot, rather fatiguing one; but this was amply compensated for by the fine forestry which was seen, and by the somewhat different kind of country which the party had the opportunity of seeing in this part of France, as compared with what was seen in the east. Here fields more square-shaped, with hedges, more pasture and less cultivation of the land in long strips were observable, and, on the whole, the face of the country presented more of the appearance with which one is familiar at home than was the case in the tracts visited in the earlier part of the Excursion. At Bellême the party was conducted over the forests by M. Loyer, Conservateur des Eaux et Forêts, Alençon, and by M. le Levreur, Inspecteur des Eaux et Forêts, Montagne, and here the already considerable number of nationalities represented in the party was still further augmented by the addition of two Russian students of forestry who had come to France to study.

At the close of the day's outing, the party dined at the hotel at Bellême, and, dinner over, a number of toasts were proposed, that of "British Forestry Education" being given by Professor Schwappach. Mr Robert Forbes gave the health of "The President," and, in doing so, took occasion to refer to the great service which Mr Fothringham had rendered to the party in interpreting, in such a lucid way, the details of management and other particulars regarding the forests which the French forest officers had so freely communicated; and it may be mentioned here that a meed of praise is also due to Professor Fisher for a like service which he rendered in the earlier part of the Excursion, and for his kind assistance otherwise. To the French forest officers of all grades the Excursionists are also

deeply indebted for the great trouble they took in organising and carrying to such a successful issue the Excursion of 1904, and for the unfailing courtesy and kindness which they at all times showed.

Thursday and Friday were spent in visiting the various places of interest in Paris, and some of the party paid a visit to Versailles. On Friday evening, 5th August, the party left Paris, and, returning by Calais and Dover, reached London on the following morning, and thence proceeded to their various destinations, the majority travelling northwards by the Midland Railway.

For the photographs illustrative of the forestry seen in some of the districts visited, which appear in the following pages, the Society is indebted to Dr J. H. Wilson, St Andrews, Mr W. C. Orkney, Montrose, and the Assistant Editor.

IX. *A Short Account of the State and other Forests of France visited by the Royal Scottish Arboricultural Society, July–August 1904, and of the Forêts de St Amand, et de Raismes (Valenciennes).* Prepared from official sources by Colonel BAILEY, R.E., Lecturer on Forestry in the University of Edinburgh, and Professor FISHER, Royal Indian Engineering College, Coopers Hill.

PART I.

State Forest of Champenoux.

By M. LARZILLIÈRE, Conservateur des Eaux et Forêts, Nancy.

SITUATION.

The State Forest of Champenoux is situated in the plain which extends to the west of Nancy, between the rivers Meurthe and Seille.

AREA.

The total area is 3509 acres.

SITUATION.

The forest consists of two blocks, separated by a depression of the ground, at the bottom of the Amezule stream. The one to the north contains 2377, the other to the south an area of 1132 acres. The railway from Nancy to Chateau Salins crosses the first block. From north to south the forest extends through more than $6\frac{1}{4}$ miles. The boundary is irregular, and woods belonging to communes and to different private owners are found on its outskirts. In the interior of the principal block is found the Pond of Brin, and wooded enclosures belonging to private owners.

CONFIGURATION.

The Forest of Champenoux is a forest of the plains. The ground is moderately undulating, and the altitude varies from 720 to 900 feet above the level of the sea. The ground

is undulating rather than abrupt, and the slopes are not steep except in the southern part, where occasionally they attain 30 per cent. Elsewhere, the declivities are very gentle, and the soil parts but slowly with water from rain and snow.

Geology and Forest Soil.

The Forest of Champenoux lies partly on Lias marls and limestones, partly on modern alluvium.

The subsoil is clayey and stiff, but sometimes calcareous; the vegetable soil varies in thickness, is generally somewhat deep, and forms two series of soil, one, the most common, known locally by the name of white soil, being composed of an intimate mixture of clay and silicious sand. It is light and perfectly suited to forest growth, particularly of the oak. The other is clay. Both are deep and wet, here and there excessively so.

Crops.

The principal species is the oak (sessile and pedunculate), which forms the greater part of the standards, and more than half the crop. This tree grows well at Champenoux, where it finds the soil particularly well adapted to its requirements, and attains large size. Seed-years are, unfortunately, not frequent, but they are sufficiently so to form a high forest crop. After the oak, in order of importance, come the hornbeam, the beech, and softwoods. The hornbeam forms almost everywhere the main portion of the crops. In young crops it is invasive, and it is necessary to make frequent cleanings in order to prevent the coppice-shoots from killing all the oak seedlings

As in the case of all forests under conversion for a long time past, the crops have very different appearances. One meets with coppice-with-standards; old poles on stools, sometimes dense and flourishing, sometimes open and approaching the condition for regeneration; and thickets of saplings and seedlings, which will form future crops of high forest.

In 1900, the Forest Department established, in the Forest of Champenoux, an Arboretum, which occupies an area of about 25 acres, in two plots. The number of exotic species which have been introduced there up to the present time is about two

hundred and seventy-five. In one plot they are grouped by the countries of their origin; in the other, each species occupies an area of fully half an acre.

[*Photo, J. H. W.*

OAK COPPICE: CONVERSION TO HIGH FOREST—CHAMPENOUX.

Management.

In 1826, it was decided to convert into high forest the Forest of Champenoux, which, up to that time, had been treated as coppice-with-standards. But, during a long period, the operation was limited to preparatory cuttings, and the regeneration fellings were not introduced until the 11th of August 1868, the date of the decree which sanctioned them. This decree divides the forest into two working-sections, each formed by one of the two existing blocks, and it prescribes a conversion of all the crops into high forest during the course of one rotation of 160 years, divided into four periods of 40 years each, to which correspond four periodic blocks. In principle, each periodic block should be regenerated during the corresponding period.

During the first period, regeneration fellings should be made by volume in the first periodic block in each working-section;

preparatory cuttings by area in the second periodic blocks and in a part of the third; coppice cuttings in the fourth.

This scheme of management has for a long time been subjected to modifications of detail only, bearing principally on the yield of the cuttings by volume. In the first block (2377 acres), which is attached to the Experimental Station of the National Forest School, a plot of 165·7 acres was, by decision dated 17th February 1887, detached from the fourth working-section, to be subjected as an experiment to the method called that of Control. The actual condition of the crops does not always lend itself to the immediate application of this system. It has not, up to the present time, been possible to do more than pass over them by fellings made at intervals of six years, in which is removed a fixed volume, the amount of which is determined by an estimate of cost, made also every six years.

Without speaking of this experiment, still in its infancy, it may be said that the system of management of the Forest of Champenoux generally yields satisfactory results. On some scattered plots natural regeneration could not be attained, but it will there be supplemented artificially.

Average revenue and expenses during the last six years:—

Revenue.

Principal produce,	205,398 cubic feet,	£3072 9 6
Minor ,,		191 3 6
Total,	205,398 cubic feet,	£3263 13 0

Expenses.

New Works,	£177 15 0
Works of Maintenance,	60 9 6
Supervision,	127 17 6
Total,	£366 2 0

NANCY, 12*th July* 1904.

The State Forest of Haye.

By M. LARZILLIÈRE, Conservateur des Eaux et Forêts, Nancy.

SITUATION.

The State Forest of Haye forms part of a wooded area, containing about 27,210 acres, which occupies the angle formed by the convergence of the Meurthe and the Moselle, to the west of the town of Nancy.

AREA.

The area belonging to the State is 15,940 acres.

SITUATION.

The forest forms a single block of irregular shape, extending from the south to the north through 8·7 miles, and from east to west 5 miles. It is cut in the middle by the main road from Nancy to Toul.

CONFIGURATION.

The forest occupies a plateau, of which the mean altitude is about 1150 feet above the level of the sea, and 490 feet above the Meurthe and the Moselle, and which terminates abruptly to the west and to the south by steep slopes. The plateau is intersected by narrow valleys in various directions, the sides of which are often steep.

GEOLOGY AND FOREST SOIL.

The forest rests entirely on the two lower strata of Jurassic rock. The subsoil, which contains considerable beds of iron-ore now being worked, is formed of limestone, fissured and cut by numerous vertical cracks. The superficial layer is composed of sand and limestone in variable proportions, with oxide of iron The vegetable soil is shallow and light, and nearly always dry and stony.

It has a remarkable tendency to become dry. As a result, the soil of the Forest of Haye cannot maintain its fertility, or improve itself, unless it be constantly covered by a crop with dense foliage.

CROPS.

The principal species are the oak, the beech, and the hornbeam.

The oak is represented by the two species, sessile and pedunculate. Its rate of growth is slow. If it holds an important place by reason of the value of its timber, it forms, except in a few plots, a very small proportion of the stock.

The beech tends to become the dominant species. It is also the tree best suited to the nature of the ground. Its thick foliage maintains shade and cover, and permits the forest vegetation to prosper on soil which, ill covered, would be

[*Photo, A. D. R.*

YOUNG BEECH AND OAK—HAYE.

burnt up by the sun. It grows well, and yields timber much sought after for industrial purposes and as firewood.

The hornbeam occupies an important place in the coppice and underwood, where it has also a tendency to become invasive. The other species, among which may be mentioned ash, *Ulmus campestris*, maples, and softwoods, are chiefly met with scattered here and there, and occupying a secondary position.

The blocks present very various appearances, by reason of the different methods of treatment to which the forest has been, and is still, subjected. One finds there coppice-with-standards of all ages, with standard poles more or less numerous; thickets and

saplings, the result of the conversion fellings; and some old crops, having the appearance of high forest, though grown from coppice. They are generally complete, and in good condition.

System of Management.

The Forest of Haye has for a long time been treated as coppice-with-standards. During the first half of the last century they commenced to allow certain plots to grow on, with a view to converting them into high forest, and a decree of 26th March 1859 divided the forest into one block of high forest and another of coppice.

In this last block (2883 acres) there were constituted seven working-sections of coppice-with-standards, with a rotation of 35 years.

The high forest block (13,056 acres, including the forest nursery of Bellefontaine) forms eight working-sections subjected to operations having for their object the progressive conversion of the crops into high forest. The rotation was 140 years. This was divided into four periods of 35 years, each working-section being itself divided into four periodic blocks. The progress and the nature of the cuttings had been regulated after the classic method, by regenerating each section within the corresponding period. During the first period they had to regenerate the first periodic block; to make preparatory fellings in the second periodic block; and to exploit provisionally in coppice-with-standards the third and fourth periodic blocks.

In 1886 it was recognised that the regeneration of the first periodic block would not be ended within the desired time, and the first period was prolonged by eight years; this expired in the year 1903.

The condition of the forest was then studied, and the results were sanctioned by a decree of 12th March 1904, and a working-plan approved of on the 1st of June following. This new scheme of management maintains the disposition relating to the coppice division. It preserves also, without modification, the division of the high forest section into eight working-sections. But while prescribing the continuation of the treatment of the crops with a view to their conversion into high forest, it makes some changes in the original prescriptions.

The first, second, third, fifth, sixth, and seventh working-sections,

which are managed by the officers of the ordinary service, were worked under a rotation of 144 years, divided into four periods of 36 years. During the second period, which commenced in 1904, they must, *in the first periodic block*, complete the regeneration at all points where it is not already completed, and make cleanings and thinnings in the regenerated crops; *in the second periodic block*, carry out the regeneration as high forest; *in the third*, make preparatory cuttings; and *in the fourth*, cuttings of coppice. The regeneration fellings in the first periodic block are confined to trees of large size, and governed by the development of the seedlings. They are controlled by volume. All other cuttings are made by area. Whenever the second periodic blocks shall have been entirely gone over by seeding fellings, and it is desired to make in them secondary and final fellings, the yield will be fixed by volume.

The fourth and eighth working-sections of high forest are attached to the Experimental Station of the National Forest School. The new scheme fixed the rotation of the former at 120 years, and that of the latter at 150 years. The number of periodic blocks and periods is four in the fourth working-section and five in the eighth. All cuttings are made by area.

Although seedlings grow slowly in the Forest of Haye, and thus render the regeneration fellings difficult to conduct, it may be said that on the whole the conversion into high forest progresses satisfactorily. The failures, which have occurred rarely at some points, are due to faults of execution, and not to defects in the management scheme itself.

Average revenue and expenses during the last ten years:—

Revenue.

Principal produce,	646,360 cubic feet,	£7301	11 9
Minor „		435	13 9
Total,	646,360 cubic feet,	£7737	5 6

Expenses.

New Works,	£69	12 6
Works of Maintenance,	468	16 6
Supervision,	433	1 6
Total,	£971	10 6

NANCY, 8*th July* 1904.

The State Forest of Celles.[1]

By Professor FISHER, Royal Indian Engineering College, Coopers Hill.

(From Notes by M. MÜLLER, Inspecteur des Eaux et Forêts, Lunéville.)

SITUATION.

The State Forest of Celles is in the Département des Vosges, not far from the town of St Dié, and is situated on a projecting spur of the Vosges mountains, between two branches of the river Meurthe, the rivers Rabodeau and Plaine, which unite with the Meurthe above Raon l'Etape, the railway station at which is seven miles from the forest. This projecting spur leaves the crest of the Vosges at Le Donon, at an altitude of 2662 feet above sea-level.

AREA.

The area of the forest is 2925 acres, including 27 acres occupied by roads, forest-guards' houses, and saw-mills.

CONFIGURATION.

The general configuration of the ground is towards the north and west, in two large and nearly circular basins, which are intersected by deep depressions, so that the contours are steep and variable. The altitude varies from 1014 to 2662 feet, averaging 1838 feet above sea-level.

GEOLOGY AND FOREST SOIL.

The subjacent rock is Vosgesian sandstone, corresponding to the Permian and New Red Sandstone strata in England. Most of the crests of the hills are composed of conglomerate, while lower down red sandstone prevails. The resulting soil is extremely porous. Sometimes it is entirely silicious, dry, and very poor, often containing quartzite pebbles, which become more numerous near the ridges. Lower down there is a certain admixture of clay, and the soil is more adapted to hold moisture.

[1] Reproduced, by permission, from *The Land Agents' Record* of 24th September 1904.

Climate.

The climate is characterised by long, severe winters, and hot, but short, summers. Rain is abundant, and during spring and summer violent storms occur.

[*Photo, W. C. O.*

ONE OF THE NUMEROUS LARGE SILVER FIR AT CELLES, VOSGES.

Crop.

The crop contains the following percentages of species :—

	Percentage.
Silver fir, ...	90
Beech, with a few spruce and Scots pine, .	10

Beechwood is used only for fuel, and most of the silver fir is extracted in butts and sawn up at the saw-mills in the valleys below the forest. The silver fir attains fine dimensions, many trees being 11½ feet in girth at chest-height and 130 feet high. One tree measures 13¼ feet in girth and is 140 feet high.

History and Management.

The Forest of Celles formerly belonged to the Princes of *Salm*, this small State being united to France in 1793. It was managed under the selection system of high forest till 1827, when attempts were made to transform the treatment into that of the shelter-wood compartment system, this latter being finally adopted in 1843, with a rotation of 120 years; and in 1846, the annual yield of all fellings, including thinnings, was fixed at 56 cubic feet per acre. The present working-plan was framed in 1877, the fixed annual yield being revised in 1890.

According to the present working-plan, the forest is subdivided into two working-sections, managed according to the shelter-wood compartment system, with a rotation of 144 years. Each working-section contains four periodic blocks. During the first period (1873-1908) the first and fourth periodic blocks are being regenerated. In the remainder of the forest, thinnings are carried out every twelve years.

In calculating the prescribed annual yield, all the trees were measured that were standing in the compartments destined to be regenerated in the first period.

This gave the following figures:—

Working-Section.	Total Area.	Area to be Regenerated in First Period.	Cubic Feet to be Felled.	
			In First Period.	Annually.
	Acres.	Acres.		
I.	1597	827	4,076,600	206,815
II.	1328	407	2,064,545	103,005

Owing to a system termed *précomptage*, all trees exceeding 1 foot 4 inches in diameter felled in the thinnings, or wind-falls, etc., in any part of the forest, are deducted from the fixed annual yield for the regular fellings; so that the latter are already far behind the period prescribed for them in the working-plan.

The thinnings are carried out over 98 acres every year in the first working-section, and over 120 acres in the second working-section, in all parts when the young crop is sufficiently old, and where regeneration fellings are not prescribed.

This working-plan is to be revised in 1905, as the present one has been completely upset by abnormal windfalls, in one year 898,045 cubic feet having been blown down in the first working-section, and 319,655 cubic feet in the second.

This furnishes another proof of the unsuitability of the shelter-wood compartment system for mountain forests, and shows that reversion to a modified selection system is necessary.

[*Photo, A. D. R.*

SILVER FIR WOOD—CELLES, VOSGES.

Yield.

During the ten years, 1890-99, the mean annual yield of the forest was 424,305 cubic feet, or 144 cubic feet per acre, the value of the timber sold standing averaging 4d. a cubic foot.

Revenue.

The average receipts and expenditure were as follows during the same period :—

Receipts.

Timber, ...	£6979
Sporting lease and other minor produce, .	35
	£7014

Expenditure.

Supervision, ...	£90
Works (planting, repairs to roads and buildings),	142
	£232

The net annual revenue was therefore £6782, or £2, 6s. per acre. It is noted, however, that fellings were less during the previous ten years (1870-1889), when only 230,020 cubic feet were felled.

This is said to be one of the few mountain forests in France where the red-deer still exists. As a rule, in France, red-deer are chiefly found in plain forests of broad-leaved trees.

The Communal and State Forests of Gérardmer.[1]

By Professor FISHER, Royal Indian Engineering College, Coopers Hill.

(From Notes by M. INGOLD, Inspecteur des Eaux et Forêts, Gérardmer.)

GEOLOGY AND FOREST SOIL.

At Gérardmer the underlying rock is everywhere a grey granite, greatly resembling Aberdeen granite, which affords by its disintegration a loamy soil that is rendered moist by the impermeable nature of the rock, through which water cannot percolate.

THE COMMUNAL FOREST.

AREA AND RELIEF.

The Communal Forest of Gérardmer contains 2359 acres, and it varies in altitude from 2200 to 3250 feet.

CROP.

The crop consists of 58 per cent. of spruce (mostly planted), 40 per cent. of natural growth of silver fir, and 2 per cent. of

[1] Reproduced, by permission, from *The Land Agents' Record* of 10th September 1904.

beech. Including the dense pole-woods of planted spruce, the crop is very flourishing, and contains on the average 4550 cubic feet per acre, solid measure (3550 cubic feet measured by quarter-girth). One compartment contains 8316 cubic feet (6534 cubic feet quarter-girth) per acre. This forest was greatly damaged by a storm in February 1902, and is now suffering from an attack of bark-beetles (*Bostrychus typographus*), which have spread, owing to the quantity of broken wood there has been in the forest since this storm.

System of Management.

The forest is divided into four working-sections of high forest, near the town. Three working-sections are managed according to the shelter-wood compartment system, with a rotation of 140 years; the fourth working-section, 219 acres, forms a pleasure-ground for the town, and here only dead and dying trees are felled.

Yield.

The estimated yield of the first three sections is as follows:—

Section	I., 67	cubic feet per acre	annually.
Section	II., 84	,,	,,
Section	III., 85	,,	,,

The total estimated annual yield of the three sections is 175,000 cubic feet.

THE STATE FOREST.

Area and Relief.

The State Forest of Gérardmer contains 11,897 acres, and is situated on the western slopes of the Hohneck, and on some detached portions of that mountain. There are slopes in the forest in all directions, some of which are very steep, and the altitude varies from 1950 to 4000 feet above sea-level.

Crop.

The crop consists of 50 per cent. silver fir, 25 per cent. spruce, and 25 per cent. beech, each species occurring either mixed with the others or as a pure crop.

Beech predominates at the high altitudes, increasing in importance as we ascend, and near the top of the Hohneck pure

crops of stunted beech are found, with an occasional dwarf silver fir. This crop of stunted beech, which grows very slowly, and is treated as coppice, is due to the strength of the westerly gales, which destroy the leading-shoots of the conifers. Some of the crops of pure spruce result from plantations, but the general character of the woods is that of a natural forest of silver fir, with a mixture of the other species. These woods are all completely stocked, and the trees are tall and flourishing, especially at the lower altitudes, where the soil is moist and fertile The crop contains, on the average, 5500 cubic feet per acre (solid measure), attaining 11,000 cubic feet per acre in the best parts of the forest. This represents 4400 to 8000 cubic feet quarter-girth measurement.

Altitude here exercises a prejudicial effect on tree growth only after 3600 feet. At 2950 feet, along the road to the Schlucht, a pass which leads across the Vosges into Alsace, there is a crop containing 10,752 cubic feet per acre. Fine silver fir trees abound in the forest, and several of these trees measure 3·9 to 4·2 feet in diameter at chest-height, with a total height of 130 feet.

System of Management.

The working-plan of the forest was made in 1871, and revised in 1893. The forest consists of two divisions, the first division being managed by the selection system, and comprising the higher land near the Hohneck and the steep slopes adjoining the lakes of Retournemer and Longemer. It is subdivided into two working-sections, each of which is cut over every twelve years, equal areas being dealt with annually, and trees considered mature, or defective, or that are injuring their neighbours, being felled. The second division of the forest is managed by the shelter-wood compartment system, with a rotation of 148 years, which commenced in 1869. There are six working-sections in this part of the forest, and four periodic blocks in each section, the first blocks with periods of 40 years, and the three others with periods of 36 years each.

Natural regeneration is being carried out in the first blocks of each section, and in some compartments of the fourth blocks. The rest of the area is treated by periodic thinnings. All trees of 1 foot 5 inches in diameter and above, whether felled in regeneration fellings or in thinnings, or after windfall, are

measured and their volume counted in the fixed annual yield. Owing to this provision, fellings for natural regeneration are greatly retarded, as much middle-sized timber that was dying has to be removed in the thinnings.

A storm on February 13th, 1902, caused windfalls to the extent of 292,500 cubic feet of timber. On this occasion the wind blew from the north-east, and as all the fellings had been arranged to guard against westerly gales, the damage done on north-easterly exposures was enormous. Some part of the damage was also due to certain old plantations of pure spruce being exposed to the gale. Had these crops been mixed with beech and silver fir, they would have proved much more resisting. Owing to this storm, all regular fellings have been suspended since 1902, and the windfalls are still being removed. At first the price of timber fell 30 per cent., but matters are now satisfactory in this respect. Owing to the impossibility of barking all the injured trees forthwith, an invasion of bark-beetles has followed the damage done by the storm, but this affects the spruce much more than the silver fir.

The damage done by this storm has shown the absurdity of managing hill forests of conifers and beech by the shelter-wood compartment system, and a new working-plan is now in preparation by which every working-section in the forest will be divided into ten blocks, each of which will be worked in succession. The volume of all trees that are fit for felling in the next ten years has been calculated, and one-tenth of these will be felled annually, besides removing badly-shaped and defective trees, and those injuring their better neighbours. It is also impossible in such forests to have a rotation fixed by age, for silver fir and beech trees remain alive for years in the shade of larger trees, and then grow up rapidly when the latter are removed, so that there is no necessary connection between their age and dimensions.

Owing to the moist nature of this forest, natural regeneration of all three species of which it is composed is excellent, seedlings of all ages occurring everywhere in the mossy soil-covering, and developing into poles and trees, as soon as they get sufficient light, by the removal of older overshadowing trees. The beech tends to be invasive in this forest, and to suppress the conifers, but this tendency is checked in the thinnings.

Yield and Revenue.

The yield of the State forest has been as follows:—

Average Annual Yield for Period.	Cubic Feet.	Value.
1870–79	649,390	£7,650
1880–89	786,485	8,430
1890–99	851,725	10,076

The annual production during these periods was 55, 66, and 72 cubic feet per acre annually, the price varying from 1¾d. in 1870 to 4½d. in 1882. Thus the gross income in 1890-99 was about £1, 6s. per acre annually.

Section VIII.[1] of this forest contains 1910 acres. This section produced annually 76·6 cubic feet per acre from 1881 to 1892, as compared with 61·6 cubic feet per acre for the whole forest, the average price of the timber being 3d. per cubic foot, and the gross income being 19s. 2½d. per acre.

PART II.

Management and general Character of Beech and Oak High Forest in France.

By Professor Fisher, Royal Indian Engineering College, Coopers Hill.

(From Notes by M. Cottignies, Inspecteur des Eaux et Forêts.)

Forêt de Retz (Villers Cotterets).

Situation.

The Forêt de Retz is situated in the N.E. of France, on three sides of the town of Villers Cotterets, between the river Aisne, a tributary of the Oise, and the Oureq, both being tributaries of the Seine.

The height above sea-level varies from 200 to 800 feet.

[1] This was the only section of the State forest visited by the Society.

Climate.

The climate is temperate, and very suitable to the growth of broad-leaved trees, especially the beech and oak. The winds are not very dangerous, except on a few plateaux, and then precautions must be taken in the seeding fellings.

Geology.

The base of the forest is composed of Cerithic Limestone of Tertiary formation. Above this limestone is Tertiary sand, of much the same appearance as the Bagshot Sands at Coopers Hill. In the sand large Sarcen stones are found, and on high levels, masses of hard quartzite form ridges of rock, which is quarried for street cobbles.

Soil.—The soil in which the forest grows consists of a sandy loam, about 20 inches deep, lying on the top of the sand. In the highest parts of the forest the quartzite occasionally comes to the surface, rendering such parts practically useless for forestry, at any rate for the production of oak and beech.

Area.

The total area of the forest is 32,044 acres, which is divided into sixteen working-sections, of which 27,768 acres are high forest and 4276 acres coppice-with-standards. The working-sections are unequal in size; for instance, the ninth working-section has an area of 2760 acres and the fifth working-section an area of 1496 acres. Every working-section was, up to 1902, subdivided into five periodic blocks, each of which was regenerated in thirty years, and each contained on an average 440 acres. A periodic block was again subdivided into compartments, the number varying from eight to twelve, depending on similarity of soil and growth, also on the aspect, gradient, etc. Compartment D. of II. periodic block, in the ninth working-section, contains about 43 acres, whereas compartment E of the same block and section contains about 31 acres. By the last working-plan revision in 1902, periodic blocks are given up, and the woods in each section are regenerated successively, in accordance with their age and condition.

History.

A century or so ago this forest produced very fine oaks, which were used for the French navy. In 1672, during Louis XIV.'s

reign, and during Colbert's term of office, the system known as *Tir et Aire* was started. It consisted in treating the area under the clear-cutting system, but leaving eight beech or oak standards (chiefly the former) per acre if available, the object being the production of large trees and the self-sowing of the clearings. No thinnings were made. Under this treatment the beech increased in numbers and the oak diminished. There was also a little coppice in some parts of the forest. The system was carried on up to 1830, and in 1832 the compartment method (*Régénération naturelle avec éclaircies*) was adopted, followed by a working-plan in 1857, which was itself revised in 1887, and has now been revised again in 1902.

Dangers.

The forest may be considered comparatively free from dangerous influences.

(a) *Frost and Snow.*—Frost and snow do not appear to be sources of much danger. Only in one case did we hear or see of a wood being affected by frost, and then a very severe frost some thirty or forty years ago necessitated cutting back the young beech over the whole seedling area.

(b) *Winds.*—Strong westerly gales are the greatest danger in the compartment system. When an area has been thinned in order to produce seed in quantity and to diminish the density of the cover, the mother-trees, being more or less isolated, are often blown down. Nevertheless, in the Forêt de Retz such damage is rare; but, as before stated, care must be taken when felling areas are at all exposed.

(c) *Climbing Plants, etc.*—The woodbine, sallows, and birch endanger the young crop at the time of the final felling, but by continual cleanings, and owing to the fact that the beech is a shade-bearer, also that the oaks when planted are five or six feet in height, this danger is easily overcome.

(d) *Game.*—Rabbits would entirely ruin the young crops were they not continually kept down by the brigadiers and guards. There are many red-deer, but the area of this and adjoining unfenced forests is so large that they do comparatively little damage to the forest. Compensation is paid by the lessee for any damage done to adjoining farms by the deer, the forest being unfenced.

(e) *Insects.*—Insects do very little harm. Conifers, so subject to insect attacks, are not planted on the high sandy soil, owing to the danger from fire, but the birch is preferred.

Management.

The forest forms part of the conservatorship of Amiens (the present conservator being M. Sainte-Claire Déville), and is under the direct charge of an inspector (M. Gibert): it is subdivided into two *cantonnements*, under a sub-inspector and a chief guard. Under these officers are six brigadiers and twenty-one forest guards, and each brigadier has twenty labourers, who work at cleaning and repairs of roads, boundaries, plantations, etc.

Besides the above, there are three guards for the fishing and one for supervising repairs to the roads. Houses in the forest are provided for all the officials, except the inspector; and each brigadier and guard has about two and a half acres of land attached to his house for garden and orchard. They are also allowed to graze two or three cows on the forest rides.

The forest is managed under the shelter-wood compartment system, with a rotation of 150 years. The wood is divided into thirteen working-sections of high forest, each of which is treated in the same manner, and may, in fact, be considered as a complete forest. There are also three working-sections of coppice-with-standards, which are being converted into high forest, and two of them (1265 and 1326 acres) have rotations of 40 years for their underwood. The third (1685 acres) has 30 compartments with 30 years' rotation, and 10 stocked with conifers which are thinned every ten years. The age-classes in the high forest are marked by colours on the map, of which black represents a wood from 0 to 30 years of age; yellow, 31 to 60 years; red, 61 to 90 years; and blue, 91 to 150 years.

A *preparatory felling* is made when the trees are about 110 years old. The object of this felling is to prepare the standing trees for bearing seed, and, at the same time, to preserve the cover. When the trees are about 135 years old, a seeding felling is made. When the regeneration of an area is started, it can generally be finished in twelve to fifteen years. Hence it is not necessary to make a felling area of a whole compartment; on the contrary, a compartment contains several felling areas. These are usually defined by girdling a few trees on the edge with a band of red paint. Generally the felling areas are small,

the amount of wood cut out not exceeding 17,500 cubic feet, having a value of about £400.

The preparatory felling is merely the final thinning of a wood preparatory to the seeding felling, and since throughout the late thinnings in a wood the future mother-trees have always to be considered, the preparatory felling may be discussed under the head of thinnings.

[*Photo, W. C. O.*

BEECH—VILLERS COTTERETS.

The first felling proper which takes place in a wood is the *seeding felling.*

The chief species grown in this forest are beech, oak, and hornbeam. The inspector chooses the trees to be felled in the summer, and a brigadier or guard marks them with a cross. A sub-inspector and brigadier follow, marking each selected tree in two places, one at 4 or 5 feet from the ground, and the other as low as possible. A piece of bark is taken out of the tree in each place, and the exposed surface on the tree is then stamped with a

hammer bearing the Government mark. These two men also measure the diameters of the trees, and calculate the volume by means of "form-factors" obtained from past fellings.

The objects of the two marks are: the upper mark shows the merchant the trees to be felled, and the lower mark must be left after felling, in order that the Government may be satisfied that none other than authorised trees have been felled. The trees are sold standing, and are valued by the inspector. To this valuation a certain percentage is added, giving an excess price which no purchaser would pay.

The trees in all the lots in the forest are sold as they stand in September, by "Dutch auction," the auctioneer gradually crying down the value of the lot until a merchant says *je prends* (I take).

The thinnings in the younger woods are generally sold to the highest bidder by a method called *par unité*, in which the bidding is at so much per cubic metre above the valuation, the lot going to the highest bidder. The reason for this method of sale is because the volume of wood in the thinnings is not known beforehand, trees being marked during the progress of the thinning. The merchant is allowed eighteen months for the cutting and clearing away of the fellings, and twelve months only for the thinnings.

In a *seeding felling*, about a quarter of the volume of standing wood is felled, or about one-third of the number of trees. All the oaks are allowed to remain, unless dead or dying. The hornbeam is cut out, wherever this is possible, in preference to the beech, but at the same time the mother-trees should be uniformly distributed over the area. In the woods there are reminiscences of the *Tir et Aire* system, in the form of huge old beech standards. These are cut down in this felling, since they are probably too old to bear seed. In such cases a large blank is left, and consequently all surrounding trees must be preserved. Any advance growth or underwood of beech and hornbeam present at the seeding felling is also cut out. The felling is usually made when there is every prospect of a good seed-year. A heavy triangular harrow is used to tear up the ground and prepare it for the seed. It weighs 6 cwts., and is dragged by four horses. Three or four acres are harrowed in a day, and the brambles and other weeds are torn up, so that the seed gets well into the ground. This costs 8s. 4d. per diem.

During the next twelve to fifteen years of the period of

regeneration, about four *secondary fellings* are made, including the final felling.

The object of these fellings is to give more light to the young crop, and to bring it gradually into the open. The mother-trees, whilst standing, give some protection to the young crop, and continue to regenerate bare patches.

The first secondary felling is not carried out at any definite time, but depends entirely on the condition of the young crop. If by bad luck with regard to the seeding felling, the ground did not become fully stocked with seedlings, another seed-year must be awaited before initiating further fellings. These fellings are carried out in the same manner as the seeding felling, but trees are felled wherever the young crop requires more light. The *final fall* is the last of these secondary fellings, and in it all the remaining overwood, often consisting chiefly of oak, is felled.

During the time of regeneration the wood has been open, and consequently all sorts of weeds, sallows, birch, and aspen make their appearance. Bare spots and temporary tracks remain unregenerated, and these are planted up, after the final thinning, with oaks five or six feet in height. If during the secondary fellings large blanks occur, these may be at once planted up, thereby giving the oak a start. The number of oaks planted on a felling area is about four hundred per acre.

The next operation is the process of *cleaning* the young wood. This consists in cutting away the sallows, birch, and aspens, and thinning out everything, including beech, that interferes with the young oaks. The first cleaning is executed by the brigadiers and guards alone, after which the guards have each twenty men under them to assist in the following cleanings. The cleanings are made quite irregularly, and just as often as is thought necessary by the inspector, generally every four years. For this work money has to be obtained from the Government, and the guards receive an extra 1od. per day. The produce of cleanings is brought out of the thicket, and, if possible, sold; but the price is frequently so small that cleanings may be defined as thinnings, from which no profit can be obtained.

Such cuttings go on until the wood is twenty-five years old. Henceforth, and until the seedling stage again comes round, *thinnings* are made every ten years. According to the age, the Government value the thinnings at so much per *stère*, that is, so much per cubic metre stacked (35 cubic feet), and the

merchant bids so much per cent. above the valuation, and the highest bidder obtains the wood. Trees to be felled in the thinnings are marked by the sub-inspector with a cross. After some progress has been made in a thinning, the brigadier is allowed to mark more trees if he thinks necessary.

In making thinnings, suppressed beech and hornbeam under beech must be removed, but if under oak they should be left to shelter the ground and force up the oak. All trees threatening the oak must also be felled, as well as all dead and dying trees. Comparatively large beech, which are the result of not cutting back the advance growth in regeneration fellings of a score or more years ago, are also felled, and the number of hornbeam is reduced as much as possible. Better care is now taken to cut back all advance growth. Thinnings of all kinds are marked over one-fifth of each periodic block in June, whilst the foliage is on the trees, and the felling is commenced in the following October. Each periodic block, except those that are being regenerated, is divided into thinning areas, each one-fifth of the block, and two of these are thinned annually in each working-section.

As a thinning in a fairly old wood is practically a preparatory felling, preparation for the seeding felling should be borne in mind.

All beech and hornbeam wood up to one metre (40 ins.) in girth is considered as firewood, and above one metre as timber.

In the principal fellings (other than thinnings) a certain proportion of the volume of wood fixed by the working-plan is felled. The volume is obtained by measuring all trees in the oldest age-class, this measurement being revised every ten years. As a result of the last revision, in 1902, the quantity of wood fixed to be felled annually throughout the forest in the principal fellings is 36,618 cubic metres, being 46·2 cubic feet per acre. Thinnings are also made annually over 1750 acres, and yield 28,536 cubic metres, or 35 cubic feet per acre for the whole high forest. Hence the total volume of wood felled annually is 81·2 cubic feet (actual contents) per acre for the high forest. The coppice yields about 4240 cubic metres annually, or 35 cubic feet per acre.

Composition and Character of Forest Growth.

In some parts of the wood large beech standards still remain, but are now being cut out, after which the *Tir et Aire* system will be entirely superseded. It is partly owing to these trees

that in some parts the wood is not completely stocked, causing a lot of advance growth of beech to grow up under the other trees. In a seeding felling made some three years ago, the seedlings are not very numerous, owing to the failure of an anticipated good seed-year.

An area on which the secondary fellings were in progress was observed to contain lots of sallow, birch, etc., as well as blanks. These latter amount to four or five per cent. of the whole forest, and are being planted with oak.

Under the old system, hornbeam became far too plentiful, and oak was suppressed. Now, however, the hornbeam is being cut at every opportunity, and oak are more numerous in the young woods.

On poor soil where no loam caps the sand, birch is grown.

The height of the trees is, for the most part, very good, reaching from about ninety to one hundred and thirty feet in the mature woods.

The distribution of trees over the whole forest is as follows:—

Beech, ...	40 per cent.
Hornbeam, . . .	40 ,,
Oak, ...	15 ,,
Sallow, poplar, chestnut, and elm,	3 ,,
Conifers, ...	2 ,,

Hence we see that hornbeam is still far too numerous, whilst the percentage of the oak will be raised to 30, oak timber being highly valued in France.

The beech and hornbeam are sawn into planks and used as furniture. Small beech and oak are used for railway-sleepers.

A good beech mast usually occurs once in seven years, and in 1898, numbers of people were admitted to the forest to gather some of the excess of beech nuts, from which salad oil was made to the value of £6000, besides 300 bushels of seed being sent to other State Forests in France, and sufficient seed reserved to restock the felling areas.

Yield.

As regards the product of thinnings, a wood forty years old gave 350 cubic feet per acre, valued at £2, 15s. A wood eighty years old gave 250 cubic feet, valued at £10 per acre; while the mature standing crop is about 9500 cubic feet per acre, at an average price of 10d., worth £396.

In Section IX. and No. 2 periodic block, the stock in the

mature woods in 1900 was about 10,000 cubic feet per acre, and was valued at about 7d. per cubic foot, or £291, 13s. 3d.

An older wood in the same block, before the secondary felling, contained 7000 cubic feet per acre. After the felling, 5360 cubic feet per acre were reserved, and 1580 cubic feet felled. The details of the felled and reserved trees are as follows:—

Felled.		*Reserved.*	
6	Oak.	19	Oak.
200	Beech.	583	Beech.
30	Hornbeam.	21	Hornbeam.
236	trees.	623	trees.

The value of the first thinning in a wood when about thirty years old is about £1, 4s. per acre; whilst the third thinning usually fetches from £2, 10s. to £3 per acre.

Revenue.

The average annual yield of the whole forest from 1898 to 1900 was 684,430 cubic feet, realising £24,613.

Accessory income derived from the lease of hunting, shooting, fishing, etc., amounted to £4372, of which *la chasse*, chiefly red- and roe-deer, figures for £1380 per annum, or 2s. 1d. per acre.

The average annual yield per acre per annum during the last three years was 82·56 cubic feet, valued at 15s. 1½d., thereby giving 2¼d. as the average price received for one cubic foot of wood, the low price obtained being due to the fact that nearly one-third of the yield is firewood, and the chief timber beech and hornbeam.

The total expenditure in 1900, under the different heads, was as follows:—

New Roads,	£579
Repairs to Old Roads,	43
Plantations,	410
Repairs to Buildings,	173
Clearing Ponds for Fish,	20
Cultivation of Felling Areas for natural regeneration,	65
Lopping Roadside Trees,	3
Protective Establishments,	949
Rates,	2501
	£4743

During the same year, the total receipts were as follows:—

Sales of Wood, . . .	£24,487
Lease of Hunting and Shooting, .	3,103
Sales of Grass, Fern, Stone, etc., .	851
Total,	£28,441

Besides the above, works to the value of £1192 were executed by purchasers of the standing crops. These works are detailed in the conditions of sale, and consist of repairs to roads and ditches, of lopping trees, and even in some cases of plantations. Naturally, the purchasers deduct this amount from the price they would otherwise pay for the standing crop, and the amount should therefore go to increase the revenue, as well as the expenditure, of the forest. The value of work done by the forest guards is also put down at £64.

The Forest of Retz is one of the finest and best managed beech and oak forests in France.

PART III.

Forest of Bellême. By Professor Fisher.

Situation.

The Forest of Bellême is in the Département de l'Orne, near the town of Bellême. It is on a small, isolated plateau, 500 to 800 feet above sea-level, with sloping sides, the small watercourses from which drain into the river Sarthe, a tributary of the river Loire. There are several fine oak forests in the neighbourhood.

The forest is in the conservatorship of Alençon, the present conservator being M. Loyer. The inspector of forests is M. le Levreur, living at Mortagne, about ten miles from the forest.

Area.

The area of the forest is 6072 acres; it is subdivided into four working-sections, all under high forest.

Geological Strata and Soil.

The plateau is capped by the Tertiary loam, termed *Argile à Silex*, which contains numerous flint nodules. Below this loam

are sands of the Lower Cretaceous system (Cénomanien), termed *Sables du Perche.* The loam forms a deep soil, often fertile, but sometimes full of flints. The sand is ferruginous, yellow, and very deep. Below the sand, in the country near the forest, are hills formed of Oolitic rock, on one of which the town of Mortagne is situated.

Climate.

The mean temperature is 48° F., somewhat lower than that of London, and the winter cold is moderate, the average minimum being about 10° F. The mean summer maximum is 86° F. Spring frosts are to be feared till the middle of May. The rainfall is fairly heavy, averaging 38 inches, and is uniformly distributed.

History.

The Forest of Bellême has belonged to the Crown of France since the fifteenth century, before which it belonged to the Counts of Le Perche. It has several times formed an appanage of French princes; the last concession was to the Duc d'Alençon, brother of Louis XVI., who became King of France, as Louis XVIII., after the abdication of Napoleon. The Duc d'Alençon subjected the forest to the following treatment, after its having been since 1660 managed under the system known as *Tir et Aire* (successive clear-cuttings, with reservation of eight standards per acre, and a rotation of 150 years, no thinnings being allowed) :—

In the first and fourth working-sections, high forest, with a rotation of 99 years. In the second and third working-sections, coppice-with-standards, with a rotation of 33 years. The Revolution luckily prevented this from being carried out, except that a commencement was made to ruin the forest.

Under the Republic and subsequently, the *Tir et Aire* system was resumed, until 1825, when the *Système de réensemencement naturel avec des éclaircies* was introduced, corresponding to what is known to some as the "shelter-wood compartment system." [1]

The presence of a few of the old standards from the *Tir et Aire* gives some of the woods the appearance of a two-storied high forest.

[1] *Natural regeneration under parent trees* seems much preferable.—Hon. Ed.

Forest Growth.

Oak.—The sessile oak is the predominant species, forming about half the crop, the general composition of which is as follows:—

	Percentage.
Oak,	50
Beech,	35
Conifers,	10
Hornbeam and others,	5
	100

There is a complete crop of acorns every six to eight years, and the reproduction of oak is favoured by removing beech in the thinnings and seeding fellings. The oak attains large dimensions, one tree I measured being 133 feet in height, with a girth of $14\frac{1}{2}$ feet at chest-height. Reproduction of the oak is so good that only 2 per cent. of the felling areas has to be planted with it.

On the lowlands below the forest, which are less well drained, the hedgerows are full of pedunculate oak, showing the different stations assigned by nature to these species.

Beech.—Beech forms about one-third of the standing crop. When the *Tir et Aire* system was in force, owing to the absence of thinnings, beech tended to supplant the oak, especially as the rotation was then 150 years, instead of 200, as at present. Even when the present system was first introduced, as the reproduction areas were not carefully treated by cutting away sallow, birch, and beech, which tended to suppress the oak saplings, beech became too numerous; but this is no longer the case, as in the cleanings and early thinnings the beech and softwoods are cut out and lopped, in order to protect the oak from their shade.

Beech trees, when isolated in the seeding fellings, get sun-blistered and become stag-headed; but in the mature woods, they occur 130 feet in height and 10 feet in girth.

Hornbeam.—Hornbeam is found disseminated throughout the forest, and forms about one-twentieth of the crop. It is useful in filling up thickets of young oak, and being less vigorous than the beech, is not so dangerous to the oak.

Scots pine.—This species has been planted pure on all the sandy areas, and forms about one-tenth of the whole crop. The pine poles are now about forty-five years old.

Ash.—A few ash are found here and there, but cannot compete in height-growth with the oak and beech. In some plantations on marshy ground, pure ash poles are found in a promising condition. Sallow and birch spring up on the felling areas, but are speedily cut out.

Brambles also grow on the felling areas, as well as raspberries and dense masses of tall grass and broom.

Dangers to the Forest Growth.

The strong westerly gales are not particularly dangerous, as the oak is wind-firm, and the fellings are made from east to west.

Red-deer sometimes browse on the oak transplants, which are used to fill up blanks on the felling areas.

Spring frosts are sometimes hurtful to the young crops of oak and beech in the depressions. In such places, sallow, birch, and broom are very useful as nurses to the young saplings, until they have grown beyond the frost-level.

The Scots pine has been much injured by a fungus, *Rhizina undulata*, which attacks the roots of the trees, and, as it spreads from tree to tree by their roots, the trees attacked die in circular patches. Hence this disease is known as *Maladie du rond.* This has been so prevalent in the forest, that it has been proposed to substitute silver fir for pine on the sandy area.

Present Management.

A working-plan was sanctioned in 1859. It prescribed fellings in successive compartments, with natural regeneration. Each working-section was divided into eight periodic blocks (*affectations*), corresponding to a rotation of 200 years, in the periods of 25 years for each block. In 1859 the periodic blocks were not concentrated, but were scattered over each working-section, according to the actual age of each compartment, the oldest woods being regenerated first. This did not please the working-plan revisers in 1882, when the periodic blocks were rearranged so as to form contiguous areas. The former arrangement, however, is much the more rational, as, owing to the revision, many immature crops must either be regenerated too soon, or left standing, in defiance of the working-plan. There will be a fresh revision of the working-plan in 1907, when it is presumed that the former more sensible arrangement, which has now been

adopted in the Forests of Retz and Compiègne, will be reintroduced into Bellême.

Regeneration is generally effected in three fellings—the seeding, secondary, and final felling. Young oak will not stand much shade, and reproduction is so successful in Bellême that twelve years and even less time suffice to restock a felling area.

Before the seeding felling, all the beech advance growth is cut, and the standards are left so far apart that their crowns touch when a fair breeze is blowing. Chiefly oak standards are left at the seeding felling, with a few beech to complete the cover. The ground is then frequently hoed up to keep down brambles, and to assist the acorns in germination. Wherever there is not a sufficient supply on the ground, acorns brought from other forests are roughly sown under the standards (*Croquetages*).

As the trees are so tall, their tops are lopped off before they are felled, by men who climb the trees with climbing-irons. If application be made to the Inspector beforehand, this operation can be shown to the visitors, ten francs being a usual present to the man who lops the trees.

At the secondary felling, most of the beech standards are felled, and the oak standards are thinned out wherever the young seedlings are fairly numerous. All remaining standards come out at the final felling, except a few monumental trees left here and there in the forest.

After the final felling, a cleaning is made to set free oak saplings that are overcrowded by beech, the latter being either seedlings or coppice-shoots from the advance growth. All softwoods are also pulled up by the roots or cut back. All gaps are then planted up with oak transplants, and with ash in the moister parts of the felling areas. Similar cleanings are repeated when necessary, till the crop is about 25 years old.

Thinnings.—Thinnings are made, in woods over 25 years old, twice in 25 years, though these were made only once up to 1882, but did not set free the oaks sufficiently. The markings for the thinnings are made progressively, as the operation proceeds, and the yield from all young thinnings is sold by unit of produce, that is, the produce is stacked in cords and paid for by the purchaser, who has agreed to take each class of firewood or any timber at a rate fixed by public auction beforehand, but the quantity of material is not specified then, although an estimate of it is given. When the trees are about 100 years old,

the thinnings are sufficiently severe to set free the crowns of the best oak trees, their boles having then nearly attained their full length. This enables beech undergrowth to spring up and serve for soil-protection, and at the same time causes the oak to increase considerably in diameter.

In all thinnings, beech is always cut away, or lopped, when interfering with promising oak; suppressed oak are felled, but suppressed beech are carefully left under the oak, so that the ground may be covered by the leaf canopy. Softwoods are also cut out, perhaps too rigorously at first.

These thinnings are continued until the wood is about 175 years old, when it comes into the age-class of mature trees, and is left untouched until the seeding felling is made. In the older thinnings the trees are marked for sale and sold by the cubic metre, as in the regeneration fellings. Such thinnings usually consist of suppressed oak trees.

Yield.

The average number of trees in a mature crop is 80 per acre, containing about 9800 cubic feet, worth about £450 at 11d. a cubic foot. The best standing crop, about ten years ago, was 13,258 cubic feet (actual) per acre, worth about £600. The fixed annual yield of the principal fellings is about 30 cubic feet per acre for the whole forest, while the thinnings yield about 20 cubic feet per acre annually.

The following figures, giving the yield from thinnings at different ages, were kindly supplied by M. le Levreur, the inspector of forests in charge.

Age.	Yield per Acre.	Value.
Years.	Cubic Feet.	£ s. d.
30	308	1 7 10
42	392	2 1 10
55	196	1 10 0
67	280	1 15 10
80	252	3 12 3
92	210	2 0 7
105	182	1 13 0
117	182	1 13 0
130	238	3 16 2

The markets for the oak timber are Brest and other seaports, and Paris for building material and firewood. Much beech is also used locally for *sabot*-making.

Management of the Pine Woods.

The area under pine is not included in the general working-plan, as the trees are still too young except for thinnings, which are made every 7 years, and commence at the age of about 25 years. These pine woods are the result of sowings in lines, 7 lbs. of seed per acre being used. Oak and beech are now springing up under the pine, and wherever the sandy soil will produce oak, it is proposed eventually to establish this species with beech and hornbeam, as in the rest of the forest. Some of the tallest oak in the forest, in fact, grow on sandy soil, but the quality of the timber is said to be inferior to that produced on the loam.

Revenue and Expenditure.

The following figures of revenue and expenditure for this forest for the year 1894 were kindly supplied by M. le Levreur.

Receipts.		*Expenditure.*	
Produce of fellings and thinnings,	£6802	Planting and other works,	£246
Minor produce, shooting leases, etc.,	170	Works executed by purchasers of timber, guards, etc.,	160
Value of produce given to villagers,	87	Pay of brigadier and guards,	145
Total receipts,	£7059		
Deduct expenditure,	£551		£551

Net revenue £6508, or £1, 1s. 6d. per acre.

PART IV.

Short Account of the Forest of Compiègne.

By Professor Fisher.

(From Notes by M. Récopé, Conservateur des Eaux et Forêts, Paris.)

Situation and Area.

The State Forest of Compiègne, in the Département de l'Oise, in the conservation of Paris, about fifty-two miles to the north-east of Paris, has an area of 36,072 acres. It is separated only by the river Aisne from the large State Forest of Laigue (10,000 acres).

Most of the forest (about 25,000 acres) is on level ground in the valley of the Aisne, the remainder being on a range of hills to the east and south. The altitude of the forest above sea-level varies between 117 and 497 feet. The inspector in charge is M. Peiffer.

Geology and Soil.

The chief geological strata are: Upper white chalk (*Craie à belemnitelles*), Bracheux sand (*Sables de Bracheux*), plastic clay and lignite (*Argile plastique et lignite*). These underlie more than half the forest area. On the slopes of the hills nummulitic Soissons sand (*Sables nummulitiques de Soissons*) occurs, and on the plateau above the slopes are coarse milialitic and nummulitic limestone (*Calcaire grossier à milialites et à nummulites*). All strata above the chalk are Eocene. Alluvial deposits cover the low ground, and the plateau is overlaid with loam.

The soil is generally poor, dry, and shallow; moderate fertility can be secured only by maintaining a dense crop of trees under high forest treatment. The plastic clay holds a supply of rather stagnant water, which forms some ponds and marshy depressions.

Forest Growth.

The forest is stocked with oak, beech, hornbeam, and other broad-leaved trees. In a few places there are conifers forty to sixty years old. An area of 32,292 acres, divided into ten working-sections, each treated independently, is managed as high forest, with natural regeneration obtained by successive fellings (shelter-wood compartment system); periodic thinnings

are also made in the growing woods of each section. Considerable difficulty is experienced in securing natural regeneration, owing to the large number of deer and rabbits.

There are two sections, comprising 2027 acres, treated as coppice-with-standards, the rotation of the underwood being thirty-five years.

One working-section (1753 acres), that of Beaux Monts, is treated as a picturesque forest (*Série artistique*).

[*Photo, A. D. R.*

OLD OAKS—COMPIÈGNE.

The rotation of the high forest is 150 years, the annual fellings of mature trees in it producing 992,915 cubic feet, or 27 cubic feet per acre. To this should be added about 700,000 cubic feet, the yield of the thinnings, which are made every ten years in the growing woods, so that the total annual yield is 46 cubic feet per acre. The thinnings are chiefly made to protect oak from being overgrown by inferior species, and extend over 3000 acres annually.

This forest was, up to 1870, managed under a clear-cutting

system, the areas cleared being carefully fenced against deer and rabbits, and the ground ploughed up and planted with potatoes. This cost £2, 7s. 6d. per acre, but was partly recouped by the sale of the potatoes. Forest plants were then planted, or sown, and the fences removed when the young crop was old enough. Of late years, planting has been abandoned in favour of natural regeneration.

Revenue.

The average gross revenue of the forest, during the last ten years, has been £33,480, including £3880 for hunting and shooting leases.

The forest of Compiègne is the fourth in area in France, and owing to its wealth in old trees, its splendid network of roads, its proximity to Paris, to the noble old Palace of Compiègne and the majestic Chateau de Pierrefonds, as well as to the beautiful views obtained from the surrounding hills, it is one of the finest forests in France.

PART V.

The Treatment of Oak in Coppice-with-Standards in the North of France.

By Professor Fisher.

(From Notes by F. W. Collings, Esq.)

Forêts de St Amand et de Raismes (Valenciennes).[1]

Situation.

These two forests, Forêt Domaniale de St Amand and Forêt de Raismes, are very favourably situated near the town of Valenciennes, in the Department du Nord, in France, and close to the Belgian frontier, at an elevation of from 50 to 100 feet above sea-level. To the north-west flows the river Scarpe, a tributary of the Scheldt. Railways, tramways, rivers, and canals all run through the forests, making transport comparatively easy; and the neighbourhood of the French and Belgian coal-fields gives the wood a special value.

The Forest of Raismes is surrounded on three sides by the Forest of St Amand, and forms a compact area.

[1] These forests were not visited by the Society.

Climate.

On account of the lowness of the land, and consequent bad drainage, the locality is subject to severe late frosts; on the whole, however, the climate is mild and moist, thus acting very beneficially on the growth of trees. The distance from the North Sea is about 65 miles, so that the influence of the sea air renders the climate moist and more equable in temperature than at stations farther inland.

Area.

The Forest of St Amand has an area of 8190 acres, which is divided into eighteen working-sections, of about 455 acres each. This forest is in the conservation of Amiens, the conservator being M. Sainte-Claire Déville. It is managed by Inspector M. Dion, of Lille, under whom the local sub-inspector is M. Marechal de Bièvre.

The Forest of Raismes is 3500 acres in extent, and consists of two working-sections of 1750 acres each. This forest is managed by M. Gueuning.

History.

Up to the time of the French Revolution, the Forest of St Amand was chiefly owned ecclesiastically, belonging to the two abbeys of Vicogne and St Amand; nevertheless, parts of the forest, near its extreme east and west boundaries, have always been State property. During the Revolution, however, the ecclesiastical possessions were confiscated, and now the whole is entirely under State management.

The Forest of Raismes is a private forest, at present owned by the Duchesse d'Aremberg, and there are no rights of common. In the ancient State portions of the Forêt de St Amand there are certain rights of common, chiefly of pasturage of cattle and horses—not to exceed one per hectare—but the cattle cannot enter felling areas under six years old.

Geology.

The French Coal-Measures, above which is Miocene sand and Eocene limestone, underlie the forest areas.

Soil.—The soil consists of a sandy loam; on high ground this is capped by loose sand, in some parts forming sand-dunes, where the soil is not suited for the growth of oak. On low ground the loose sand is absent, and the soil is then a deep, moist, and very

fertile loam. In places swamps occur. The district is rich in coal, and mines extend in all directions at about 600 metres below the surface, often causing a sinking of the land, which is generally the cause of these swamps. The trees die when the ground sinks and becomes swampy; they are then felled, and the swamp filled with debris from the mines and replanted. Some swamps are being thus filled up; on others pollard willows are growing. The present plan, however, is to dig tanks for fish on all sunken areas.

Dangers.

Frost.—Spring frosts form one of the chief dangers to these forests.

Snow.—Snow is not very dangerous in a coppice-with-standards, but a few long, slender oak standards have bent over, owing to the weight of snow that accumulated on them last year.

Climbing Plants.—The woodbine constitutes another danger, especially among coppice-shoots.

Rabbits.—These animals are kept down in winter by shooting as many as possible, especially in the State forest. They are also trapped during summer. In passing through a part of the wood where the coppice compartments gradually rise in age, it was found that the height of the coppice actually descended. This was accounted for by the fact that in an adjoining private forest the rabbits had not been sufficiently suppressed. No coppice can exist where rabbits abound.

Insects.—*Tortrix viridana* frequently destroys the first foliage of the oak trees.

Birds.—The only birds to be seen were pheasants and a few other common species, but these interfere in no way with the growth of the trees. Jays are regularly shot, as they destroy pheasants' eggs.

General Management.

These forests are managed under the system known as coppice-with-standards. In the State forest about 2000 acres are under Scots pine, as high forest; in the private forest about 375 acres.

There are eighteen working-sections with a twenty-five years' rotation. The annual felling area in a section in the State forest averages only about 25 acres, whereas a felling area in the private forest extends over 125 acres, there being only two working-sections, with fourteen years' rotation.

(a) *Coppice.*—In the State forest no plants to be treated as coppice are planted, whilst in the private forest underwood is planted where necessary. For instance, last year 1200 coppice plants were planted in one felling area of 125 acres, whilst the other felling area was considered to be well enough stocked in this respect.

Up to 1880, the rotation of the State forests varied; but under the present working-plan of 1881 the rotation is everywhere fixed at twenty-five years. In the private forest the rotation is only fourteen years. It may be noted that a change of rotation of the underwood should take place gradually, otherwise an excess of the lower parts of the crowns of the standards may be killed by the consequently taller growth of the coppice.

One cleaning of the coppice is made at seven years in the private forest, in order to free the young standards from any threatening coppice-shoots; whilst in the State forest no less than three cleanings are made,—at six, twelve, and eighteen years respectively. In these cleanings, all coppice-shoots too near the standards are cut back, and the standards are pruned, and superfluous forked leaders suppressed.

(b) *Standards.*—In the State forest oak standards are planted as large-sized transplants of about 6 feet in height and seven years of age. In the private forest the young standards, when planted, are larger, being about 12 feet high, and frequently with balls of earth. In the private forest, when the area to be restocked is near the nursery, the plants are transported with balls of earth; but when the distance between forest and nursery is great, the earth is shaken off, and saplings are transplanted in the ordinary way. Twenty thousand young oak are planted out annually in the Forêt de Raismes, and 16,000 in the Forêt de St Amand, or 48 per acre. The planting takes place about the middle of October, in order to avoid injury by spring frosts, and to allow roots to get settled before all root-growth has ceased.

At the thinning of the coppice, the young standards are pruned and all epicormic branches are cut off the older standards; in the case of the private forest this is done by means of a triangular-shaped instrument, one edge of which is sharpened, attached to poles of different lengths. The instrument is pushed up from below, and the epicormic branches severed from the trunk.

For pruning trees of their larger branches, climbing-irons are used, and the branches sawn off. This method is followed in the

private forest, but the trees are injured by the climbing-irons, and it would be better to leave dying branches to fall naturally, as is the system in the State forest, and to leave large, sound branches unpruned.

The standards are under no fixed rotation, but all middle-aged and young standards give way to old, sound standards; that is, at the end of the rotation, where a flourishing standard ("ancien") is threatened by others, the latter are removed, whereas, if the "ancien" show signs of falling off, it would be felled, and the young ones allowed to take its place; in fact, preference is given to the "ancien" as long as it is sound and thriving. As long as a tree at least doubles its value in twenty-five years, it is considered flourishing.

When the age of the standards is moderate, then those with the best crowns are chosen to remain. With regard to the number of standards per acre which are removed, the following figures show the volumes for some actual felling areas in the State forest:—

Cubic feet before felling.	After felling.	Per cent. felled.
1400	840	40 per cent.
1680	1050	37½ ,,
1064	616	42 ,,
2240	1890	15½ ,,
2072	1428	31 ,,
1890	1498	21 ,,
1904	1288	32 ,,
1708	1176	31 ,,
1666	1050	37 ,,
1554	1092	30 ,,

The ideal aimed at is to have 1400 cubic feet of standards per acre when the underwood is twenty-five years old, and to fell half this volume, leaving 700 cubic feet of standards to grow for another twenty-five years, when it should again amount to 1400 cubic feet.

The method of procedure for the felling of the trees differs in either forest, although in both, felling is done by the purchasers of the trees.

In the State forest the standards to be reserved are marked, before the felling of the coppice, by slicing out a piece of bark at the base of the tree; a State hammer-mark is then impressed on

the exposed surface of the wood. Standards to be felled are marked in the same manner, at a distance of 3 or 4 feet from the ground, but no hammer-mark is made. The standards and underwood are then sold by public auction, to one purchaser, on a felling area of 22 acres. After the felling a counting, or "récolement," is made by the Inspector, to see that no hammer-marked tree has been felled.

The buyer is allowed eighteen months for the clearing away of the trees. During the autumn, before the buyer leaves, young oaks are planted.

In the private forest the underwood is sold in September, and cut in the following December. Afterwards, the standards are marked and sold, either singly in the case of large trees, or in lots of about ten where the trees are of medium size. In this forest only the trees to be felled are marked, and then two marks are inserted on opposite sides, so that at least one mark always remains uppermost when the tree is felled.

High Forest.—After the Napoleonic wars, a large number of oak trees as well as Scots pine were planted in the State forest, one quarter of which was practically bare heather land till 1848. In the private forest certain sandy areas were planted up with Scots pine about 1863.

These pine woods are thinned out at the same time as coppice, viz., about every six years; such thinnings go on until the woods are seventy years old, when a heavy felling is made, and oak is planted, whilst birch springs up abundantly to serve as underwood. Finally, all the pine are gradually removed, and the coppice-with-standards system is again introduced.

These Scots pine poles are valuable for the mines as pit timber, etc.; and according to their diameter and length they are marked by cuts, and classed accordingly, each class having a fixed value per 100. Thus in the private forest the following classes occur:—

Girth in Inches.	Length in Feet.	Marks.	Value per 100.
6½ to 8	19½	O.	8s.
8 „ 10½	23	I.	19s.
10½ „ 12½	26	II.	27s. 6d.
12½ „ 16	29½ to 33	III.	51s. 6d.
16 „ 19	29½ „ 33	IV.	103s.
19 „ 28	29½ „ 33	V.	178s.

Character and Composition.

The crops in the forest may be divided into three kinds, viz.:—

I. Those in which the standards are too numerous.
II. Those with a normal stock of standards
III. Those in which the Scots pine stands over broad-leaved species.

I. The French Government have a very great idea of high forest, and consider it to be the only kind of forest worthy of the State's superintendence. It is partly for this reason, and partly on account of the sand in certain places, that the undergrowth in the State forest is often valueless, and the standards are so close together, that one might easily call it a poorly stocked high forest. The evenness in age of the oak is very striking, and clearly marks those planted after the Napoleonic wars.

Seeing that the State never plant any underwood, it might probably be more advantageous to work under high forest. On such areas the standards represent about 2240 cubic feet per acre, whereas 1400 cubic feet is sufficient for standards in an ordinary coppice-with-standards Nevertheless, since the Government require timber, they certainly attain their end, for the oak is in splendid condition, and thriving well.

The annual increment of the oak in girth, measured at 4 ft. 4 in., was 0·70 in. on fertile soil and 0·40 in. on sand. Among the standards are ash, and white and grey poplar, the annual increment in girth of which was 1·48 and 1·60 in.

II. Certain parts of the State forest are splendidly stocked with both coppice and standards, whilst the private forest consists of underwood fourteen years of age, and 25 to 30 feet high, with standards quite as good as those of the State forest. Great trouble is taken in the private forest to obtain an even distribution of the standards, stores of one rotation being often transplanted from one part of the area to another.

III. Up to between thirty and forty years of age the Scots pine forms a dense forest with little or no undergrowth. After this age, and up to seventy years, the wood gradually gets thinner, and birch makes its appearance as advance growth, together with a few oak. After the heavy thinning at seventy years, followed by planting of oak, the Scots pine and birch must be cut away where they interfere with the oak, so that the

wood eventually consists of an almost even-aged forest of oak, with a thin undergrowth of birch and other species.

The tree used as standards is chiefly oak. Ash, poplar, and birch occur, however, at intervals, and the beech very rarely on the poorer soil.

The natural underwood consists chiefly of alder, birch, aspen, hornbeam, hazel, sycamore, and sallow; in the private forests no hazel is ever planted, the species favoured and planted (to serve as underwood) being hornbeam, ash, alder, and sycamore.

Nursery.

Each forest has its nursery, that of the private forest being 17 acres in area.

The oaks are sown, and transplanted after two years, the space between each being 1 ft. 6 in. by 9 in. This is rather a tight fit when the plants reach five or six years of age, and it is recommended to plant 1 ft. 6 in. by 12 in. in future. In the private nursery the oaks so planted are thinned by again transplanting when it is thought necessary. An experiment is being tried of planting them far enough apart at two years in order that they may attain their required size without a second transplanting.

Large Scots pine are also grown in the private nursery. One point to be noticed is the much greater area required for a broad-leaved nursery than for a coniferous nursery.

Measured Trees.

The growth in these forests is rapid, 0·4 of an inch being about the annual diameter increment laid on by the oak.

The following are a few trees actually measured:—

Oak 155 years old,	. .	7 ft. 9 in. girth.
„ when planted,	. .	0 ft. 4 in. „
„ 14 years, .	. .	1 ft. 0 in. „
„ 28 years, .	. .	1 ft. 6 in. „

The average reserve of standards per acre in the State forest consists of—

110 oak	= 73 per cent.
3 beech and ash . . .	= 2 „
37 poplar, sycamore, elm, and hornbeam	= 25 „

In one felling area of 16½ acres in the State forest, the following trees were felled:—

130 oak tellers.
61 oak of two rotations.
24 oak of three or more rotations.
6 ash of three rotations.
3 poplar of three rotations.

The volume felled was 4725 cubic feet, and the price obtained £560, or £34 per acre, equivalent to an annual return of £1, 7s. 2½d. per acre.

The *average annual revenue* of the State forest between 1886 and 1895 was as follows:—

Fellings, ...	£8240
Shooting lease, . . .	1444
Sales of grass, . . .	384
Value of produce given away, .	352
Total, .	£10,420

The corresponding *average annual expenditure* was as follows:—

Works, including maintenance of houses, roads, plantations, etc., . .	£432
Supervision, ...	304
Rates, ...	316
Total, .	£1052

This gives a balance of £9368 for 8290 acres, equal to £1, 2s. 8d. per acre per annum.

I could not obtain recent statistics for the revenue and expenditure of the private forest, but in 1897 it appears to have been as follows:—

Sales of wood, ...	£5337
Expenditure, ...	1337
Balance, .	£4000

for 3500 acres, equal to £1, 2s. 10d. per acre per annum.

X. *Report on the Excursion to France, from 23rd July to 6th August* 1904.[1] By GEORGE U. MACDONALD, Forester, Raith, Fifeshire.

After a lapse of only two years, over seventy members of the Royal Scottish Arboricultural Society again held their Annual Excursion in a foreign land.

The country chosen this year was France, and on all hands it has been admitted that this year's Excursion has been, from a forester's point of view, most successful and instructive.

Leaving Edinburgh on the afternoon of the 23rd July, London was reached a few minutes before midnight, when members were afterwards driven in omnibuses to the Manchester Hotel, in Aldersgate Street.

On Sunday, the 24th, the Excursionists were early astir in order to make the most of the time at their disposal in viewing the sights of London, and in paying a visit to Kew Gardens, under the leadership of Mr Munro Ferguson, before leaving at 9 P.M. for Dover and Calais.

Leaving Calais at 12.58 on the morning of the 25th, and travelling by way of Amiens, Reims, and Chalons-sur-Marne, Nancy, which was to be the headquarters of the Excursionists for the following three days, was reached at 11 A.M. Between Calais and Chalons the country is very flat, and is almost wholly given up to agriculture. The crops, which were then being reaped, included oats, barley, wheat, and rye, all of which appeared to bulk well in the stook, and to be of exceptionally fine colour. Between Chalons and Nancy, the country generally becomes more diversified, the land is more undulating, and the low hills, with their vine-clad slopes, are a pleasing contrast to the former wide and rather monotonous tract of flat corn-fields.

Throughout this region there are no forests of any large extent. In the flat and agricultural district, shelter-belts, composed chiefly of pine, have been planted in long strips in face of the prevailing winds, in order to break their force, and to provide shelter for grazing-stock.

[1] Numerous corrections on points of detail have been made throughout the Report, on information kindly given by Professor Fisher, who is well acquainted with many of the forests visited.—HON. ED.

Alongside the roads and canals, avenues of trees, composed chiefly of black Italian and Lombardy poplar, are planted with great regularity in the intervals, and appear to thrive exceedingly well. *Robinia*, or the wild acacia, springs up like a weed all over the railway cuttings, and on thin patchy land wherever the seed reaches the soil.

Before describing the various forests visited during the Excursion, it may not be out of place to state here the approximate area and composition of the woods belonging to the Government, the communes, and the private proprietors of France.

The total wooded area is approximately 35,470 square miles, or a little more than 17 per cent. of the entire area of the country —the wooded proportion of the British Isles being only 4 per cent. of the entire area. Of this vast area, about 66 per cent. is owned by private proprietors, 22 per cent. by communes and sections of communes, 10 per cent. by the State, and 0·3 per cent. by public institutions.

The small number of the different kinds of trees which enter into the composition of the French forests is very remarkable; for it appears that oak, beech, and hornbeam occupy 60 per cent. of the tree-covered area. The next in importance are the silver fir, Scots pine, evergreen oak, cluster pine, spruce, and larch.

Broad-leaved forests, pure and mixed, constitute about 67 per cent. of the entire wooded area, and mixed broad-leaved and coniferous forests 18 per cent., while pure coniferous forests amount to but 15 per cent. of the whole.

The Excursion proper began on July 26th, by members paying a visit to the famous *École Forestière*, founded in 1824, at Nancy, which is the principal Forest School in France—although there is another school at Les Barres, where subordinate forest officials can qualify for the higher public forest service, as well as be trained for subordinate service and for posts in private forests. Before 1824, the Department was chiefly recruited by means of retired officers of the army. Few of these, however, received, under the old system, a professional training sufficient to enable them to discharge their duties satisfactorily, and it was to remedy this state of things that the School was established.

The controlling and teaching staff is composed as follows, viz.:—One Director (Professor of Political Economy and Forest Statistics), one Deputy Director (Professor of Forestry), one Assistant Professor of Forestry, one Inspector of Studies (Pro-

fessor of Law), one Assistant Professor of Law, one Professor of Natural History, one Professor of Applied Mathematics, one Professor of Agriculture, one Professor of German, one Professor of Military Science, and one Inspector for Experiments.

The conditions for admission to the Nancy Forest School are that all candidates, except one or two from the *École Polytechnique*, who rarely care to join the Forest Service, must have obtained a certificate at the *Institut Agronomique*. Each year about 100 students qualify for such certificates, and they may choose the Forest Service according to seniority on the list; and those who select this are sent to Nancy. Though not a highly-paid service, there is a good deal of competition to obtain a nomination to the School.

Each year of study at the School comprises $6\frac{1}{2}$ months of theoretical and $2\frac{1}{2}$ months of practical instruction.

During the first year of *theoretical instruction*, the subjects taught are Sylviculture in all its branches, Botany, Political Economy, Law, Surveying and Road-Construction, German, and Military Science. For the second and last year the subjects taught are Working-Plans, Mineralogy and Geology, Zoology (especially that branch of it relating to insects which attack trees), Agriculture, Building, the treatment of Torrent-beds, and Pisciculture, as the French Forest Service are now in charge of all inland non-tidal waters.

The *practical course*, which occupies $2\frac{1}{2}$ months of each year, consists of tours made into the forests in the neighbourhood of Nancy, in the Vosges, and in the Jura, for the purpose of studying Forestry, Natural History, and Surveying.

The School is splendidly equipped. The museum contains very complete collections, illustrating the courses of Mineralogy and Geology, and with woods, fruits, seeds, and dried specimens of the foliage and flowers of trees. There are also stuffed mammals, birds, reptiles, and fish, and a collection of insects, with sections of wood showing the damage done by them to trees. There is a collection of models of saw-mills, of torrent-beds treated with weirs, of sand-dunes, showing the progress of their afforestation with *Pinus Pinaster*, and of an apparatus for transporting timber from the mountains, consisting of a rope and pulley arrangement, with carriers working on an incline. There is also a very interesting collection of forest-tools, as well as numerous examples of the uses to which wood is put in

husbandry and in the industrial arts. In the grounds in which the buildings are situated, there are experimental plots to ascertain the effects of growing trees in different kinds of soil.

The time at the disposal of the Excursionists was much too short to do justice to this most interesting institution. Nevertheless, the forestry members present saw much to interest them; and from the full explanations given by Professor Henry, and lucidly translated by the President, Mr Steuart Fothringham, they were able to carry away with them information of great practical value.

Immediately after luncheon a start was made for the State Forest of Champenoux, situated in the plain which extends to the west of Nancy, between the rivers Meurthe and Seille.

It has a total area of about 3500 acres, over 2000 of which are attached to the Forest School at Nancy, the other part being under State Forest administration.

The configuration of the ground is undulating, with an elevation of from 700 to 900 feet above sea-level.

The soil, which overlies limestone, is of a clayey nature, with a large proportion of silicious sand; it is fairly light, and is well adapted to the growth of oak, beech, and hornbeam, 50 per cent. of the entire crop being composed of oak (sessile and pedunculate), and the remaining half consisting chiefly of hornbeam and beech.

On entering this forest, members were much interested in seeing and having explained to them the methods whereby the original crop of coppice-with-standards is being converted into high forest. This is done in no haphazard manner. Careful and scientifically prepared working-plans or schemes of management have for many years been introduced by the French Forest Department, so that to-day practically all the forests under its control are subjected to the provisions of such plans, as provided by law. According to these, no fellings can be made without the express sanction, in each case, of the Government, by whom all plans must be approved before they can be adopted.

The provisions of a working-plan must necessarily vary according to the nature of the forest to which it relates; but in all cases the object in view is to ensure that a permanent annual yield of a particular class of produce can be secured, and that the forest may be protected against risk of gradual extinction.

In Champenoux, as already indicated, the whole forest was

formerly coppice-with-standards, but it is now being converted into oak highwood, with a rotation of 160 years. For this purpose the forest is divided into two working-sections, and each of these is subdivided into four blocks, with a regenerative period of 40 years each. During the first period, regenerative fellings, fixed by volume, take place in the first periodic block; preparatory fellings by area in the second and third blocks; and coppice cuttings in the fourth.

For purposes of conversion, when the last fall of coppice takes place, a selected number of oak stores or tellers are left to grow into the overwood, and so form the highwood crop.

Where the oak is too thin to give a sufficient number of stores or tellers, these are either supplemented artificially by planting or by also leaving a few beech or hornbeam to complete the number required. The old standards are at this time entirely removed.

It was not until 1868 that the actual conversion of this forest was begun, although preparatory fellings had been carried out many years before. At the present time, therefore, there is but one-fourth of the whole area which has been converted into high forest, while the remaining parts are in the transition stage.

All the principal trees in this, as in most other forests in France, are regenerated naturally, with the exception of a few isolated places where natural regeneration has been retarded, or rendered impossible, owing to circumstances over which the forester has no control. In such instances, planting is resorted to.

All through the tour, members were much struck by the apparent ease with which those forests are regenerated. In Champenoux, oak, beech, and hornbeam seedlings were seen springing up as evenly and as thickly as if the seed had been artificially distributed. To procure those satisfactory results, however, great care has to be exercised in the management of the crop from its earliest years until the final felling takes place.

Certain conditions in the soil and crop are necessary to bring about successful natural regeneration. In the first place, there must be a certain number of seed-bearing trees. Those selected for seed-production should be tall, straight individuals, with crowns of normal shape and size, and should be left at as regular distances apart as possible. Kinds which bear heavy seeds, such as oak and beech, require to be left thicker on the ground to sow a given area than is necessary for trees with winged

seeds, which are carried by wind to a much greater distance from the parent tree. Again, for the reception of the seed, the surface must be comparatively clean, free from weeds and other soil-covering, and in a loose, friable condition. Unlike the open woods in our own country, where all kinds of weeds get possession of the soil, the woods in France are managed by maintaining a thick crop of trees throughout the entire rotation, so that the shade and leaf-fall combined kill off the surface-growth. This is, in fact, the only natural way by which the surface-soil of woodlands can be kept in proper condition. The covering of the seed by soil has also to be carefully considered. In France, the foresters rely on large quantities of the seed getting into the soil by felling a certain proportion of the crop in the autumn of a seed-year. The dragging and carting of the timber, as well as the treading of men, horses, and oxen, greatly facilitate this process; and, as already indicated, the condition of the surface is generally so loose and friable that even heavy rain helps to bury the seeds.

In Champenoux, the hornbeam reproduces itself more abundantly than either oak or beech. As oak is the tree that is most favoured in this forest, care is taken that the young seedlings are not suppressed or damaged by other kinds. With this end in view, the forest guards go over the crop and make cleanings as often as the oak saplings require to be set free from invasive hornbeam, beech, or sallow.

Thinnings of oak, beech, and hornbeam here become remunerative when the crop is from 25 to 30 years old, and yield, sold standing, about 12s. per imperial acre. Before thinnings become marketable, the poorer peasants are allowed to cut out the small suppressed stems that have been previously marked by the forest guards, and to remove and appropriate them to their own use, in lieu of payment for the work done. When thinnings become marketable, they are sold by auction, and are cut by the purchasers, under the control of the brigadier or head forest guard. After that, the thinnings are generally repeated at intervals of about 10 years, until the time comes when preparatory fellings have to be made, with the view of stimulating seed-production and of preparing the soil for the reception of the seed.

An experimental station for testing the value of exotic trees has also been formed in connection with this forest. It is 15 acres in extent, and lies along the margin of the lake of Brin.

The ground selected is much exposed to frost, so that the test as to hardiness of the various trees should be a fairly severe one. The nineteen kinds now under observation are *Abies grandis*, *A. Nordmanniana*, *Betula lenta*, *Carya porcina*, *Cupressus Lawsoniana*, *C. nootkatensis*, *Fraxinus alba*, *Juglans nigra*, *Larix leptolepis*, *Libocedrus decurrens*, *Liriodendron tulipifera*, *Picea sitchensis*, *Pinus ponderosa*, *Prunus serotina*, *Pseudotsuga Douglasii*, *Quercus palustris*, *Q. rubra*, *Q. tardissima*, and *Thuya gigantea*.

Of these nineteen kinds, it was noticed that *Fraxinus alba*, *Liriodendron tulipifera*, and *Thuya gigantea* were thriving much better than any of the other kinds. The plants, which are from 2 to 3 feet high on the average, have been planted amongst the rough herbage at intervals of about 6 feet.

A visit to the Arboretum at Champenoux was the last item on the programme for the day. It is 25 acres in extent, and is of quite recent origin. The plants are being arranged geographically, and for the time being look rather stiff. As yet no idea can be formed of the kinds likely to prove of most use.

From a note given in the hand-book describing the different forests that were visited, the revenue and expenditure for this forest during the last six years appear to be as under:—

Revenue—

Principal produce, 205,400 cubic feet,	at £3072
Secondary produce, ...	191
Total, . .	£3263

Expenses—

New Works, ...	£178
Works of Maintenance, ...	60
Supervision, ...	128
Total, . .	£366

On the 27th, a visit was paid to the State Forest of Haye.

This forms part of a massive woodland containing about 27,200 acres, which occupies the angle formed by the convergence of the Meurthe and the Moselle, to the west of the town of Nancy. The total area belonging to the State is given as about 16,000 acres.

The forest occupies a plateau, of which the mean altitude is about 1150 feet above sea-level. It rests entirely on the two lower strata of Jurassic rock. The subsoil is formed of limestone, fissured and cut by numerous vertical cracks, and it has a slight admixture of clay in the subsoil, as well as broken limestone and sand. The surface-soil is composed of sand and lime in variable proportions, with oxide of iron; it is shallow and light, and though not always dry, it is liable to become so in dry weather. As a result of this, the Forest of Haye cannot maintain its fertility unless it be constantly covered by a species of dense foliage.

This forest was originally beech, was afterwards transformed into coppice-with-standards, and is now (during the last 42 years) being converted into high forest. The forest is for this purpose divided into eight working-sections, in which the rotation varies as under:—

Under regular Forest Service.	Working sections I., II., V., VI., VII., 144 years.	
	„ „ IV., 120 years.	Attached to the Experimental Station at Nancy.
	„ „ VIII., 150 years.	

There is no difference in the rotation for oak and beech, as they are grown throughout in mixed crops. Hornbeam occupies an important place in the coppices and underwoods. All kinds are naturally reproduced.

Shortly after entering the forest, much interest was taken in an experimental plot between 30 to 40 years of age, which has been set aside for the purpose of ascertaining the best method of thinning.

In the first section, no thinning or attention of any description was given to the trees from the time of reproduction. In the second section, the most promising and valuable trees were cut free from others which interfered with their crowns (*éclaircie par le haut*). In the third section, thinning was simply confined to the removal of suppressed trees (*éclaircie par le bas*). In this last plot, all promising trees of erect habit and vigorous growth were being encouraged by the removal of suppressed and ill-shaped trees interfering with their free development, and by giving to the individual oaks more light and freedom than is

admitted by either of the other systems. After careful examination of the different methods, it was generally thought that the last method was the one which would ultimately give the best results, although the opinion was also expressed that the second method, in which oak is set free from oppressive beech, while suppressed beech are left to cover the ground, is preferable.

As in Champenoux, the oak is here, even in spite of the dry soil, the tree that is most encouraged, because of its much greater value, although beech and hornbeam are undoubtedly better adapted for this class of land, for the maintenance of whose productivity the soil must be kept continually covered by means of a canopy so dense as to exclude the rays of the sun from parching an already rather dry soil.

This was clearly evidenced in another experimental plot which is being operated on farther through the forest, and which the members had the privilege of seeing. This plot is about 60 years of age. In the first section, only a very small percentage of the original crop was removed in the shape of thinnings. In the second, a heavier thinning was made, but so carefully that the overhead canopy was preserved practically intact; while in the third section the oaks were entirely isolated, the whole of the beech and hornbeam having been removed. After experimenting in this manner for a number of years, it was clearly demonstrated that the practical isolation of the trees was the most mischievous method that could have been adopted. The standards became stunted in growth, and their stems were covered with epicormic branches, while the surface of the soil, being exposed to the light, became infested with brambles and other rough herbage, which greatly deteriorated its fertility. In this instance it was clearly proved that the system whereby a gradual thinning takes place, without interfering to any serious extent with the overhead canopy, is by far the most successful. Where the beech is cultivated as a pure crop in this forest, it was a fine sight to see the trees, with their white-grey bark, grow so tall and dense that one could scarcely see through them for a distance of 30 yards. It also demonstrated how easily beech can adapt itself to a thin and dry soil, which for other purposes is practically useless. A good deal of this poor land was seen outside the forest, where corn and other crops were so miserable as to make them scarce worth harvesting.

Many years ago, when agriculture was much more prosperous

than it is now, large areas of very poor land were put under cultivation, with the result that to-day, owing to the low prices obtainable for agricultural produce, much of it has again been allowed to become waste, while a fair proportion of it is being afforested. Where this is being done, Austrian pine is planted on the poorest limestone soil, and in other places beech is sown, the mast in many instances being sown along with a crop of corn. In deeper and slightly more fertile soil, larch and spruce are planted. The plants used for this purpose are generally 2-year seedlings, and they are put at distances of about $3\frac{1}{4}$ feet (1 metre) apart. The cost of planting is given at 80 francs per hectare, or about 25s. 4d. per imperial acre.

The average revenue and expenditure from this forest during the last 10 years are officially given as under:—

Revenue—

Principal produce, 646,360 cubic feet, at	£7302
Secondary produce,	436
Total,	£7738

Expenditure—

Including New Works, Works of Maintenance, and Supervision,	£972

On the 28th, an early start was made by train for the Vosges, Raon l'Etape being reached about 6.30 A.M. After a pleasant drive of an hour and a half through a beautiful and well-wooded district, the forest of Ellieux, at Celles, was reached, the forest guards being also in waiting to conduct the party through the forest. Long before our destination was reached, it was obvious that forestry of a very different kind from that seen in the vicinity of Nancy was to be met with here. For miles around, the steep slopes of the mountains are densely covered with silver fir, while a few patches of Norway spruce, and still fewer of Scots pine, were discernible among the glossy foliage of the silvers.

Before starting to explore the forest, the system upon which this particular block is being worked was explained, and information was given as to the altitude and nature of the soil.

It is situated at an elevation varying from 1300 to 2600 feet above sea-level, and stands on the red sandstone characteristic

of this region, and known as the *grès vosgien*. The soil is consequently extremely porous, and great care has to be exercised in keeping it continually covered with a crop dense enough to exclude the sun's rays from parching it, and making it less fertile.

Here the silver fir is worked with a rotation of 144 years, and regeneration is brought about naturally.

The forest is divided into four periodic blocks of 36 years each, and the fellings are done by volume.

In thinning for regenerating purposes, more care has to be exercised than if the crop were of any other kind. Silver fir being rather tender while very young, the seedlings require a considerable amount of shelter from the parent trees, whose heavy shade they endure well for the first few years.

The plan usually adopted is to make light gradual clearances every three or four years, cutting away the heavier or broad-crowned trees, and gradually exposing the young seedlings to the light.

Wherever regeneration-fellings had taken place, it was interesting to notice how luxuriantly the young seedlings were establishing themselves, and how evenly they were distributed over the open areas.

If one were to criticise the method by which those regeneration-fellings are being made, it would be to advocate the system of felling by area, instead of by volume. Many thousands of over-mature trees were seen standing in this forest, where they are no longer even required for seeding purposes. Obviously, these trees are deteriorating in value, and their ultimate removal will seriously interfere with the younger crop. This fault would be much more easily remedied if the working-plan provided that the final fellings were to be done by area, instead of by volume.

Thinnings are made every 10 years, when suppressed and inferior trees are gradually removed.

Thinning on such high altitudes requires to be very skilfully performed in order to prevent wind-fall. But in spite of all the precautions taken in this respect, the efforts are not always successful, as in this forest alone about 9,000,000 cubic feet of timber have been uprooted by recent gales.

In one section, at present only 60 years old, the trees were found to measure, on the average, 90 feet in height, while the estimated growing-stock per acre is computed at 5000 cubic feet.

In the best of the older parts of this forest, the final yield will not be less than 7000 cubic feet, representing a money value of over £200 per acre.

Numerous saw-mills for the conversion of the produce from this forest were seen along the valleys and the edges of the wood. Owing to the scarcity of water, the motive-power for these mills is limited, for it was seldom that more than one frame-saw was seen at work in any mill. In this particular district the haulage is mostly done by bullocks, and it was remarkable to see the enormous loads with which those animals trudged along.

In the majority of cases, the slopes of the mountains are so steep that neither bullocks nor horses can be got to remove timber with any degree of safety. In such instances other means have to be adopted.

On the steeper ground, down tracks formed for the purpose, the logs are slid by their own weight to the bottom of the slopes; but where the ground is less steep, the logs are taken down on sledges, which are slid over specially constructed roads. These sledge-roads are formed by cutting a suitable track, and placing across it, at intervals of about 2 feet, lengths of saplings which are fixed at the ends by means of pegs driven into the ground.

The sledge, which is made of a light hardwood frame, is guided down this track by a man who places himself in front, with his back to the load, and who, from long experience, can deftly lead it down the desired course.

This kind of work is generally contracted for, so much being allowed for the cubic metre of wood, the price varying according to the distance from which the logs are taken. On inquiry, it was found that woodmen doing this kind of work earn an average wage of from 3s. 6d. to 4s. per day, while the ordinary woodman earns an average wage of 16s. per week. It was interesting to note how few signs of disease or of decay of any kind were to be seen in this vast forest; even the very old trees, which are probably more than 300 years of age, looked the very picture of health.

Lunch having been served in the forest, driving was afterwards resumed through a picturesque and splendidly wooded country until Raon was again reached, where the party took train for Gérardmer, arriving there about 7 P.M.

On Friday the 29th, a start was made to examine the forests round about Gérardmer, and as these are in the immediate vicinity of the town, the outing was accomplished on foot.

The State and Communal forests round this beautiful mountain town extend to over 14,000 acres, about 2300 acres of which belong to the commune or municipality, and these were the first visited. The crop is composed of 58 per cent. of Norway spruce, 40 per cent. of silver fir, and 2 per cent. of beech.

It appears that such forests belonging to communes as can be worked on a regular system are managed directly by the State Forest Department for the benefit of their owners, the principal features of this management being as follows, viz.:—

The laws relating to State forests are applicable to them; they cannot be alienated or cleared without the express sanction of the Government in each case; they cannot be divided among the members of the community; the annual sales of produce are effected by the State forest officers, and the money realised is paid directly by the purchasers into the communal treasury. Before sales take place, the quantity of timber and firewood required by the inhabitants for their own use is made over to them, usually standing in the forest, and the distribution of firewood is made according to the number of heads of families having a real and fixed domicile in the commune. Grazing is regulated by strict laws, and is forbidden altogether in a number of communes.

The State defrays all expenses of management, and is reimbursed by the payment from the communal treasury of a sum equal to 5 per cent. on the sales of the principal produce, including the value of the wood made over to the inhabitants.

The communes pay the guards' salaries, the taxes, and all charges for the maintenance and improvement of the forest.

In managing communal property, the forest officers are bound to act on the principle that they are managing it for the benefit of its owners, who must be consulted through their representatives, the mayor and the municipal council, whenever a new working-plan is made or an old one is revised. The wishes of the commune are then communicated to the Forest Department by the prefect, who alone can act through Government in opposition to the Forest Department.

At Gérardmer, the forests grow on a granite formation, and up to an altitude of 3000 to 4000 feet above sea-level.

The method of management here is practically the same as that seen at Celles, the rotation being 150 years. One-fourth part of the communal block is reserved for amenity and ornament. Though many fine trees were seen here, they did not bulk so largely throughout the area as did those seen on the previous day.

During the winter of 1902, a severe gale uprooted enormous quantities of spruce and silver fir, the damage then done being estimated at £600,000. Following this gale a plague of *Bostrichus typographus* infested the fallen wood, and since then they have seriously attacked the growing trees. Those insects are now causing enormous damage to the growing-stock, and one is surprised that more stringent measures are not being taken to exterminate the pest. This seems a case in which, for the time being, the provisions of the working-plan should be subordinated, and very extensive special falls should be permitted to try and exterminate the insect.

Consequent on the wind-fall, and the killing of the standing trees by the *Bostrichus*, large areas have had to be clear-felled, and natural regeneration cannot there take place. As it is the aim of the management to reduce the percentage of spruce and increase that of silver fir, it is proposed to plant those vacant areas first with a crop of Scots pine, and afterwards to raise a crop of silver fir beneath the shade of the pine; and this seems to be a good plan. In that part of the forest which was visited, and which is now 80 years of age, it was estimated that there was a growing-stock equal to 5000 cubic feet per acre.

The average price of timber in this locality during the last 30 years is given at 4d. per cubic foot, sold standing.

In the State forest, the silver fir forms 50 per cent. of the crop, while spruce and beech are each in the proportion of 25 per cent. It was rather remarkable to notice that in this district the beech grows to a higher altitude than either the silver fir or spruce. In not a few instances beech was seen growing at 3500 feet above sea-level, although, naturally, at this height its growth is slow and the trees are much stunted, and practically useless for commercial purposes.

Two very fine silver fir were seen in this forest. One, the *Beau Sapin*, has a height of 144 feet, and a girth of 140 inches

at 4 feet up; it contains 777 cubic feet of timber, and is valued at £16. The other, the *Géant Sapin*, has a height of 157 feet, and a girth of 173 inches at 4 feet up; it contains 1095 cubic feet of timber, and is valued at £27.

After visiting granite quarries, weaving manufactories, and the summit of the Hohneck, one of the highest points in the Vosges, the first part of the programme was brought to a close.

On Saturday, the 30th July, the party left Gérardmer for Paris, travelling by way of Nancy, which was reached about noon. Here lunch was served, after which farewell greetings were given to several members who were proceeding homewards instead of taking part in the second portion of the Excursion.

The journey from Nancy to Paris was completed about 6 P.M., when members were accommodated in the Hotel Malesherbes, Boulevard Malesherbes, and the Hotel Columbia, Avenue Kléber.

Sunday was quietly spent in visiting the public gardens and boulevards of Paris.

On Monday, 1st August, the programme included the Forêt de Retz (Villers Cotterets), and the saw-mills, etc., in the vicinity of the town.

The first place visited was the Sleeper Works of the North of France Railway. The sleepers are made principally from rough beech and oak, chiefly the former, and are cut into sizes of $8\frac{1}{2}$ feet × 5 × 10 inches. Each sleeper contains about 3 cubic feet, and is valued at 5s. They are all thoroughly creosoted by being put, in lots of 120, into tanks 6 feet 6 inches in diameter and 26 feet in length. The machine for shaping the sleepers to receive the rail-plates, and for boring the holes for the bolts at the same time, was observed with interest. S-shaped clamps, 5 inches long by $\frac{3}{4}$ inch deep, are driven into the ends of the sleepers to prevent splitting, and flat-topped nails, with the year moulded on them, are driven into the sleepers to perpetuate their date. The life of creosoted beech sleepers is here estimated to be 30 years.

At the works of M. Carpentier, which were next inspected, the manufacture of clogs (*galoches*) chiefly occupied the attention of members. These are cut out by vertical spindle machinery, finished by hand, and turned out at the rate of 400,000 pairs per annum. The labour is done by piecework, chiefly by boys, who

earn about 2 francs per day; the wages of the men being about 4 francs. The making of the clogs costs about a 1d., and the wood 2½d., per pair. A brush and sieve factory was afterwards visited. The wood from which these are made is principally beech.

After luncheon, which was served in the Hotel du Dauphin, a visit was paid to the forest which surrounds the town on three sides. It has an area of over 32,000 acres, of which about 28,000 acres are high forest; the remainder is coppice-with-standards, but is also being converted into high forest. The altitude varies from 200 to 800 feet above sea-level. The soil on which the forest grows consists of sandy loam, about 20 inches deep. The forest is managed by subdivision into periodic blocks, with natural regeneration under parent trees (*Shelter-Wood Compartment System*), with a rotation of 150 years. The distribution of trees over the whole forest is—beech, 40 per cent.; hornbeam, 40 per cent.; oak, 15 per cent.; sallow, poplar, chestnut, and elm, 3 per cent.; and conifers, 2 per cent. The aim of the management here, as in other similar forests in France, is to increase the percentage of oak. This is done by leaving as many oak standards as possible in the seeding felling, by keeping the young plants cleared of all the other kinds that would interfere with their free growth, and by planting with strong transplants all unregenerated parts. The oak transplants are generally five years old, and are sometimes planted at the time of the fellings for gradual clearance. About 800 oaks per acre are used, and the cost of plants and planting is £4 per 1000.

Cleanings for relieving the young oak from the more aggressive growth of their neighbours are needed till the wood is 20 to 25 years old, when thinnings are made every ten years to remove all suppressed and badly-shaped trees, except where suppressed beech are left to shade the ground underneath the oaks. Most of the wood from the younger thinnings is made into charcoal.

A preparatory felling is made when the trees are about 110 years old, with the object of preparing the trees for bearing seed, by allowing the crowns to form stronger buds, as well as gradually to accustom the trees to wind-pressure.

When the trees are about 135 years old, a seeding felling is made. Once the regeneration of an area is started, it can generally be accomplished in 12 years. During this time, four gradual clearance fellings take place, the object of which is to

give more light to the young crop, and to bring it gradually into the open.

Thinnings of all kinds are marked by cutting during the month of June, whilst the foliage is on the tree, and felling commences in the following October. The marking of hardwood trees whilst in foliage cannot be too strongly recommended, and should be practised more frequently in this country. It is while the tree is in leaf that one can best judge of its health.

The beech in this forest was, both in height and in density, generally admitted to be the finest seen throughout the whole tour, and was universally admired.

The official account given of the revenue and expenditure of this forest for the year 1900 was as follows:—

Revenue—

Sales of wood, ...	£24,487
Lease of hunting and shooting, . . .	3,103
Sales of grass, ferns, stones, etc., . . .	851
Total,	£28,441

Expenditure—

New roads, repairs to old roads, plantations, cultivation of felling areas for natural regeneration, etc., ...	£4743

It should be noted that the cheap working of these forests is partly due to the fact that thinnings and fellings are invariably executed by the wood merchants, who purchase the timber standing.

The next day, the 2nd of August, was devoted to the Forest of Compiègne, as well as to a few of the more interesting sights in the neighbourhood. On arrival at Compiègne from Paris with the 7.15 A.M. train, members were met by the mayor of the town, who extended to them a hearty welcome.

Before entering the forest, a hurried inspection was made of the fine old palace of Compiègne, with its valuable furnishings and decorations, which was the favourite residence of the two Napoleons. The forest has an area of 36,072 acres, and a mean altitude of over 300 feet. The soil is generally poor, thin, and shallow, and moderate fertility can only be secured by maintaining a dense crop of trees under high forest treatment. Of the

entire area, 1753 acres are given over to ornament and game. It was, up to 1870, for centuries the hunting and shooting ground of the rulers of France. It is much intersected by roads and rides for the convenience of hunting, and some of the rides are used for training race-horses.

The forest is let for shooting in thirty divisions, while over and above this it is let as a whole for hunting, the revenue derived from these sports amounting to £3880 per annum.

The forest is stocked with oak, beech, hornbeam, and other broad-leaved trees, and in a few places there are conifers 30 to 40 years old; only the former were naturally reproduced, the conifers having been planted.

An area of 32,292 acres, divided into 10 working-sections, is managed as high forest, worked with a rotation of 150 years, and giving an annual yield of 46 cubic feet per acre from thinnings, while two sections, comprising 2027 acres, are treated as coppice-with-standards, the rotation of the underwood being 35 years.

It was noticed that a large proportion of this forest contained a pure crop of pedunculate oak about 100 years old. These were all more or less in a sickly and dying condition, owing to the absence of beech and hornbeam as soil-protectors. There is, as a rule, no underwood, and the ground under the oak is covered with a sole of thick, tough grass.

Another cause contributing to the slow growth and unsatisfactory state of the trees is the dryness of the soil, as this species requires much more moisture to grow it to perfection than does the sessile oak.

Some splendid specimens of the latter were seen. The *king of the forest*, said to be the largest oak tree in France, measures 118 feet in height, and girths 17 feet at 4 feet 3 inches up. Its total contents are 1120 cubic feet, and it is valued at £100.

The average gross revenue of the forest during the last 10 years has been £33,480.

The oak and beech forest of Bellême was the one chosen for the last day of the forestry part of the Excursion.

It is on an isolated plateau, 500 to 800 feet above sea-level, with sloping sides, the water-courses from which drain into the river Sarthe, a tributary of the river Loire.

The total area is 6072 acres. Oak forms 50 per cent. of the crop, the sessile species being predominant.

It was in this forest that the finest oak were seen. They are managed on a rotation of 200 years, and being grown mostly on deep, loamy soil, the volume per acre at the final felling is enormous. Members were informed that the best standing crop, about 10 years ago, contained 13,258 cubic feet per acre, and was worth about £600.

It was both interesting and instructive to witness the different stages of growth, from the seedlings recently germinated to the 200-year-old veterans waiting their turn to be felled.

In Bellême, seed-years are more frequent than in most other forests in France. The acorns are generally very abundant, so that 12 years, and sometimes less, suffice to restock a felling area. The beech in this forest is simply kept for soil-protection and for improving the growth of the oak. Here, as elsewhere, it was evident that, in the growing of oak, beech forms a very important factor. No one knows the value of beech better than does the French forester, and no one knows better than he how to take advantage of its various good qualities.

Here, also, the usual precautions are taken to preserve the young oak from aggressive beech and hornbeam.

Thinnings begin after the trees have reached their 25th year, and are repeated every 12 or 13 years, up to 175 years, after which the trees are left untouched until the seeding felling is made.

After dining together in the small village inn at Bellême, the members returned to Paris, which was reached shortly after midnight.

The last two days, Thursday and Friday, 4th and 5th August, members were free to spend as they pleased. The bulk of the time was pleasantly spent in taking part in organised and properly-conducted tours through the principal public buildings and thoroughfares of Paris, while not a few included in their programme a visit to the beautiful town of Versailles. Altogether, the tour was splendidly arranged.

To realise the immensity, the density, and the value of the forests in France, one must actually see them for oneself. Practically everything in connection with the management and general upkeep of the French forests differs from what is practised in our country. One is particularly struck by the expenditure side of the annual balance-sheet. The rate per acre for working and other expenses seems ridiculously low when compared with

what it costs at home; but then the French method of treating forests differs considerably from ours. To begin with, the forests there are practically unfenced, and instead of being grouped about in patches of from 20 to 200 or 300 acres, as in this country, they are distributed in unbroken masses for thousands and tens of thousands of acres. Instead of having to plant the bulk of these forests, they are so rationally and scientifically managed as to enable each tree to reproduce itself. In those few but vast differences an enormous saving in money can be effected when compared with the methods adopted in this country.

Those who took part in this Excursion owe warm gratitude to the French forest officers who conducted the party through the various forests. Ready at all times to explain the minutest details of management, they spared no pains in making the different inspections both interesting and instructive, while their invariable courtesy and kindness to all and sundry will be long and gratefully remembered. Their special thanks are also due to the president, Mr Steuart Fothringham, and to Professor Fisher, for translating the explanations given by the French foresters.

XI. *German Forestry.*[1] By FRASER STORY, Lecturer on Forestry, Edinburgh and East of Scotland College of Agriculture.

In discussing this great subject of German Forestry, it is natural enough to begin by asking ourselves the question: What is German Forestry? Many of those present to-day have been in Germany, and all here have read much of German methods, yet I venture to say that every one would have difficulty in defining exactly what German Forestry is. It has as its general objects the production of timber for profit, the maintenance in the country of a necessary commodity, and the provision of healthful employment for a large section of the people. But in treatment, German Forestry is one thing in Brandenburg, quite another in the Harz or the Riesen Gebirge, and yet different again in the Bavarian Spessart. After all, it is only the application of correct principles of forestry to the forest, and the treatment must necessarily vary with each locality. The Germans are noted for their industry, science, and system. These qualities they have brought to bear in the management of their woods, but further than that, there is nothing particularly or peculiarly "German" about German Forestry.

The German forests extend over 35,000,000 acres—an area greater by 3,000,000 acres than that under Agricultural occupation (crops and grass) in Britain—and as the forests are fairly evenly distributed over the country, one is never far away from large, well-managed woodlands. The kinds of trees met with in different parts vary much more than they do in our country, according to the soil, the local climate, and the altitude. Thus one finds that, over the great sandy plain to the north and north-east of Germany, the Scots pine occupies much the greater part of the area. The hilly and mountainous districts (for example the Harz and Thuringia) are almost wholly given up to spruce and silver fir—these species being able to grow at high elevations, and thriving well in the more abundant rainfall of these regions.

[1] Lecture delivered at the Annual Meeting, 14th February 1904. Those parts of Mr Story's lecture which were explanatory of the views shown upon the screen have been omitted, as the illustrations cannot here be reproduced. Mr Story is now Lecturer on Forestry, University College of North Wales, Bangor.—HON. ED.

Beech, oak, ash, and other broad-leaved trees are found all over the country in parts where there is sufficient fertility for them, but more especially in the west. Larch, on the other hand, is practically confined to the south-east of the Empire and the more alpine parts, where alone it obtains the conditions that suit it, namely, a hot, bright summer, an intensely cold winter, and a rapid change from winter into summer.

The species of trees grown in Germany are, of course, just the same as those which we have most commonly in Britain. Conifers predominate, occupying about 65 per cent. of the forest area. Amongst them our familiar Scots pine or Scots fir takes the first place.

Scots Pine.

This tree is regenerated in three distinct ways. The forest may be clear-felled, and either planted with small plants, or sown in strips by hand; or, instead of clearing the ground, about one-third of the trees may be left to cast seed on the area and produce a natural crop. By the last-mentioned system, the parent trees are removed within about five years after seedlings begin to appear. Such regeneration is an economy to a certain extent, but the young crop is decidedly irregular, and the practice, though once common, is now rarely adopted.

When seed is sown by hand, furrows are made with the forest plough. On the prepared ground, seed to the quantity of about four pounds per acre is sown, and lightly raked into the soil. The furrows are made about $3\frac{1}{2}$ feet apart, and each is fully 1 foot broad.

Owing to the cheapness and speed of the method, sowing is very often resorted to on medium-quality soil in level country, but both the seed and the tiny plants coming from the seed are exposed to many dangers. So it has come about that planting is more commonly adopted. In North Germany quite small seedlings are preferred to transplants. They are generally planted by means of a special spade or "piercer," which enables the roots to go straight down into the soil, so that the young trees, not having their roots contracted or bent to one side, develop naturally and resist drought. The young woods are not thinned till they are fully twenty years old. As a great many trees occupy the ground—a much greater number than can possibly exist—a struggle takes place in which only the more robust succeed. During the struggle, the light is confined to the

tops of the trees, but the leaves there assimilate enough food to keep the trees growing on in height. Lower branches, however, are bereft of light, and gradually wilt, die, and drop off, leaving the young stems free from knots. All the parts—leaves, twigs, etc.—which fall from the trees add organic matter to the soil. Moreover, in the shade of the close cover this litter turns into the best vegetable mould or humus.

With only very light thinnings every few years, the pines may grow to maturity quite unmixed with any other species. On the other hand, a fairly severe thinning may be made about the middle of the rotation period, when beech, silver fir, spruce, or other shade-bearer is introduced for the better protection of the soil. Beech very often finds its way in by natural means, through the conveyance of seed by birds. Beech is the best tree for this purpose, as its leaves, which are chemically rich and very abundant, shelter and enrich the soil. One of the woods near Eberswalde shows this system well. The Scots pine which formed the original crop are now 110 years old; beech occurs below and between the pine, but they are much younger, being only 50 years old. This shows that the pine were 60 years of age when they were underplanted with beech. The intention is to allow the wood to stand for 30 years longer, when a clear-felling will be made, and the ground restocked.

The Weymouth pine (*Pinus Strobus*) is receiving more attention now in Germany, because it grows rapidly, especially where peat is present in the soil. The timber is, of course, the same as the "yellow" pine timber so largely imported from America, and the Germans have realised that, as the American supply is rapidly becoming exhausted, they had better produce it themselves. The Weymouth pine is able to bear more shade than the Scots pine, and this allows of a larger crop being obtained, because the individual trees stand more closely together to an advanced age. In the Spessart, I saw one of the few ripe woods of Weymouth pine in Germany. The plantation was 95 years of age, and spruce occurred along with the pine. It was a remarkably fine wood, with the trees tall, clean, and cylindrical, and the timber of close, even texture.

The Oak.

The Germans grow their oak woods much more densely than we do; and here I would point out a change which has quite

recently taken place in the theory and practice of thinning. Until now it has been taught in this country, and in Germany by scientific foresters, that the proper way to thin a young wood is to remove the trees that have been overcome or suppressed in the struggle for existence. This means a removal merely of those trees which Nature has herself rejected, but there is no guidance of the growth of the remainder, and badly formed trees may in this way develop at the expense of good stems, simply because they are of larger size. Now it is realised that it is the upper, dominant class that threatens to be most harmful to the timber-grower. Strong, overspreading individuals, aggressive trees which broaden out their crowns to the detriment of surrounding stems—these are the most dangerous to the well-being of the forest as a whole.

By both the newer and the older systems of scientific thinning, the best trees are saved. The difference consists in this, that whereas formerly no large stem was removed unless it was markedly ill-shaped, now much greater freedom is taken with this class of tree, and the over-prominent are ejected in order to benefit the majority. In the words of a Continental authority, the aim ought to be to produce the "greatest number of healthy stems, straight and free from side branches."[1] To obtain such a result, one must purge young woods of the over-dominant members, but retain as many as possible of the other stems, *including the suppressed*, as long as they are not unhealthy. I lay emphasis upon this, because it is really the most important feature in modern German forestry.

While younger woods of oak should be "crowded" to make height and straightness of bole, one cannot maintain them in this condition, because by a natural process they tend to "open out" and become thin.

It is at this stage that German foresters underplant woods of pure oak—generally with beech, occasionally with silver fir. In this case the effect of the beech is not only to increase the productivity of the soil, but also to prevent the formation of side-shoots on the oaks. In the Spessart there are magnificent oak forests of great age, which have been several times underplanted with beech. In that district the particular oak met with is *Quercus sessiliflora*, which suits lighter soil and drier situations better than *Quercus pedunculata*.

[1] That is, the largest quantity of valuable timber per acre.—Hon. Ed.

Beech Woods.

On the Continent beech woods are nearly always reproduced by means of mast shed by trees left standing on the ground. The beech is specially suitable for this treatment, because the seedlings and young plants, being very sensitive to injury from frost, are sheltered by the parent trees. The last mentioned are gradually felled as the young crop requires more and more light for its normal development, until at about the tenth year from the springing up of the seedlings, the last of the old trees are removed.

Very dense crops result from the natural sowing, yet no effort is made to thin them until about the thirtieth year. Even at 80 years of age the trees stand very closely together, with tall, straight shafts. After this age is reached, heavier thinnings take place to bring about the production of seed, and to prepare the ground for its reception.

Groups of Various Species.

Blanks in older woods are frequently made the centres of regeneration by planting them with a variety of species. Very often so-called exotics are given a start in this way, and for some years they benefit by the shelter afforded by the old wood. Amongst the commonest of these non-indigenous trees are Japanese larch, Douglas fir, red oak, white American ash, Banks' pine, and several species of silver fir.

Many of these, and others which I have not mentioned, are growing well upon suitable sites, and will no doubt produce excellent timber in the course of time. Professor Schwappach, who, as you know, has made special investigation into this matter, is most hopeful of the growth of several north-west American species. The Douglas fir is exceeding even the fondest expectations, and not a few of the *Cupressus* and *Thuya* genera (coming both from the east and from the west) are proving hardy and growing rapidly; *Pinus Banksiana* fulfils a useful purpose upon the poorest, driest sand, while the white American ash flourishes even where there is stagnant water.

In some cases the Japanese larch has grown 34 feet in 11 years, but it needs a somewhat sheltered position and better soil than the European species. Nor is it entirely free from attack by "larch disease," for I found the Japanese species with unmistakable "blisters" in Chorin forest district.

Silver Fir and Spruce.

The feature of the silver fir, as grown in Germany, is the great quantity of timber which is produced per acre. In this respect the spruce comes not far behind. The two trees associate very well in even-aged mixture. Their rate of height-growth is fairly similar; they suit the same localities, and the presence of the deep-rooting silver fir in a spruce forest makes the whole more storm-firm.

Natural regeneration, under sheltering and seed-producing trees, has the same advantages in the case of silver fir that it has with beech. Spruce, on the other hand, is much less sensitive to frost, and is usually planted—transplants of four years old being generally placed about $3\frac{1}{2}$ feet apart.

Both spruce and silver fir when grown in open woods in Germany are as poor and useless as anything we have in Britain, but when raised in close forest these trees yield highly remunerative crops.

One forest district (that of Ullersdorf in the Riesen Gebirge), where I stayed for some time, produces a sustained net annual income of £11,200 from 8000 acres. This is equivalent to 28s. per acre of annual profit, yet all the land is hilly, and much of it ranges between 2000 and 3000 feet above sea-level. The predominating tree of that district is spruce; silver fir and Scots pine also occur, but larch and hardwoods are absent.

The beauty, too, of this and other forest regions in Germany, is something to reckon with. It seems to me to be infinitely finer than our bare hills and meagre woodlands at home. Our naked prominences may have a rugged boldness about them, but they have not the richness nor the grandeur of forest-clad hills.

Conditions in which the Forests grow.

There are some who would attribute the success of German forestry to favourable conditions of soil and climate. Those who would do so are grievously mistaken. The soil is remarkable for its poverty, and is, in fact, unfit for any purpose other than timber-growing. The climate is characterised by severe cold in winter and extreme heat in summer—often with prolonged periods of drought. The German spring is no less treacherous than ours, and the middle of May is regarded with dread by all the forest officers. German forests have to endure

windstorm and snowstorm—the latter to an extent never experienced here. Forest fires occur in spite of careful precautionary measures. Insect and fungous pests are greater than we can well imagine. Attacks of *Bostrichus typographus* beetles, *Liparis monacha* and *Fidonia piniaria* caterpillars, and cockchafer grubs, have ruined hundreds of square miles of forest, and yet these insects are practically unknown in Scotland. Of fungi, *Trametes pini*, *Trametes radiciperda*, *Peridermium pini*, and *Agaricus melleus* are a constant source of danger.

We, in this country, have our difficulties, but the Germans, I assure you, also have theirs. Indeed, the natural advantages lie with us rather than with them. Germany's forests are better than ours, not because Nature has been unusually kind, but because German foresters have devoted their best thought, skill, scientific knowledge, and industry to their task. If we select our trees as skilfully, plant them as carefully, and thin them as cautiously as do the Germans, our forest produce will be quite as good as theirs.

The Chairman:—I am sure you will all agree with me that we should give a very hearty vote of thanks to Mr Story for his excellent lecture, for showing us those excellent photographs which were taken by himself and a friend, and for the instruction he has given us. It is certainly most instructive to see, by means of such photographs, how they do these things in Germany.

Discussion having been invited by the Chairman, Mr Cadell, Grange, said:—I am sure we have all been very much struck with the regularity and method practised in Germany in the growing of wood. Trees are allowed to grow until they are say a hundred years of age, they are then cut down in a methodical way, and the fellings replaced by young crops. But I should like to know whether it really pays to grow wood on the scale on which it is done in Germany. I have seen it stated that a great deal of the wood produced in Germany was grown simply on account of the mines, and officials of all grades, and that it was the mines that kept the whole thing going. I should also like to ask Mr Story's opinion about the Japanese larch, and whether it is going to be a good forest tree or not. Of course Germany may be better fitted for growing wood than this country, for though it has a very cold winter it has a very hot summer, which ripens the wood. I think the

large number of insects which infest the German and continental forests generally is due to the fact that they shoot down all the small birds which feed on insects. I noticed recently in Switzerland, for example, that not even a single sparrow could be seen.

Mr Elwes, Colesborne:—I have listened to Mr Story's lecture with much interest, and I do not think I have ever seen so good forest photographs as he has shown us to-day. I want, however, to warn some of our younger members, who in the last few years have been hearing a great deal about German forestry, of the great difference which exists between the conditions that prevail in Germany and those prevailing in England. I do not want to throw stones at German forestry, but I will say this, that after twenty years' experience in travelling about, and in hunting and shooting in different parts of the country, I have never seen one purely German operation that I have been able to put into practice to make forestry more profitable in England. One thing we have learned from the Germans, and that is the great advantage of mixing beech with other trees. That is a great point we have learned from the Germans. Then with regard to soil and climate: it is said that the soil of Germany is poorer than that of England. That may be so in many parts of the country, but it must be remembered that they have hot summers. Everybody is out of doors, sitting taking their food and enjoying themselves, by the middle of May, but that is not a state of things which prevails in this country. There is no doubt that the climatic conditions are very much worse for growing timber in this country than they are in Germany.[1] Another point to be kept in view is the object for which so many trees are grown in Germany. All over Germany there is no coal. Wood is the fuel. They do not want to grow great trees for fuel, but nice straight spruce-poles, which, so far as I can see, are absolutely unattainable in the much drier soil and climate of the greater part of England.[1] However you plant them, I do not think you will make them grow as clean and straight as they do in Germany. I know of many instances where the trees have been planted and left to grow as they do in Germany, but all the same you have not got the clean straight poles of the German forests. The German landlords also have a great advantage over those of England and Scotland in growing timber trees, inasmuch as the country is not swamped with foreign timber.

[1] These assertions regarding climate seem erroneous.—Hon. Ed.

They have practically a monopoly of supply, and except at the seaports and large towns, where there is a considerable import in building timber, they have certain fixed prices upon which they can count for years beforehand; and the Government takes good care that that monopoly is not taken away. These are some of the advantages that the Germans have in growing timber, and that we have not. I am not throwing cold water on what Mr Story has told us, or in the least degree decrying or detracting from the interest of the lecture. But we have got to look at the question from both sides, and not take our ideas merely from the show-places of Germany. It does not do to think of the trees of Scotland from what we see at Murthly and Dunkeld; and I have seen hundreds of places in Germany where the forests were as bad as they are in Scotland. Let us in our own districts, according to soil and situation, consider what is best for them. If we apply German methods indiscriminately we may land our successors in a state of things which they will not bless us for. This is a subject that cannot be discussed thoroughly on such an occasion as this. My own impression is that there is more to be learned by Scottish and English foresters in France and in Denmark than there is in Germany. I think Denmark is where foresters from this country should go, because conditions there are more like those here.

Mr A. T. Gillanders:—No better educational lecture could, I think, have been brought before us than that to which we have listened from Mr Story. At the same time, I agree with the sentiment which has been expressed, that we must take German principles up to a certain point and no further. We ought to be careful not to become too "German." There are many points to be learned from German forestry, but we must be careful not to become more "German" than the Germans. Two of the errors in this country are that we plant too thinly, and we thin too early. We do not recognise either, as the Germans have recognised, that there is a great advantage to be gained in the pole-stage; and the non-recognition of the proper principles of mixture is another serious defect in British forestry. There is also to be considered the great question that always crops up before us, that we cannot carry out the sylvicultural principles of the Continent with efficiency and at the same time maintain our woods as game preserves. But I do think that if wood was grown here on a rotation of say 100 years, there would be no better game covers

than the young woods after 25 years. There is no necessity to thin these woods over much for game covers, and though they might give the beaters a little more trouble, that would not matter much. In that way we would grow the trees for timber, and have the woods as game covers as well. One point I should like to make, and that is, that a thing might be right in Germany which might not be so in this country. For example, I do not think it would be a sound principle in this country to go too far with the underplanting of Scots pine with beech. There would be difficulties connected with the thinning of it; it would be very expensive; and in the end I do not think we would get more for it per acre than we do at present.

Mr James M'Donald mentioned that in connection with a contract which his firm had with the telegraph department to supply oak, that department would not take Scots-grown oak. Had it been grown in the German way, it would doubtless have been accepted.

Mr Davidson, Secretary of the English Arboricultural Society, emphasised the necessity of getting the Government Departments interested in planting on estates which were under their own care. There was far too little wood on the Government properties.

Mr Richardson:—I should like to ask Mr Story if he has noticed much disease in *Pinus Strobus* in Germany. Mr Story mentioned a mature crop of *Pinus Strobus* at 95 years of age, but *Pinus Strobus* could not be of great size at that age. One of the essentials of that pine is the production of boards of large size, otherwise it would be of comparatively little use.[1] Yellow pine at 95 years of age cannot be much better as regards size than the timber we get from the Baltic ports. Is it a practice to fell this pine at 95 years of age in Germany? I do not think that *Pinus Strobus* is adapted for growing for timber in this country, or will ever be a success in Britain. It is now a long time since it was introduced, and it has made very little progress, and a great many of the trees are infested with *Peridermium*. As to Japanese larch, Mr Story said it was adapting itself to German conditions. It is rather a revelation to me to find it is growing so well in Germany, because Japan has a climate more like our own, and one is surprised to see a Japanese tree taking well to a climate like that of Germany.

[1] It is used for match-making; see remarks on page 172.—Hon. Ed.

As to the question of thinning, Mr Story mentioned that in Germany, instead of taking out the smaller trees, they were now taking out the stronger ones, those which overtopped the others; but I suppose that would only be done where the trees overtopping the others were very small in number, proportionately. Thus, say, if one-half of the trees overtopped the other half, I do not suppose it would be the smaller ones that would be retained. I presume it would only be when the tall trees were a small percentage of the whole that they would be removed in thinning? (Mr Story: Yes, that is so.) Of course, we know that in Germany oak and beech are grown cleaner than they are here, but for certain purposes German-grown beech would not be of much use in this country. In fact, a brush-manufacturer in Edinburgh told me recently that the beech grown in Buckinghamshire, which is grown very much on the German plan, would not be at all suitable for his purposes. Beech-wood for certain requirements must be from trees grown openly. For instance, for tool-makers, for making planes and so forth, beech as grown in Germany would be of little use. Of course the great bulk of the beech there is used as fuel, and for charcoal-making, and in that case density in the wood is not of quite so much importance.

Mr Story in reply said:—I shall not detain you many minutes at so late an hour. I thank you very much for the manner in which you have received my remarks, and for the kindly references you have made to the slides. The first speaker asked about the returns from some of the woods in the Harz. If I remember rightly, Dr Somerville, in a short account he gave of the Harz, put the return of all the woods there at 14s. per acre per annum. Some of it was less and some more, but if that is right, it is surely a good return from such poor land. Reference was also made to the officials and the increased expenditure they involved on the management; but with increase in the cost of management, the value of the woods has also increased, and to an extent which is great in proportion to the outlay. Then as to the destruction of birds, I was not very much struck with that. On the contrary, the small birds are in some places largely protected, and boxes are hung up on the trees for starlings to nest in. As to the Japanese larch, nothing can be definitely said of it as yet. They are only young trees at the best. The species was introduced, I think, at the end of Bismarck's time,

and it is still only in the experimental stage. The woods of it are only sixteen or seventeen years old.[1] Mr Elwes spoke of following German methods, and sounded a warning note about that. It must not be supposed that all I have said of German forestry could be applied to this country. Not by a long way. But I would not wish the members to think that the views which I have just exhibited are merely of show-places, or anything of that kind. They are typical of most of the woods one sees. In fact, it was not possible to photograph many of the best woods. Photography in the forest is always conducted with difficulty, and the pictures do the forests only bare justice. Mr Richardson asked about *Pinus Strobus*. Well, I cannot say exactly what the timber was used for from the wood which was cut at 95 years. The timber is considered better than spruce, and not so good as that of Scots pine. Most of the *Pinus Strobus* woods are young. They undoubtedly suffer from the pest *Peridermium Strobi* in many parts of Germany. I agree with what Mr Gillanders has said about the underplanting of Scots pine. Underplanting is not quite so necessary in our moist climate—especially with Scots pine, which makes such modest demands upon fertility. It is a different matter with the oak. Underplanting of Scots pine would be apt to lead us into a longer rotation than is generally advisable.

What I would say in conclusion is that the instruction we get from the German woods is not so much direct as it is suggestive. The treatment and so forth of German woods suggest very much to us, but German management is not in all cases suitable for imitation exactly.

The proceedings, which had lasted about three hours, then terminated.

[1] Notwithstanding its quicker growth at first, and its apparent hardiness (as yet) against the attacks of the canker-fungus, the Japanese larch is not at all likely to become so important a tree in Britain as the European larch. Prof. H. Mayr (Munich), who did much for its introduction, says of it (*Allgemeine Forst- und Jagd-Zeitung*, Supplement, 1904, p. 4):—"I have never recommended the cultivation of the Japanese larch. I said its climatic home was where that of the European larch originally lay, viz., in the region of the spruce; and I therefore concluded that it could be grown throughout the whole of Germany, with the advantages and disadvantages pertaining to the European species. I never said it could not be grown, but that it would probably be found not to be worth growing."

XII. *Notes on a Visit to some Bavarian and Saxon Forests with Dr Schlich and the Coopers Hill Students*, 1904. By JOHN J. R. MEIKLEJOHN, Novar, Evanton, Ross-shire.

I sailed from Leith on the 11th of June, reached Rotterdam on the 13th, and went on the same day to Aschaffenburg, where Dr Schlich and the other members of the party arrived next day.

On the following day, Wednesday the 15th, Dr Schlich took us over the Forestry School and Museum at Aschaffenburg, which were very interesting. We saw a great many specimens of forest produce in the Museum, and a large variety of birds and beasts of prey which are to be found in the Bavarian forests. After one of the professors had shown us over the School, we drove to Hösbach, and visited a large saw-mill on the outskirts of the forest. Here the heavy oak logs are handled almost entirely by machinery. There is a tramway laid from the wood-yard into the saw-mill, whereby the logs are run in on a trolley, from which they are transferred to a movable platform, where they are operated upon by a horizontal saw, and sliced up into boards. As each board is sawn, it is shod on the ends with a piece of beech to prevent its splitting, and then relaid on the trolley, small rinds being placed between the boards; and as each tree is finished, it is hauled out and laid in the yard in its sawn condition, care being taken to keep every tree quite separate. The saws are driven by steam power, and such were the only kind seen by us in operation throughout our journey in Bavaria.

From these mills we drove to Waldaschaff, where we were met by the Forstmeister, and were shown a forest of beech, oak, and conifers. We then went on to Rothenbuch and Lichtenau, travelling through beautiful forest land at a high elevation all the way. In our drive we passed through large peasant townships on the borders and throughout the forest. The methods of agriculture are very primitive. The carts, waggons, and implements are all home-made, and are drawn by cows or oxen. The crops indicated that the land in cultivation was poor and exhausted, and it seems to be valued at about 10s. per Imperial acre. There were, however, large tracts of grass land in the vicinity of these townships, which are rented by the

Government to the peasants, for 20s. to 25s. per acre. These lands are all irrigated by the streams passing through them, and three fine crops of hay are usually secured. The peasants were busy cutting and harvesting their hay crop as we passed, and in most of the places it was excellent. Individual effort was clearly to be traced here, as in other parts, showing that those who were industrious reaped a much heavier crop than those who were inattentive to the irrigation. I may add that the same remark applies to the cultivated lands, although generally, as I have stated, they are very poor,—so poor, in many instances, that the scare-crows were not hidden by the crop, which was in ear.

The Spessart is a block of forest consisting of 112,000 acres in the Kingdom of Bavaria, formed by a bend in the river Main, 1100 to 2000 feet above sea-level. The rock and soil are of Old Red Sandstone, and of the driest kind. The soil is a loam or sandy loam, and its depth depends upon whether the underlying rock is hard or soft. The trees in the forest are beech, oak, spruce, Scots pine, Douglas fir, Weymouth pine, birch, and aspen. Formerly it was all of beech, conifers being introduced recently to make up blanks occasioned by the rights of the peasantry, which are exercised chiefly along the edge of the forest. These peasant rights are very complicated, and vary greatly in different localities. On the whole, however, they are—(*a*) The peasants get all dry wood standing or fallen of 4 inches diameter, measured 12 feet from the ground, and they have the right to enter the forest every Tuesday and Friday, except in the months of May, June, and July. (*b*) They get faggot-wood 2 inches diameter in the middle, including the produce of regular cutting; and in the exercise of thinning, all of this size must be left on the ground for them. (*c*) They get mast for their pigs, and are allowed to put them into the wood from 29th September to 2nd February. All woods under regeneration are closed, however, and the simplest means are sufficient to close them. It is done by knotting a small bunch of straw to the branch of a tree in the district to be closed, and this is more effectual amongst these law-abiding people than a deer-fence of barbed wire would be in Scotland. (*d*) They have the right of grazing, but they do not exercise it except for geese and swine. (*e*) The peasants are also entitled to take litter from the woods, but this right is regulated, and the woods are not open to them until the regeneration process is completed, and

then only by rotation. Thus every wood is open once every 8 or 12 years, but for 10 years before regeneration the right remains in abeyance. (*f*) They are entitled to "wind-falls"—that is, in every circle of 50 yards of wind-blown trees, the people get 30 cubic feet of wood.

From the above concessions to the peasants, any thinnings that are made in the wood of the sizes specified must remain on the ground for them to lift at their convenience. Several saw-mills are situated at regular intervals round the forest, and the fellings are made with a view of keeping these regularly employed, so that the labourers may rely upon the industry year in, year out. The aim of the management is to provide a sustained yield of oak of considerable size. Hence the rotation is fixed for the oak at 300 years, beech at 120 years, and Scots pine at 72 to 120 years. The rotations are all (as nearly as possible) multiples of 24 years. The oak woods are of four classes—(1) 400 years old, partly found in a few old woods, but mostly scattered over the beech forests; (2) 260 years; (3) 80 to 110 years; and (4) considerable areas ranging in age from 1 to 60 years. The formation of the oak woods was due to special circumstances occurring in their early history. At one time the oak occupied the larger part of the forest, but the great demand for firewood, before coal was discovered, was the cause of large areas of beech being sown. As the oaks grew fewer in number, the Bavarian Government began to consider how to economise the supply of oak, and decided only to cut as many annually as would keep the saw-mills already referred to going, until the young oaks were ready. The old oaks are all counted, and only a certain number of them may be cut, even though they are decaying. Saw-mills are now importing a large quantity of Silvonian oak, which is rougher than the native, although perhaps stronger.

Next day we returned to Rothenbuch, and visited the district of Weisserstein. A portion of this wood was sown in 1794-95, and grew slowly. At 40 years of age the wood looked unthrifty, the soil was covered with bilberries, and the oaks were falling off. In 1846 the wood was thinned, and sown and underplanted with beech, and in 1861 the bilberries had disappeared and the oak was thriving. At the age of 66 years there stood on the ground 500 oaks to the English acre, the mean height of which was 60 feet, and the cubic contents about 2800 cubic feet per

acre. In 1893, when Dr Schlich visited the place, half of the oak was cut out, and the mean height of the remainder was 83 feet, while the wood on the ground was 4980 cubic feet per acre, worth (at 10d. per cubic foot) £207. In the way of oak thinnings, 2940 cubic feet per acre had been sold, and had realised £65 per acre. At the time we visited it, the average production of the forest per acre was 77 cubic feet, or, in money, 48s. per acre per annum. This was an interesting example of the necessity of improving the condition of the soil, and the method employed had the desired effect of stimulating the crop of oak to fresh growth.

The districts of Zuber and Denkstein, lying the one above the road and the other below, consist in all of 112 acres. The oak is 380 years old, and stands 11 trees to the acre. The beech is 200 years old, and with an average height of 130 feet. These woods were measured in 1888, when the yield of the oak was found to be 3508 cubic feet, valued at £330 per acre, while the beech was estimated at 4312 cubic feet, worth £72 per acre.

On the 17th we visited the district of Heisterbestände, which has been a Game Park since 1300. About 1640, during the Thirty Years' War, Tilly's army camped on the ground; and at the time they removed from the forest, a heavy seed year created an area of 1500 acres of oak in one lot. The ground had been trampled and all vegetation destroyed by the army, and the only thing left behind them was a sufficient number of oak trees to seed these 1500 acres. Beech only made its appearance about 100 years ago, and the want of the beech in the early stages of its growth accounts for the oak being shorter in this forest than in some others. Oaks of 100 years old, with beech under them all the time, have reached as great a height in these 100 years as the others have done since they were sown. Dr Schlich measured these trees in 1903, and found 96 trees to the acre, with a mean height of 93 feet, and an average diameter of 19 inches, and containing 9540 cubic feet per acre, worth (at 1s. per cubic foot) £477. The total value of the oak on these 1500 acres is estimated at £715,500.

The districts of Wolfskant, Eichhain, and Rohrbrunn were visited the same day. The greater part of Wolfskant has been regenerated from beech. After a general cutting has been made, the best spots for oak are selected, and 16 acres have so been dealt

with. The yield of the beech in that portion was 3724 cubic feet to the acre, while there were 11,172 cubic feet per acre before the fall. Blanks where the trees are standing will be filled with spruce. The locality is too moist for larch, and its price in the district is not much better than that of spruce. The preparing of the land and sowing it with oak costs 57s. per acre, owing to the thick covering of young beech which has to be removed. The sowing is done on the so-called "Ladder System," in rows from 8 to 10 inches apart, and about 2 feet between the lines. It requires 7 cwts. of seed to sow an acre broadcast, whereas $3\frac{1}{2}$ cwts. are sufficient for the "ladder system."

The oak in the forest of Eichhain is 103 years of age, and the beech grew up along with it. The system of management was to cut the tops off the beech, but that was not sufficient, and most of the beech had to be removed. Before that was done, however, they had left enough seed to cover the ground with young beech. We saw 10 acres enclosed in the forest, half of which were artificially sown, and the other half naturally regenerated. Twelve cwts. of seed were sown, at a cost of 32s. 8d. per acre. The ground is prepared for the acorns by hoeing, which costs some 9s. per acre.

In the Rohrbrunn forest there are from 100,000 to 200,000 trees, of which 800 are annually felled. The system of management is to raise large oak of fine shape with the assistance of beech. The latter outgrow the oak, and must be restricted by top-pruning once or twice, though even that is hardly sufficient. Hence the system of growing the oak in groups of a quarter of an acre in a matrix of beech. That area has, however, been found insufficient, and gradually the groups have been made larger, until now they are $2\frac{1}{2}$ acres, and even as large as 10 acres in extent. The way of establishing these groups is that, when acorns are available, the areas most suitable for oak—slopes with a southern or south-eastern aspect—undergo a seed-felling, only a screen of beech being left. All young growth of beech is carefully removed by uprooting. Then the oak is introduced by sowing acorns—sometimes by dibbling, sometimes by sowing either in lines or on the "ladder system." Large quantities of seed are used, occasionally as much as 7 cwts. per acre. Only acorns of the sessile oak are sown, and the sowing is done in autumn. At the same time, some are also sown in nurseries to provide one or two-year-old seedlings to make up blanks later on. When

the seedlings are established, the screen of beech is removed gradually within from 6 to 10 years. Meantime the surrounding beech is kept dense enough to retard regeneration. When the oak are established, the beech are taken in hand and regenerated, and this part of the regeneration is made up with silver fir, larch, and Scots pine, to increase the crop. Soon after the establishment of the groups of oak, young beech appear naturally; and these are welcome, so long as they do not interfere with the oak. When they do, they are cut back. If they do not appear naturally, they are introduced later, either by sowing or planting, but they must be kept below the oak during the subsequent operations of tending. Partial clearances, preparatory to regeneration, are begun at about 60 years of age, and consist in removing aggressive beech and defective oak, thus insuring more crown-space for the good oak. If the beech obscure the light unduly, the oak are gradually assisted.

On the 18th of June we visited Lohrerstrasse. The cultural measures adopted in this wood were to remove 58 per cent. of the old timber; and in the autumn of 1903, there being a heavy crop of acorns, suitable preparations were made for their reception by tracing small furrows through the wood. All available labour was concentrated on the gathering of acorns, 3s. per cwt. being paid for them at the inn, and 65 tons of acorns costing £195. As many as were required were retained, and the balance sold to seed merchants. Towards the end of September, Zeag and Hökweg districts were dealt with. These two compartments have a south-eastern aspect, and had a fair stock of 160-year-old oak and 140-year-old beech. The soil was well suited for the experiment, by having plenty of *humus*. The furrows were 3 feet apart, and the roots of the old trees were not severed, but passed over. The beech seedlings in the furrows were removed; those in the strips were preserved to protect the soil, and they were to be cut back if they should afterwards prove hurtful. On the 26th of October the furrows were filled in, by replacing two thirds of the earth, and scraping in the acorns on the surface. The cost of the whole operation was 18s. per acre.

Other oak sowings were made in Buchhoh on the "ladder system," and the turf was placed in the intervening spaces, thus reducing the growth of grass for the first year. The whole of the work was completed, and the cutting of the old timber commenced,

by the 4th of November 1903. The latter was sold on the 29th of January 1904, and by the 10th of May the areas were cleared of timber, and the oak plants had begun to appear.

On the 20th we went from Lichtenau to Lohr, and thence to Bamberg, a manufacturing town of about 30,000 inhabitants. We spent the night at Bamberg, and on the following day visited the Forest of Hauptsmohr. The soil in this forest is alluvial sand in the upper portions, and almost pure sand in the lower. A number of the trees have been exported to England. The forest is 5 miles long from north to south, and is situated partly on elevated ground, 7703 acres in extent. The western and southern portions are level, and consist of sand. In the east it rises to from 830 to 1100 feet. On the south and west the soil is poor, and reduced in quality owing to the removal of litter. Scots pine covers by far the greater part of the forest. Scots pine, beech, and larch are the principal trees, while subordinate to them are oak, Weymouth pine, silver fir, and aspen. Scots pine and spruce are good in the eastern parts, but poor in the west. Larch thrives well, and some fine specimens are to be seen, propagated by sowing. Beech is only dominant in a few places. The object of management is to grow Scots pine chiefly, mixed in some places with beech and larch, and worked with the rotation of 120 years. Regeneration is by sowing in strips from east to west, and the falls are always made against the prevailing wind, from N.E. to S.W., while the strips cleared are not to be broader than the height of the trees. The trees are clear-felled, and the soil is prepared by raking and hoeing, according to its nature. Sowing is done immediately thereafter. If felling takes place in winter, the seeds are sown in spring. The sowing is with two-thirds Scots pine and one-third spruce, and two to three years afterwards blanks are planted. Where larch will grow, it is sown at the rate of 1 to 2 pounds per acre, Scots pine at 10 to 12 pounds per acre. The latter is planted, when one year old, at the rate of 12,000 to the acre; but on heavier soil ball-plants are put in, at the rate of 4000 to the acre.

On our visit we noticed that a good deal of harm had been done by the pine-spinner (*Gastropacha pini*). It frequently destroys the plants altogether if it attacks them two years in succession; but it can be exterminated by the trees being sprayed in July or August, at a cost of 8s. per acre.

Severance-cuts are not made later than at 40 to 50 years.

For new cultivation, Scots pine should not be left singly, but in groups.

Our next stage was Lärchenbaum, a group of Scots pine and larch, standing about 7500 cubic feet to the acre. We saw one larch 135 feet high, containing 146 cubic feet of timber. Twenty-four per cent. of the trees were over 90 years of age; 23 per cent. 60 to 90; 30 per cent. 30 to 60; and 23 per cent. under 30 years. The final yield is about 387,000 cubic feet, and the forest contains 8780 acres. The soil is very much poorer than in the Spessart, and the rearing of these beautiful clean-grown trees on such poor sandy soil as we saw here, was a remarkable achievement. No doubt it is largely accounted for by the forcing climate and the abundance of moisture in the subsoil.

On the 22nd we travelled to Schwarzenberg. During the last part of the journey, the railway skirted the sides of a small stream such as we often see in the Highlands of Scotland, and at short intervals along this there were small manufacturing centres, mostly engaged in making pulp of wood from the surrounding forests. The water-power was used to a much greater extent than in this country.

On the 23rd of June we visited the Antonsthaler forest (Saxony), which stands in the 51st degree of latitude, at an elevation of from 1500 to 2700 feet above sea-level. The forest is used for the production of spruce, and extends to 4000 acres. It is very liable to damage by storms, and the cuttings are made to prevent this as much as possible. A revision of the working-plan is made every ten years, to determine the yield, and to decide in which compartments the falls of timber shall take place. In the natural course, about 50 acres are annually cut, and the fellings are arranged so that the total fall does not exceed 500 acres every ten years, so as to retain a normal stock. The final yield varies with the age of the wood, and the thinnings amount to about 30 per cent. of the final yield. The felling direction is here from north-east to south-west, and ten years are allowed to intervene between each two successive falls in any one compartment. As soon as the timber is removed, the area is planted with 3-year-old seedlings, to the number of 2400 per acre (at about $4\frac{1}{3}$ by $4\frac{1}{3}$ feet). The blanks are made up with 4-year-old seedlings, from patches sown thickly in the corner of each fall about to be planted. The pine-weevil (*Hylobius abietis*) does a great deal of harm to the young

plantations; and to prevent its breeding, the dry stumps are removed. These realise the cost of their removal, and in some cases from 1s. to 1s. 6d. more per acre. Collecting the insects does not answer, and it is found much better to grub the stools. In one portion of this wood, which is just 80 years old, the felling realised 40s. per acre for each year of its growth. The small spruce is converted into pulp, and is sold in three classes, at from 7s. to 8s. per cubic metre (35·2 cubic feet) for the lowest class, and up to 9s. for the highest class. Two thinnings during fifty years amounted to 200 cubic feet, and realised 28s. per acre. In 1898, 528,000 cubic feet were blown down in this forest in two hours. Another portion of the same forest visited was 95 years old, and was estimated to contain about 9360 cubic feet per acre, but the actual results generally work out at 5 per cent. more. The nursery plants are left in the row until they are three years old. Stock-maps are made every ten years. New plantations cost from 46s. to 47s. per acre, and the average receipts over the whole forest for the last five years were 42s. per acre. We saw spruce here standing 108 feet high. Two hundred and fifty acres are set apart, and a most careful note is kept in detail, so as to give data for the whole forest.

To me this forest was particularly interesting. It extends over the same area as is covered by the Novar Woods, and the plan of cutting so many acres annually is in accordance with the plan in operation at Novar. One thing, however, that accounts for the large revenue from such an exposed district is that there is a duty on all imported timber, which gives the forest a monopoly; and with the numerous mills already referred to in its immediate vicinity, it commands an excellent market for spruce for pulp-making.

We visited the forest of Crottendorf on the 24th of June. It also stands at a high elevation, the highest portion being 3000 feet. Consequently it is liable to a great deal of damage from storms coming from the north. The trees on the eastern slope are very much destroyed, and the felling-direction has here to proceed from south to north. The severance-cuttings are replanted. Great damage is experienced from game, and a number of the trees which are broken by the wind have previously been injured from this cause. One part of the wood we visited was 70 years of age. Fourteen thousand cubic feet

of thinnings were removed three years ago, and realised £30 per acre, and the rotation is 85 years. There is a good deal of dry-rot in the stools and boles of the trees on this area, and it is supposed to have been caused by the land having been used for agricultural purposes before it was planted. This defect does not, however, seem to appear in the second rotation. In 1893 this wood was 50 years old, and contained 725 trees per acre. The total volume was about 24,150 cubic feet, less 10 per cent. for brush. When the wood was 31 years of age, there stood on the ground 1370 trees per acre; at 37 years, there were 1100; at 42 years, 930; at 47 years, 830; at 50 years, 720; and now at 61 years, there are 600 per acre. Regeneration is by sowing in strips 18 inches in width, and 3½ to 5 feet apart, and costs about 70s. per acre.

Another wood visited was at an elevation of 3300 feet, and the whole stock averages 1940 cubic feet in the round per acre. It is allowed to exceed the average age of 85 years, and is to be left to 100 years.

The third wood in the same forest is situated on gneiss rock and mica slate, poor in minerals. Until it was 60 years old there was no thinning done in the wood, and now it is 106 years old, and stands about 100 feet high.

Another wood of 70 years old was visited. Eight years ago over 1000 cubic feet per acre were removed from it, and it is estimated that there are still 7200 cubic feet per acre standing upon it. The spruce-bark is peeled from the logs, and the receipts from it pay the felling, peeling, and cross-cutting. The severance-cuttings are begun at 35 years old, and the wood is thrown in one direction, which saves breaking, and makes it much easier to remove.

On our return from this forest we visited a pulp-mill, and saw the method employed. The machinery is very primitive and closely packed together, and leaves hardly enough room for the employees to move round it. In this country, with our Factory Acts, such a state of matters would not be tolerated. The mill we visited was attended to by two or three old men, who seemed to be putting through a good deal of work in their own way, and apparently at a very small cost to the owners. The agricultural measures adopted in these districts were very much the same as those in the Spessart district.

The next day I travelled to Tharandt, and visited the Forestry

School there, and part of the forest in the immediate neighbourhood. The School has a very well equipped museum, and is a commodious building. The country near Tharandt is like the Highlands of Perthshire, only much more closely wooded. Here at Tharandt, as well as at the Spessart and all the other districts visited, the fact is strongly impressed on a visitor's mind that the forest management confines itself strictly to kinds of trees which have grown in the forests for centuries, and that the object seems to be to perfect the growth of these by every possible means.

On the 26th I travelled to Dresden, and thence to Hanover and Rotterdam. The country between Dresden and Hanover is well cultivated, and offers quite a contrast to the system of farming referred to earlier in these notes. On the evening of the following day I sailed for Leith, where I arrived about 2 A.M. on Wednesday, the 29th June.

I would take this opportunity of expressing my sense of the great kindness shown to me by Dr Schlich. The knowledge gained by his experience and skill was freely communicated with enthusiasm and patience in every wood we visited, and this doubled the profit and pleasure of a most enjoyable tour.

XIII. *Notes on Continental Forestry*, 1904. By the Hon. Editor.

As many Scottish foresters will no doubt be interested in knowing how both scientific and practical matters connected with forestry are progressing on the Continent, it is intended to give here a very brief summary for the year 1904, so far as may be ascertained from three of the chief periodicals, the *Revue des Eaux et Forêts*, the *Zeitschrift für Forst- und Jagdwesen*, and the *Allgemeine Forst- und Jagd-Zeitung*. The French periodical appears every fortnight, but the two German ones are monthlies, and are considerably larger in size. A special feature of the last-named of the above is the issue of a Supplement of about 100 quarto-size pages, in which specialists in each of the four main branches of forestry and in the three chief cognate sciences (forest botany, zoology, and soil-science) give a sort of skeletonised epitome of all the books, essays, etc., published during the previous year, which must often be found very useful by those wishing to hunt up references. In these summaries, references are made to no less than 100 periodicals printed in German, of which 25 deal principally with German, Austrian, and Swiss forestry, while 7 are in French, and 2 in English (the *Indian Forester* and the *Gardeners' Chronicle*).

1. France.

The French *Revue*, a semi-official periodical, opens appropriately with interesting extracts concerning the forest budget for 1904. During the last ten years for which actuals are obtainable (1893-1902), the income from the State forests has been growing slightly but steadily, although it is somewhat less than what it was fifty years ago. On consulting the *Annuaire des Eaux et Forêts* for 1904, issued as a Supplement to the *Revue*, I find that, of the present wooded area in France, amounting to about $23\frac{1}{2}$ million acres, the State forests in 1902 extended to 2,874,017 acres, and produced a gross income of £1,406,320, or just under 10s. per acre, as compared with 2,698,857 acres, which produced a gross income of £1,464,568, or just over 10s. per acre, in 1855 (and as compared with a total area of 11,621,144 acres in 1791, at the time of the Revolution). As the total expenditure sanctioned under the budget for 1904 was £562,924—which is almost exactly two-fifths, or 40 per cent., of the gross income—this leaves (on the basis of the receipts for 1902) a net surplus or clear annual

rental value of £843,396, or 5s. 10½d. per acre, for these State forests. There are no data available to enable me to show what percentage this is on the capital value of the land and the growing stock of timber, but it is probably far from high. It should be added, however, by way of explanation, that the charges debited against the maintenance of the State forests include large sums annually expended in the purchase and re-plantation of waste lands, in improvements to water-courses, in the upkeep of the Forest Schools for the upper and the lower branches of the Forest Service, and in the maintenance and improvement of all inland fisheries, which are now controlled by the Department of Woods and Waters.

Of the sanctioned budget of £562,924 for 1904, £250,360, or not very far from the half, is required to provide for the pay and allowances of the permanent official staff, consisting of 32 conservators at £320–480, 200 inspectors at £180–240, 210 assistant inspectors at £120–160, 232 guards of higher grade at £48–104, and 3650 brigadiers and guards of lower grade. For instruction in forestry, £7000 are allotted, of which £4120 are for the National School of Forestry at Nancy (with 7 professors), and £2880 for the School of Technical and Practical Instruction in Sylviculture at Barres (with 4 professors and other assistance). It further includes £52,560 for the improvement and upkeep of forests, dunes, and water-courses, and £140,000 for the purchase and re-plantation of waste land for national-economic and protective purposes, in accordance with the law passed on 4th April 1882. For working-plans and exploitations £16,800 are sanctioned, £2000 for expenses connected with sport, and £1040 for the destruction of wolves, wild-boars, and crows. The sum of £81,800 forms the State contribution towards repairs of roads near forests and other ordinary or extraordinary expenditure of Departmental and Communal corporations; while £11,360 provide for sundries, including office expenses, prosecutions of forest offences, purchase of implements, redeeming rights of common, etc.

The great national work of fixing the dunes along the south-west coast of France has already resulted in the planting, with the maritime or cluster pine, *Pinus Pinaster*, of 157,813 acres by the Department of Woods and Waters, the frontage of which forms a protection along 277 miles of the coast-line. The forests that have thus been raised on the dunes of Gascony are now old

enough for natural regeneration; and as on such soft sandy soil transport by rail is the only suitable method of extracting the mature timber, a 28-inch tramway, 9½ miles long, is now being constructed on the Hourtin dunes (Gironde).

Steps are also being taken to ameliorate the condition of poor grazing lands in the Pyrenees, where about 1,675,000 acres offer scope for improvement. On the plateau of Lannemezan, a wind-swept waste of 12,500 acres, wind-breaks or shelter-belts are being planted with oak (species not mentioned) and birch in belts about 35-50 feet in breadth, which cross each other at right angles, and enclose square blocks of about 16 acres each. When these shelter-belts grow up sufficiently, it is intended that the interior 16-acre blocks thus protected shall be utilised either for agriculture, or pasture, or planting, according to the nature of the soil.

In addition to Government work in both of the above directions, however, the forestry question in the south-west of France, from Bordeaux to Carcassone, has, during the last three or four years, begun to attract much general attention, and "a serious movement is taking shape, and is growing in strength from day to day, in favour of the conservation of the actual forest area, and of replanting on a larger scale than at present."

A particular feature about this budget is the consideration it gives to the future of the French forests; and one passage is of so much general importance, with reference to all other countries (and their colonies and dependencies), that I translate it in full:—

"An examination of the receipts from the State forests will show that for some years past they have been steadily increasing.

"The market for forest produce is dependent on the general state of business. During prosperous times, there is activity in building factories, houses, and railways; many more packing-cases and crates are required for carrying goods; far more coal is extracted; and, consequently, more wood is needed for building, for the development of prosperity, for the transport of merchandise, and for pit-wood, etc. One would therefore expect that during these last few years of general depression in trade there would be a decrease in the income from the State forests. But the opposite is the case.

"To take proper account of this question, one must separately consider the market for timber, and that for small wood.

"From year to year, the quantity of timber used throughout

the world is constantly increasing, while the woodland resources are limited. In certain countries these are entirely exhausted, and nothing is being done to form fresh stores. And besides that, it takes at least one hundred years to grow a large tree; so it is easy to understand that, as the supply decreases, the value of timber must increase. Despite the depression in our trade, the law of supply and demand has produced its effect, and made the price of large timber rise; and this accounts for the increase in the income from the State forests, in which timber forms a considerable part of the annual falls. But the situation is quite different as concerning the private proprietors who only grow small wood.

"In France we really grow more small wood than we need. Formerly our woodlands supplied all the requirements of metal factories and for domestic purposes. Firewood and charcoal could easily be disposed of. But changes in metallurgy, in the means of heating, and in the more general use of coal, petroleum, alcohol, etc., have very much reduced the demand for those forest products and the prices obtainable for them.

"To improve this outlook, not only in the interest of the State, but also of the Communes owning about 5,000,000 acres, and of the private proprietors owning about 15,000,000 acres of woodlands, the remedy consists in changing the method of utilisation. One must stop growing small stuff that does not now sell, in order to follow the market and grow wood such as trade requires, *e.g.*, pit-wood, fire-wood, etc. To do this one must give up short rotations, and raise the age of the falls of wood. One should store up more saplings of timber-trees among the coppice, so that they may grow into the timber which will be needed more and more as time rolls on.

"The Department of Woods and Waters has adopted this policy, to try and show the owners of woodlands that their best interests lie in this direction; and it is now especially anxious to convince the municipalities whose woodlands are entrusted to it, and to show itself really careful of the interests committed to its charge."

Bearing on the above, it may be remarked that of the smaller wood about 360,000 tons weight of pit-wood and poles are annually exported from France; and, as M. Mélard remarks in an article on *Customs' Duties on Timber*, England is France's best customer, taking six-sevenths of the pit-wood and props exported.

Early in 1904, the "Practical School of Sylviculture," formed on the Barres estate at Nogent-sur-Vernisson (Loiret), was transformed into a "School of Technical and Practical Instruction for Guards of Woods and Waters." The new course of technical instruction, extending over ten months (15th October to 15th August), and combined with professional (outdoor) teaching, includes the following branches, taught on four days in each week:—(1) elementary ideas ("*des notions très élémentaires*") of sylviculture and artificial regeneration, management of forests, and sale and extraction of wood, 30 lessons: (2) forest law and prosecutions, so far as concerns forest-guards, 20 lessons: (3) mensuration of area and volume, 20 lessons; elementary surveying, plan-drawing, and levelling, 15 lessons: (4) "elementary notions" of works carried out in the forests and mountains, 25 lessons: (5) sport and poaching; rearing, maintaining, and protecting game; trapping and destroying vermin; the protection of useful birds, 10 lessons: (6) fishing and poaching on rivers; protection of fish; pisciculture, 10 lessons: (7) French spelling and composition, 50 lessons. In addition to the above, outdoor teaching is given on two days a week in the neighbouring forests. It is striking to note that out of the 180 indoor lessons, no fewer than 50 (or 28 per cent.) should be considered necessary in "*orthographie, rédaction*," or spelling and composition of their own language.

Also of interest are the facts, that on 19th March 1904, a retired forest officer was appointed by the Ministry of Agriculture to deliver lectures on Sylviculture in the National School of Agriculture at Grignon, and that there is a Practical School of Agriculture and Sylviculture at St Pau, near Sos (Lot-et-Garonne), at which bursaries are given to lads of not less than fourteen years old.

Interesting articles deal with the forests of Morocco, the Balearic Isles, Siberia, Japan, New Zealand, and the United States, and also with the forestry question in Italy. For France, the Morocco forests have a particular interest at present. In the north, the cork oak is one of the chief trees, in the central region the Atlas cedar (*Cedrus atlantica*), and in the south *Argania sideroxylon*, an equatorial species of ironwood.

In Italy, the forest question is much the same as in Britain. The forests still left are insufficient to meet the growing national requirements in wood, and in 1902 the imports were valued at close on £2,500,000, nearly five-sixths of which came from Austria-

Hungary, and nearly half of the remainder from the United States, while large quantities of charcoal have also to be imported. Consequently, endeavours are being made to induce Government to undertake afforestation and planting, and to encourage private planting by placing an import duty on wood and charcoal.

As it is only within recent years that the inland fisheries have been placed under the charge of the Forest Department, there are, as might be expected, several articles treating of diseases of fresh-water fishes; but there are also special articles on forest trees, such as the walnut, the Scots pine of Auvergne, and the silver fir of Normandy, as well as on such matters as mountain planting in the Cevennes, the geography and vegetation of Languedoc, the correction of mountain torrents in Austria, on caoutchouc, the preparation of artificial cotton from wood, tanning materials, the value of different antiseptics, and various other miscellaneous subjects. Nor can it be matter of surprise that a good deal of space is given to jurisprudence and politico-fiscal questions, such as the taxation of timber imports,—the frontier duties being one of the ever-burning questions on the Continent.

Of course there are some purely scientific articles, mostly contributed by professors at the Nancy Forest School. One of these gives a summary of the Report for 1903 of the Swiss branch of forestry investigations that are being made simultaneously with similar researches in the other branches throughout Central Europe. Three questions are here specially dealt with, relating to—(1) the benefits obtainable in different degrees of thinning; (2) the laws concerning the development of the underground organs (root-system) of forest trees; and (3) the comparative value of different leguminous plants as live green-manure for nurseries. The results of thinnings made thrice since 1889 in spruce and beech woods, and in four different degrees, now show that the increment both in total basal area (or diameter) of the stems, and in height, is greater when the thinning is free—though not excessive—than when it is merely confined to the removal of suppressed, moribund, and entirely dominated stems. And of course this is just what is also indicated by practical experience. The investigations into the growth of the root-system were confined to 1- to 6-year-old plants of six broad-leaved and six coniferous species, all of common woodland growth. The results arrived at are as follows:—

1. The growth of roots is not continuous throughout the year, but is interrupted by periods of rest, which do not, however, correspond exactly with those of the ærial portions (crowns).

2. Among conifers, root-vegetation is entirely suspended from November till March or April; whereas among broad-leaved trees there is no such total interruption, and their roots can develop even in the middle of winter if the season be mild, whereas the month of February and the beginning of March are the times least favourable for root-growth. The decrease in soil-temperature causes the diminution of growth during winter, and its total cessation among conifers is doubtless a natural adaptation to severe climates, which has become a hereditary property.

Here we have a further explanation of why it is preferable to plant broad-leaved kinds of trees in autumn, and conifers in spring.

3. The roots of most kinds of trees (except larch and alder) begin to grow at a lower temperature than is needed for the commencement of vegetation in the ærial portions (twigs and leaves). This is of course easily intelligible, just as in the same way it is self-evident that a pump or a boiler must first begin to work before any machinery dependent on it can commence operations. The length of time by which root-activity must precede active vegetation in the buds is usually several weeks, though in some cases it is only several days; but in the case of larch and alder—the former a tree of the higher Alpine tracts, and the latter a tree of the far north and of frost-bound marshes—the buds open about a month before the roots resume their activity.

That means, of course, that in the meanwhile the buds and young leaves live and develop by drawing on the reserve nutrients stored up in the twigs and branches. And it also at once suggests a partial explanation concerning the deciduous foliage of the larch, because, if its leaves were persistent like those of pines and firs, then any considerable amount of transpiration, through the foliage, before the root-system could supply the necessary water, would inevitably result in the death of the plant—as often happens with the evergreen conifers during bright sunny weather in winter, which induces transpiration while water is not obtainable from the inert roots and frost-bound soil.

4. During summer, when the soil is driest, the root-growth is interrupted for about three to eight weeks in August and

September, the extent of this varying according to the meteorological character of the summer.

5. This summer rest is succeeded by a new period of greater activity, which is more intense and more prolonged among broad-leaved species than among conifers.

6. The roots grow quickest at the beginning of summer, the mean maximum for all the oak plants observed being 0·39 inch during the early part of July; for maple, 0·35 inch about the end of June or the beginning of July; for Scots pine and silver fir, 0·24 inch.

As live green-manure for enriching exhausted soil in nurseries, the experiments made with various leguminous plants showed that on limy soil, whether binding or not, common peas and beans gave the best results, while white and yellow lupine and hairy vetch (*Vicia villosa*) are also good if the soil is very fresh and does not contain more than 2 to 3 per cent. of lime, and yellow lupine is best on soil poor in lime (less than ½ per cent.). Common vetch (*V. sativa*) was found only to give good results on stiff clayey soil, where it forms a very cheap, though mild manure. Peas are best to use at high elevations, where the climate goes to extremes, and where growing can only begin late.

Of the other scientific articles, the most interesting is one by Professor Henry of Nancy, on the "Fixation of Atmospheric Nitrogen" by the layer of dead leaves found in woodlands. The investigations were carried out in consequence of the fact that although the poor shifting sandy soil on the dunes of the Landes contains neither humus nor nitrogen, yet the fine crops of maritime pine now being grown there contain a considerable proportion of nitrogen; and the new inquiry was a continuation of similar investigations already published in the *Revue* in 1897.

As the result of experiments made with oak, beech, hornbeam, aspen, Austrian pine and spruce, he found—(1) that dead leaves of all kinds, whether alone or mixed with earth, have the property of fixing a considerable proportion of atmospheric air, and especially when they rest on a damp substratum (clay, sandstone, or lime); (2) that on a poor substratum of pure sand, dead foliage of beech, pine, and spruce either do not (beech) become richer in nitrogen, or else the increase is very slight and insignificant (pine, spruce)—though in no case do they lose nitrogen; (3) that reliable experiments of this nature cannot be conducted in the forest on account of the action of earth-worms,

because these latter attack all kinds of leaves, though showing plainly preferences for certain kinds, and that to earth-worms is certainly due the rapid disappearance of dead hornbeam leaves, even where this tree forms the main portion of the crop. But Professor Henry thinks that, in the fixation of atmospheric nitrogen by the dead layer of foliage, various lowly plants are active (especially algæ, lichens, and mosses), as well as the special bacteria, of which only a small number are yet known (*Clostridium*, *Granulobacter*, *Azotobacter*).

Here and there rabbits are destructive, as they appear to have been as early as before the Revolution of 1789, and a new enemy (in France) to the silver fir has appeared (in Auvergne) in the shape of a geometric moth, either *Boarmia crepuscularia* or *B. consonaria*, unless it prove an entirely new species. In 1902 the caterpillars appeared and attacked a small 500-acre isolated block of silver fir, damaging about half an acre; but no particular notice was taken of them, and in the following spring they completely defoliated about 125 acres; then in 1904 they again reappeared and stripped 250 acres, making the part infested as bare and black "as if fire had passed through it." Fortunately it is a moth that can easily be combated, because the caterpillars spin down to the ground about the beginning of September to pupate, and the chrysalides are eagerly devoured by swine and fowls, while a parasitic ichneumon also soon appears to find them out.

One would hardly have thought that as many as 8786 wolves (163 being full grown) could have been killed during the twenty years 1883-1902, or an average of 439 annually, although in 1902 only 73 cubs or half-grown animals (and no full-grown wolf) were killed. The rewards have therefore been lowered (which seems a mistake, as not likely to lead to these savage brutes being exterminated), and now range from 16s. 8d. per cub to £3 per full-grown wolf, and £4 for those attacking human beings.[1]

2. Germany.

The German periodicals are, of course, far richer in matter of all sorts than those of any other country, as might be expected

[1] Wolves are now rare in Germany. On 27th February 1904 a large male wolf, known locally for several years back as the "tiger of Sabrodt," was shot near Nunstadt, in Lausitz (Liegnitz). It was 5 feet long, 32 inches high, and 90 lbs. in weight. The last wolf known to have been seen in Scotland was the one killed by Sir Ewen Cameron of Lochiel, in 1680.

where there are so many university and collegiate centres of instruction, so many eminent professors engaged in investigations as well as in teaching, and so many highly-trained foresters employed in the management of the vast woodlands.

Among the leading articles in the *Allgemeine Forst- und Jagd-Zeitung*, the longest, and perhaps the most important from a practical point of view, is one on the "Protection of Woodlands against Storms," by Forstmeister B. A. Bargmann. Our own periodical losses in the British Isles are heavy every ten or twelve years; while in Germany it is calculated that, at a low estimate, wind-falls average about 1,225,000 cubic feet annually. The most destructive storms recorded there took place in December 1868 (when over 245,000,000 cubic feet were thrown), in October 1870 (when over 390,000,000 cubic feet were thrown), in March 1876 (over 154,000,000 cubic feet), in February 1894 (over 105,000,000 cubic feet), and on 31st January and 1st February 1902 (over 58,000,000 cubic feet). A careful and painstaking study is made of the storms and the storm literature of the nineteenth century, and the subject is considered from the four main points of view—(1) Management or Working-Plans, (2) Sylviculture, (3) Protection, and (4) Utilisation of Woodland Produce. Unfortunately, space does not allow of anything more being given here than a summary of the conclusions he arrives at; and it must of course be borne in mind that he is dealing with the conditions of large compact blocks of forest, and not with comparatively small isolated patches like the great majority of British woodlands. Bargmann's deductions from his studies are as follows:—

(a) *As regards Management or Working-Plans*—

1. When the main local danger arises from winds coming from some other quarter than the generally prevailing heavy winds (which usually come from W., N.W., and S.W.), this fact must be taken into consideration in laying out the Compartment lines. And such network should be at an angle of about 45° to this local direction of greatest danger, no matter whether or not this necessitates the lines running at right angles to the horizontal.
2. The network projected for the forming of Compartments should not necessarily be based entirely or chiefly on the existing roads.

3. Broad open drives cleared even along ridges and other exposed parts are often very useful for protection against wind—but only when they are cleared to their full breadth in crops still quite young. And the same applies to such Compartment lines as follow ridges.
4. Wherever possible, the broad side of each Compartment should face the direction from which the most dangerous winds are expected.
5. In general,—especially for silver fir, and except for spruce,—the (Saxon) system of fixing the annual fall on considerations affecting each crop individually is preferable to forming regular series of falls, even should such series be short.
6. Severance-cuttings made early are an excellent means of protecting adjoining crops.

(b) *As regards Sylviculture and Utilisation*—

1. Natural regeneration in family patches and groups is the best way of securing protection, because it is the only way of growing the trees so that they are always given the best conditions for resisting the violence of storms.
2. For artificial regeneration, planting is preferable to sowing.
3. Mixed crops (of conifers and broad-leaved trees) should everywhere be cultivated as much as possible, as being one of the simplest and best means of protecting woodlands against storms.
4. Thinnings should begin as soon as possible, and be repeated frequently.
5. Good wind-breaks or shelter-belts should be made 13 feet back from the edge, and then either planted wide and thinned heavily, or else planted close and not thinned at all (the former being preferable).
6. All young spontaneous growth of trees should be carefully protected.
7. The falls of timber should proceed, as much as possible, straight in the direction of the most dangerous wind, and with the broad side facing it.

8. But at specially exposed places, the falls should proceed *wedge-shaped* in the direction of the worst wind.

(c) *As regards Protection*—

1. Each Compartment and each sub-Compartment, and each crop or separate part of a crop, should, so far as possible, be treated as an independent unit in striving to attain security against wind.
2. When middle-aged crops have been broken into by wind, the exposed outer edges should be strengthened by weighting it down with wood and stones.

Each monthly issue contains the report of one, and sometimes of more than one, Annual Forest Conference held by the local foresters. Most of the subjects discussed are mainly of local interest, while others are of general importance. Among these latter may be mentioned one of the themes at the Thuringian Conference (June 1903), "On the Results attained Locally in cultivating Foreign Kinds of Trees," where it was considered that the Weymouth pine was the most valuable introduction, and, next to that, the Douglas fir. Reports received from 32 different forest circles showed that when Weymouth pine and spruce are mixed, the former outgrows the latter on a pronounced pine-soil, and *vice versâ* on the best classes of spruce-soil, but even in this case the Weymouth pine can bear the side-shade sufficiently well to hold out until about 60 years of age, when it forms valuable thinnings. And its wood is specially useful for match-making, on account of its elasticity, as well as of its softness and straight fibre. The plantations made with it during the last twenty years are growing well, even on somewhat marshy, heavy moorland soil. It seldom suffers from frost or is broken by snow, ice, or wind, but roe-deer are fond of eating the buds and using the young stems as fraying-stocks. The Douglas fir has only been planted experimentally since 1880, so that less is as yet known about it; but reports from 31 forest circles state that it is doing well, and is outgrowing spruce and Scots pine both in height and girth—although it, too, attracts the attention of roe-deer, like all other plants that are introduced as novelties into the woods.

At the Hessian Forest Conference (Cassel, July 1903), one of the three themes proposed for discussion was "The Leaf-Shedding

Disease, and the best means of combating it." The discussion was of course introduced by considering the three known possible causes of this disease (frost, winter transpiration, *Lophodermium Pinastri*), and it was accepted that the fungus was the chief cause. The results of many thousands of experiments made in all parts of Germany have shown that spraying the plants with solutions of copper is the only effective method. Spraying has only proved ineffectual in the case of young Scots pine when they are just about one year old; and, according to v. Tubeuf, this is due to the primary needles of the pine being covered with a thick waxy coating from which the fluid rolls off. The Bordeaux mixture is the best to use, at least 2 lbs. of copper-vitriol (blue-stone) being added for every 10 gallons of water. Spraying should take place between 1st July and 15th August, and repeated annually till the plantations are four to five years old, and the cost may vary from about 3s. to 8s. an acre. Plants grown from Scandinavian seed seem to suffer far less in Germany from this disease than those grown from German seed.

At such reunions sport receives its fair share of attention as well as forestry, and one of the four subjects of discussion at the Pomeranian Forest Conference (Stargard, June 1903) was, "Is it desirable that changes should be made in the close time for game? And, if so, what amendments should be proposed?" Such a question directly interests German forest officers, who are allowed to rent the shootings for deer and other game of the woodlands in their charge, the rate assessed being fixed at a lower price than the game is worth for ordinary household food, while the head of game kept and number of red- and roe-deer to be shot off in the course of each year are duly fixed like a regular annual budget or working-plan. Elk are only obtainable in the Baltic provinces, and chamois in the Bavarian Alps, but wild boar, red-deer, and roe-deer roam throughout most of the large forests, and fallow-deer also here and there; and endeavours are now being made to give the two latter further protection than at present exists in Prussia, by extending the close time for stags from 1st March to 30th June, and for hinds and calves from 1st February to 15th October, and for roe-bucks from 1st January to 30th April, and does and young deer from 1st January to 31st October. Both in Germany and in France it is found desirable to afford additional protection to roe-deer, this being rendered "absolutely necessary" in Germany by the bucks

being shot off in so large a proportion as to constitute a danger for the maintenance of the stock, and in France by the simple fact that the numbers have altogether been greatly reduced.

It is interesting to note that rabbits, which have hitherto throughout Prussia only ranked as game in Hanover and Hesse (the two provinces annexed in 1866), are now dismissed altogether from the class of "animals fit for sport"; and quite rightly, too, for rabbits can never be anything else than *vermin* so far as forestry is concerned.

Among the more directly practical articles, which are very few in number compared with those of an academic or scientific character, there is an interesting one by Forstmeister Lang on "The Leading Points to be Kept in View in making Thinnings." Even though it deals with German conditions, and is not applicable to our British woodlands, its leading points may be thus summarised, as indicating what may now be considered to be the modern method of thinning in extensive forests:—

(a) *General Principles to be kept in view*—

1. Crop-increment is dependent on the nutrition of the various individual poles or trees.
2. As the total amount of food absorbed from the soil by the crop apparently cannot be much increased by thinning, but can only be enhanced by increase in the leaf-area (foliage), the latter ought to be the first object aimed at. The maximum leaf-area and the maximum insolation of the foliage will be attained in a crop when the individual tree-crowns extend as far down as possible, and touch each other at their edges; and this is therefore the condition to be aimed at in thinning, as being that best calculated to produce the maximum increment for the given soil and situation.
3. But where it is also desirable to combine *quality* with *quantity* (*i.e.*, where *timber* pays better than *fuel*), then the crown of foliage must be kept as high up as practicable, and not allowed to extend far down the stem.
4. Both of these two conditions can to a certain extent be attained by making the thinnings partly among

the dominating trees and partly among the dominated.

5. The total crop-increment depends, however, not only on the individual poles or trees, but also on the soil, the condition of which can be greatly affected by the way thinnings are made,—because artificial improvements, such as soil-preparation and manuring, can only be undertaken in exceptional cases.
6. Next to a certain necessary degree of warmth, freshness or moisture in the soil is the main essential for inducing rapid decomposition of the dead foliage littering the ground, and rapid *humus*-formation is always beneficial.
7. *Humus*-formation is assisted by whatever measures can protect the soil against dry winds and direct insolation, while allowing as free a passage as possible for the atmospheric precipitations.

(b) *Practical Measures based on the above General Principles*—

1. As the thinning is generally made with a view to improve the growth of the crop, it should, particularly in woods about 40 to 50 years old, give greatest consideration to the dominating trees, rather than to those more or less dominated.
2. Hence, in young crops the aim will chiefly be to free all well-grown, dominating poles of valuable kinds of trees from the pressure of their neighbours, and especially from those of the latter that are badly grown; and when necessary, at the same time more or less dominated trees of the better kinds should be freed with a view to promote them into the dominant class. Sickly, moribund, and dead poles should, however, always be thinned out, but otherwise suppressed stems that are still healthy should only be removed when this is necessary to allow the atmospheric precipitations to reach the ground in sufficient quantity.
3. Later on, when the crop has completed its main growth in height, the main object is to increase the leaf-area by gradually allowing a larger growing-space to the

stems that will form the mature crop, and thus to increase their girth as rapidly as possible. Here again, the dead, moribund, badly-grown, and sickly individuals are those first of all thinned out, and sound healthy trees should only be removed to such an extent as is actually necessary.

4. The above rules apply to crops containing a fair proportion of shade-enduring broad-leaved trees (and to silver fir). But in spruce woods it is not advisable to retain suppressed poles or trees that may still be fairly healthy, as this only increases the danger from insects, although some of the dominated stems may be left to form part of the main crop in older woods.

Among the reviews of books, letters to the editor, and casual notes, there is also much of interest that might well be mentioned if space here permitted.

In the *Zeitschrift für Forst- und Jagdwesen* there is also a great deal of exceedingly interesting and instructive matter, though comparatively little of it can be said to be of direct practical use for British conditions. The keen desire for information about the forests of other countries is evinced by long articles on "Forestry in the Dutch Indies," and "A Journey through the Forests of Roumania and the Eastern Carpathians." The work of forest conservancy in the United States and in other countries is also duly recorded, while of course specially German questions are dealt with, such as timber import duties and railway rates, etc. Among the scientific dissertations, along with the more useful papers on the large cambial beetle (*Hylesinus micans*), the pine-looper (*Fidonia piniaria*), the pine fungus (*Trametes pini*), and other enemies of conifers, there is the never-failing bitter controversy. This time it is about the dying off of the tops of young spruce, said by Professor v. Tubeuf (Munich) to be due to electricity (electric exchanges between the tree-tops and the clouds during the period of vegetative rest), but asserted by Professor Möller (Eberswalde) to be due to the small moth *Grapholitha pinicolana*. It is among the shorter articles and the notes, however, that matters of particular interest to British foresters are more usually to be found.

During the last ten to twelve years the pine-looper moth (*Fidonia piniaria*), which also does damage here and there in British

woodlands, has proved such a very destructive insect in Germany, that it must henceforth be classed along with the Pine moth, the Nun or Black Arches, and the Pine Owlet-moth, as among the worst enemies of the German woodlands. It did immense damage in the forests near Nuremberg in 1892-96, and in Friedesdorf in 1893-95, while more recently a series of dry summers led to very destructive attacks in the Letzlinger Heide, in North Germany, from 1899 to 1903. The hot, dry summer of 1901, favourable to the insect, brought the culmination of the attacks; but the cold wet May and June of 1902, and the natural increase in parasitic *Ichneumonidæ* and *Tachinæ* that generally takes place after three years of any such insect calamity, stopped further damage.

Although the pine woods attacked were chiefly young crops, 20 to 40 years old, it was found that the portions twice stripped bare of foliage by the caterpillars were quite past saving, and had to be felled as soon as possible to keep down bark and cambial beetles (*Hylesini*). The consequence was that in 1903 and 1904, in place of an annual fall of 2,220,000 cubic feet, 41,370,000 cubic feet had to be felled on about 21,500 acres, of which about 17,000 acres had been entirely denuded of foliage.

In combating this attack, it was found that the best plan was to try and destroy the pupæ during winter. Grease-ringing the stems to prevent the ascent of caterpillars blown down by wind, etc., did not prove effective, as at most only about one-fourth of the caterpillars are thus brought to the ground. Driving in swine was out of the question throughout the whole of the area infested, as about 50,000 would have been needed, so that this plan could only be adopted near villages. There, however, free pannage was given, and rewards to the swineherds. Hens were also bought and kept in the woods, and proved useful, although many of them died from diphtheria and soft crop, or were carried off by foxes, hawks, etc. Over large areas, however, the best means was found to be the removal of the soil-covering of dead foliage and moss, which could be sold locally as litter.

The Letzlinger Heide is a poor sandy stretch between Berlin and Hanover, where sylvicultural measures of prevention are hardly applicable. "One reads in text-books—(1) underplanting; (2) mixed crops; (3) protection of this insect's enemies. But where can these measures be carried out? Protecting its enemies—of

course!" The sandy soil is there generally too poor for mixed crops; but even where spruce and pine were growing together, both were attacked, and also juniper. The local experience there has been that "attacks of the pine-looper cannot be effectually prevented by sylvicultural measures; but during the early stages, the best means of exterminating the insect consist in removing the layer of soil-covering, and in herding swine and feeding hens where the pupæ are."

Official statistics show that throughout the German empire the total woodland area was in 1900 about 34,500,000 acres, or 25·89 per cent. of the total area, while about 1,575,000 acres, or 1·17 per cent., of waste land are classed as fit for planting (upwards of six-sevenths of this being in Prussia). The area under conifers is rather more than twice that under broad-leaved trees; and among these latter, the area under highwoods is nearly twice as large as that under copsewoods and coppices, while the simple coppice prevails largely over coppice-with-standards.

Arranged according to age, the various highwood crops group themselves into the following age-classes:—

(1 HECTARE=2·47 ACRES.)

Highwoods of	Total.	Over 80 Years old.		41–80 Years.		1–40 Years.		Blank Spaces and Unwooded Areas.	
	Hectare.	Hectare.	%	Hectare.	%	Hectare.	%	Hectare.	%
Beech, etc.,	1,827,216	646,351	35·4	701,442	38·4	467,663	25·6	11,760	0·6
Oak,	532,395	156,619	29·4	155,961	29·3	209,575	39·4	10,240	1·9
Birch, Alder, Aspen,	212,339	9,199	4·3	78,440	37·0	116,147	54·7	8,553	4·0
Total,	2,571,950	812,169	31·6	935,843	36·4	793,385	30·8	30,553	1·2
Scots Pine,	5,603,128	843,559	15·1	1,864,371	33·3	2,681,170	47·8	214,027	3·8
Spruce,	2,492,122	380,617	15·3	826,324	33·2	1,214,203	48·7	70,977	2·8
Silver Fir,	298,708	107,427	36·0	89,436	29·9	95,792	32·1	6,054	2·0
Larch,	13,309	796	6·0	5,541	41·6	6,759	50·8	212	1·6
Total,	8,407,267	1,332,399	15·8	2,785,672	33·1	3,997,924	47·6	291,270	3·5

It will here be noted that while the age-classes for oak and beech are still fairly distributed, those of pine and spruce show an abnormally large proportion of young crops. This is explainable partly by the transformation of old broad-leaved woods into conifer crops, and partly to the greater profit obtainable (with spruce especially) in a rotation not extending beyond 80 years.

In Prussia, as in France, the purchase and planting of waste lands by the State has been steadily carried on for more than

the last twenty years. From 1883 onwards, when 34,500 acres of waste land were in hand, large tracts have been bought *en bloc*, and after the sale and exchange of parts suitable for agriculture or pasture, the plantable portions fit for forming large compact woodlands aggregate other 214,200 acres, of which 182,700 acres have now already been planted. The area annually taken in hand has varied from 5840 acres (1889) to 12,200 acres (1897), and has amounted to 9140 acres on the average, while the beating up of blanks extended altogether to 61,100 acres, or 3060 acres a year on the average, and just over one-third of the area of one year's new planting. About 91,200 acres of "State acquired" waste land remain in hand still to be dealt with, and this represents over 1·40 per cent. of the total woodland area of the Prussian State forests (6,498,300 acres).

The statistical summary from which the above details are taken does not give any information about the planting of these wastes by the State; but the plantations, no doubt, consist mainly of Scots pine or spruce, according to the nature of the soil, like the similar plantations also being made on a smaller scale by private associations, such as the Society for Moorland Cultivation in Schleswig-Holstein. The objects of this Society are the amelioration of the province by replanting waste lands and improving agriculture. It can merely work on a small scale, as its funds are only about £950 a year (of which the State, the Province, and the Agricultural Chamber respectively contribute £275, £200, and £50); but it does very useful work in providing the assistance of a head forester, in making advances for buying plants, and in giving prizes for successful planting. Great difficulties have to be contended with. The soil is poor, and often impervious from moor-pan, while climatic conditions are unfavourable. The spruce seems specially suitable for planting, as, owing to the dampness of the air, it here grows fairly well even on poor sandy soil. Deep soil-preparation is necessary where there is moor-pan, and beneficial where there is no pan; because, though it looks loose and porous, the sand is very fine-grained, and is all the better for being thoroughly broken up and aerated. Hence trenching in strips, with plough or spade, is preferable to pit-planting. Subsoil ploughing with a woodland plough and four horses costs from 20s. to 28s. an acre, while spade-work is dearer, and costs about ¼d. per running yard. Marshy spots have of course to be drained. Where the moor-pan layer is not

bad, the land can, with great advantage, be enriched with marl and artificial manure, and used first for rye, and buckwheat, and sheep-grazing before being planted. But where this cannot be done, then either the whole area must be steam-ploughed, or else trenches and mounds must be formed, the former costing about 32s. to 48s., and the latter 80s. to 120s. per acre.

Protection against storms and blasting sea-winds is of the greatest importance. In exposed situations the spruce plantations are mixed with silver fir, white and Menzies spruce, and pines. As a protection against fire, the outer roadways are kept free of inflammable matter, and the rides between Compartments are ploughed and planted, wherever possible, with oak, birch, alder, silver and grey poplar, mountain ash, and larch.

Plants and planting cost about 52s. an acre, and beating up blanks averages about 12s. an acre; but thus improved and stocked, the value of the woodland area is estimated at about £6 an acre. The price at which the waste land can be purchased in its unimproved condition is unfortunately not stated.

Similar work on a larger scale has been undertaken by the Moorland Society of Denmark, continuously since its foundation in 1866, with the primary object of bringing the moors of Jutland into cultivation by drainage, planting, and road-making. Its membership is now 4712, and it employs 10 foresters and 13 assistant foresters for the supervision and carrying out of its forestry operations, 1 officer and 7 assistants for moorland and meadow cultivation, and 1 irrigation engineer and 2 assistants for its canals, while the whole organisation is under the direction of a head-forester in Aarhus. The woodlands owned by the Society extend to 13,800 acres, while the total woodland area coming under its agency is about 137,500 acres. Besides this, there are three centres of moorland and meadow cultivation, with about 2750 acres of high and low peat-bogs, 185 acres of irrigated meadows, and 70 acres of arable land. The State provides free transport by railway for the marl and lime needed, and in 1902-03 gave a subsidy of £17,000 towards the administration and the work of the Society on its own and other properties, of which £3850 were spent on the Society's own plantations, and £5665 on those of private owners. Altogether more than 100 canalisations have been carried out, and more than 20,000 acres of waste land have been converted into meadows; while, merely in order to provide sufficient marl for the meadows, three

tramway lines have been constructed, having a total length of 37½ miles.

Planting is, however, the chief work of the Society, and up to the end of 1901 it had made 1449 plantations, covering 135,600 acres. When planting is desired by a private landowner, a plan of operations is first drawn up, and if the proprietor is willing to subject such areas to the provisions of the Forest Conservancy Law, the Society obtains a State grant towards the cost of planting. As a rule, the planting is a mixture of two rows spruce and one row mountain pine; but previous to planting, the soil is well prepared for some years in advance (details of which are not yet given).

A great deal of planting also takes place for providing shelter from wind to farm-houses, fields, and meadows. About 50 planting-unions, with 25,000 members, have been formed for this special purpose; and the State subsidy to the Moorland Society on behalf of these small unions amounts to £3850. Further, the Society publishes a journal of its own, and arranges for collections and exhibitions of forest produce, moorland implements, etc.

The Moorland Society of Denmark has a wide field still open for its work, because more than 750,000 acres of waste land await improvement and cultivation.

The action of the State in France, Germany, and Denmark seems well worthy of imitation by our own Government. Our waste lands can certainly never be planted extensively unless the work is either done by direct State agency, or else assisted by State subsidies in one way or another. And it seems to me that the best means of bringing about such a desirable state of activity throughout Great Britain and Ireland would be to obtain complete information concerning—(1) what has been done, (2) what is being done, and (3) what is about to be undertaken in future, in the way of planting wind-swept waste lands in Denmark and Prussia, which are the portions of Continental Europe where the climatic conditions most closely resemble those obtaining throughout the United Kingdom.

Planting, thinning, felling, and every other kind of woodland work can be done much cheaper in Prussia than in any part of the United Kingdom. The official statistics for 1902 show that throughout the Prussian State Forests the average wages paid for daily labour, in different localities, were as follows:—

	In Summer.		In Winter.	
	Daily Wage.	Hours of Work.	Daily Wage.	Hours of Work.
	s. *d.* *s.* *d.*		*s.* *d.* *s.* *d.*	
Men, . . .	1 5½ to 1 7¼	9⅝ to 10	1 2½ to 2 5	7 to 8⅛
Women, . .	0 10 to 1 6		0 8 to 1 4½	
Young people,	0 8 to 1 5		...	...

When employed on piece-work, the wages of men were estimated at from 1s. 9d. to 3s. 5d. in summer, and 1s. 5d. to 3s. in winter.

In all, 159,283 hands were employed, and 10,506,941 days' work were paid for; but the total sum paid is not mentioned in the summary now before me. This means, however, the equivalent of permanent employment all the year round for about 35,000 hands; and as the Prussian State Forests extend to 6,498,300 acres, it also means that (besides all permanent officials and subordinates) one hand might be permanently employed for every 185 acres of woodland.

And at the same time it is interesting to note, in conclusion, that the average prices obtained, or estimated, as the value for timber and firewood in these Prussian State Forests, were as follows during the year 1902:—

Kind of Wood.	Timber containing over 18 cubic feet (*actual contents*).		Firewood Billets per Stère-cord of 36 cubic feet (nearly).	
	Stère-loads of 36 cubic feet (nearly) (*actual contents*).	Average Price per cubic foot.	Stère-cords sold.	Average Price per Stère-cord.
		Pence.		Shillings.
Oak, ...	43,602	6·60	...	...
Beech and other Hardwoods, .	49,658	3·96	936,605	5·17
Birch and other Softwoods, .	10,161	3·38	...	...
Spruce, . . .	178,174	4·56	167,762	3·26
Scots pine, . .	523,574	3·74	1,036,406	3·74

These full rates work out in pence per cubic foot (stacked) to 1·71d. for beech, 1·08d. for spruce, and 1·23d. for Scots pine.

XIV. *On Planting Waste Land for Profit.*

By George U. Macdonald, Forester, Raith, Fifeshire.

Having fixed on an area for planting, the boundary line must first be carefully surveyed and pegged out for fencing, as the future welfare of a plantation is considerably affected by the way in which the boundary is laid down, especially on high and exposed lands.

Shelter.—The planter therefore should first of all study the physical geography of the district and ascertain the points from which the most destructive winds blow. He should then, whenever possible, lay the widest side of the enclosure facing the prevailing wind, giving the boundary line on that side a bold convex form. Long straight lines should always be avoided on exposed land, as the wind strikes on these with unbroken force; whereas a line thrown well outwards breaks the force of the wind by dividing it to right and left.

The boundary line being fixed, the land must next be enclosed with a fence suitable to the local conditions.

Stone-and-Wire Fencing.—If a fence is required on exposed land to act as a shelter for the young plants, then we would recommend a dry-stone dyke, provided stones can be got within a reasonable distance. A dyke $3\frac{1}{2}$ feet high, including cope-stone, with three wires on the top, is the most durable of all plantation fences. It should have a firm foundation, with a base-course 32 inches wide, and should be built with a regular batter, having a through-band stone at every 3 feet, to a width of about 14 inches at the cope, which should be bedded in lime, and pointed.

The standards for the wires should be set 36 feet apart, and firmly batted into the through-band stones. Straining pillars should be set at about 180 yards apart, and iron droppers firmly wedged to the wires every 6 feet. Provided stones are got within a reasonable distance, and taking cartage and labour at an average rate, this class of fence can be erected in a workmanlike manner for 1s. 10d. per lineal yard.

Turf-Dyke and Wire-Fencing.—Where shelter is necessary, and stones are scarce, a single turf-dyke with three wires on the top is the best fence. On the outside of this dyke there should be a ditch $5\frac{1}{2}$ feet wide at top, $2\frac{1}{2}$ feet wide at bottom, and about 2 feet deep. The turf used in building the dyke is cut to about

6 inches thick, and the excavated earth is thrown to the back of the dyke, sloped up, and firmly trodden.

The height of this kind of dyke from the bottom of the ditch when finished should be about 6 feet, as after a time the turf will settle and reduce the original height by at least a foot. The base of this dyke should be about 2 feet wide, and the cope or topmost turf, 15 inches wide, should be turned with the green side up, all the others being turned with the green side down.

The posts for the wires, whether of wood or iron, should be put in while the dyke is being made, and the wires attached afterwards. The posts should be placed at 18 feet intervals, with two droppers between. The cost of this description of fence should not, in ordinary circumstances, exceed 1s. per lineal yard.

Wire-Fencing.—Where shelter is of little importance, and it is only necessary to protect the plantation from sheep and cattle, the Corriemony wire-fence is the cheapest and most durable. The height should be $3\frac{1}{2}$ feet. It should consist of one seven-ply strand of No. 6 galvanized wire on the top, and six wires of No. 8 Bessemer steel below. Standards of T iron (furnished with side stays) for fixing into stone laid 14 yards apart should be erected along the line of fence, and droppers at 6 feet apart should occupy the spaces between. Straining-pillars 180 yards apart should be sufficiently close. The cost of such a fence should not exceed 1s. 2d. per lineal yard.

Fencing against Cattle and Horses.—Where only cattle and horses have to be reckoned with, a much cheaper fence than any of those mentioned can be erected with equal safety to the plantation. It consists of creosoted Scots pine posts placed at 12 feet intervals, with larch straining-posts 200 yards apart, having four lines of No. 7 galvanized steel-wire below and two lines of 3-inch galvanized barbed-wire above. Kept thoroughly strained, this is a perfectly reliable protection against heavy stock. It can be erected at a cost of 6d. per lineal yard.

Fencing against Ground-Game.—It must always be remembered when enclosing ground for planting that the exclusion of ground-game is even more important than the exclusion of farm-stock. No land that is overrun with ground-game can be planted with profit unless the rabbits and hares are either exterminated for miles around, or the whole be enclosed with wire-netting, and the vermin destroyed before planting is begun. For this purpose the

wire-netting used should neither be less than 3 feet high nor wider than $1\frac{1}{4}$ inch in mesh.

Drainage.—The land being safely enclosed, the next step to be taken in order to prepare the soil for receiving the young plants is to drain it. Many failures in young plantations have been due to want of proper drainage. Any experienced forester can easily tell, by the natural appearance of the land and by the plants growing on it, what parts require to be drained.

All plantation drains should be open. The main-drains should be $2\frac{1}{2}$ feet deep, 30 inches wide at top, and 10 inches wide at bottom, with the tributaries from 18 to 20 inches deep.

If the ground proposed to be planted be very wet, or if much of it is composed of "moorband" or pan, then it should be drained at least one year before planting. In this way all stagnant water is removed, and the soil is made pervious to air and rain, both of which assist in breaking up the pan and checking its formation. On peaty or clay soil, the drains should be set closer and dug deeper than in light or drier soil.

The cost of making such drains depends largely on the nature of the soil, as well as on local labour; but on the average, main-drains should be made for about 3s. 2d. per chain, and the tributaries for about 1s. 5d. per chain.

Roads.—In all large plantations a certain number of roads should be laid out. Everyone having the management of large woodlands knows the importance of good roads. Whatever tends to lessen haulage and facilitate the harvesting of the future crop should receive careful consideration. Not only do such roads reduce the cost of removing thinnings, etc., but they are also of great service to sportsmen. It has been argued by some that it is not economical to make the roads until they are required for the removal of thinnings. With those we cannot agree, because main roads can be made much more cheaply, and also much firmer, by simply marking off and opening the side-drains *previous* to planting.

If the roadways were planted, all the stools of the trees would require to be rooted up before carting began. This is no small labour, and would cost as much as the trees on the roadway would be worth at the time of the first thinning. The soil, too, would be so loose and open from the roots of the trees that grew in it, that it would take a long time before the surface would be firm enough to stand any ordinary traffic. Another great

advantage in laying off the roads before planting is that the contour of the area can be seen, and the roads laid out along convenient lines on hard and firm ground.

The cost of road-making of course depends on the nature of the ground, but on an average it should not exceed 1s. per lineal yard. Roads should not be taken in a straight line to the outside of the plantation.

Plants and Planting.—Before selecting plants for planting, the forester should go carefully over the enclosed area and estimate the total number of each kind of tree he will probably require. Much of the success or failure of a plantation depends on this important matter, and frequent mistakes have often in the past been made by planting kinds of trees not really well suited to the given soil and situation. The main points to be considered in this respect are the following:—

Altitude.—Elevation and exposure are important factors as regards the growing of timber for profit; and of course local circumstances vary greatly in this respect. For instance, trees may grow well on a tableland sheltered from wind by higher hills; while at the same height, on an exposed site, they would always remain stunted. The forester must therefore use his own judgment, based on practical experience, in deciding up to what altitude planting has a fair chance of proving profitable. Generally speaking, where bracken, close healthy heath, or mountain grasses no longer thrive, one cannot expect to grow timber with profit. The most suitable crops are usually as follows:—

Moorland and Hill.—On peat with a clayey subsoil plant Scots pine in pure crop. On sandy peat or heathy soil resting upon ferruginous clay, either Scots pine, spruce, or larch will grow.[1]

Hillsides and Plateaux.—Sandy loam, resting on sand or gravel, is well suited for the growth of all the kinds of pine in common cultivation. Chalky soil resting on calcareous sand is particularly well adapted for the growth of beech, ash, and oak.[1]

Valleys.—Moist clay, with a mixture of gravel and sand, will grow oak, ash, sycamore, maple, elm, hornbeam, and all kinds of pines. A clayey loam, with a clay and gravel subsoil, is the most fertile, and will practically suit all our indigenous trees.

Selection of Plants.—When selecting plants for purchase, the forester should visit the nurseries during the summer months,

[1] In warm situations, Weymouth pine does well on good peaty soil, and Austrian pine fairly well, even on poor lime.—Hon. Ed.

when the plants are in full growth. If there be any signs of disease, or of beetles or caterpillars amongst the plants, their ravages are more easily detected then than in the winter months when deciduous foliage has been shed, and when the year's growth is finished.

Diseased or damaged plants should not be purchased, nor any which have been over-crowded in the seed-beds or in the nursery-lines. These are readily known by their long, thin growth, their very thin bark, and their deficiency in fibrous roots. Plants grown crowded in the nursery never harden their young shoots sufficiently to protect them against severe frost when planted out; thus loss and disappointment are often caused.

In purchasing *Scots pine*, if the ground to be planted is covered with short heathy growth, then select plants which have been two years in the seed-bed and one year transplanted, and which have short, stubby stems well furnished with branches, dark green needles, and a good supply of fibrous roots. If the ground to be planted is covered with bracken, rough grass, or heather, then use plants which have been two years in the seed-bed and two years transplanted. The bigger plants will occasion less cleaning or weeding during the first two or three years after planting, and will thus repay their higher cost.

Spruce, which is of slower growth than Scots pine at first, should stand two years in the seed-bed and three years (twice transplanted) in the nursery-lines before being planted out.

In selecting *larch* for ordinary ground, the plants should be one-year seedlings, one year transplanted. If the surface of the ground be covered with rough herbage, then use two-year seedlings, two years transplanted. See that they have their original leaders, for often the young plants nipped by frost in the seed-bed afterwards develop a bushy crown which no method of cultivation can remove.

Hardwoods should not be planted out less than three feet in height, and they should be twice transplanted.

Another important point to be kept in view when selecting plants is that they should not be brought from a low-lying, well-sheltered nursery and planted on a high, exposed situation. To have a fair chance of thriving, the plants should be taken from some nursery of about the same altitude and exposure as that of the new plantation.

Planting.—Having selected the plants, great care has to be

exercised in lifting them in the nursery. There should be no breaking or barking of the rootlets; and the roots should not be exposed to the atmosphere one minute longer than is actually necessary.[1] In tying or bundling them use willow wands in preference to twine, as the wands are less apt to damage the bark.

In conveying them to the scene of operations, make sure that none of the roots are exposed to the air. Immediately they arrive, heel them into the earth. If the bundles be large, loosen the wands and spread the plants in the heel to prevent heating.

Mode of Planting.—Scots pine, spruce, and larch should be planted by notching, and hardwoods by pitting.

In notching, each man with a half-worn spade cuts the surface like a cross, or in the shape of the letter L or T, and turns up the ground by pressing the handle of the spade downwards, when the plants are inserted into the cut, and afterwards firmly pressed with the heel of the workman's boot. Care should be taken that each cut is made deep enough to admit of the plants being inserted without doubling or cramping the roots. Before firming the soil with the foot, the plant should be gently raised upwards to get the roots into a natural position. It is also important, especially when notching larch, that the planter should not injure the bark of the plants with his heel when firming the soil, because such wounds often lead to fungous diseases.

Never allow the young trees to be planted deeper than they originally stood in the nursery. Inattention to this simple rule often proves disastrous.

In a district where boys can easily be hired, it is best for each man to be followed by a boy who carries the plants in a strong apron and inserts one into each notch as it is opened by the spadesman. In this way a man and a boy on ordinary ground should plant from 1400 to 1600 plants a day.

Where boys cannot be got for inserting the plants, a man with a light spade in one hand and plants in the other can plant as well, though not as quickly, as a man and a boy. On ordinary ground a man can generally plant about 1000 plants a day.

[1] The importance of protecting the tender rootlets against the drying action of the air has not hitherto been sufficiently recognised. The root-hairs and suction-rootlets, through which the plants imbibe moisture and food from the soil, very soon dry if exposed to the air; and if any large proportion of these be withered, it is impossible for the plant to establish itself and grow well until the damaged root-hairs and suction-roots have been replaced by new ones.—Hon. Ed.

In notching it is necessary to have either a boy or a woman for every eight or ten men, with a basket to carry the plants from where they are heeled. A handful is then served out to each man whenever he requires plants.

In pitting hardwoods the workmen should be guided by the root-room required for the different species. Enough room should be made so that the roots of the plants can be laid out to their full length.

When *Scots pine* is planted for profit, it should form a pure crop, at from 3 to 4 feet apart, according to the soil and situation.

Spruce always does best when planted as a pure crop. In hollows and moist places it may be grouped very effectively in a plantation the bulk of which is composed of Scots pine.[1] Spruce should be planted at 3½ or 4 feet apart.

Larch thrives best on land which has a northern exposure. It may either be grown as a pure crop, or in mixture with beech or Douglas fir, and in either case about 4 feet apart is a suitable distance. If associated with beech or Douglas fir, plant two of the former to one of the latter.

All *Hardwoods*, whether grown pure or as mixed crops, should be planted at from 4 feet to not more than 6 feet apart. When planted wider they take longer to establish themselves, owing chiefly to their exposed condition, and many deaths often occur during the first and second years.

The *Cost of Plantations* depends largely on their size. Planting on an extensive scale costs less per acre than when small areas are dealt with; and much also depends on the amount of drainage necessary, and the kind of herbage with which the ground is covered.

The following is the approximate cost per acre of enclosing, draining, forming roads, and planting, with Scots pine, larch, or spruce, about 500 acres of waste land in the north of Scotland:—

Enclosure, say 25 yards of fencing, at 1s. 3d. per yard,	£1	11	3
Drainage,	0	10	0
Main road,	0	6	0
Plants,	2	12	6
Notch-planting,	0	14	0
	£5	13	9

[1] This, of course, forms a mixed crop, as is best.—Hon. Ed.

Assuming an equal area to be planted with hardwoods, then the price per acre would amount to about £6, 15s. because, although fewer hardwood plants are required per acre, the price of pitting will be more than double that of notching conifers.

Scots pine, larch, and spruce can, in ordinary seasons, be safely planted from the middle of October to the end of November, or from the middle of February to the middle of April. Hardwoods may be planted during the whole of November, or during February and March. In a comparatively mild season hardwoods may also be planted in December, and even in January. No kind of tree stands planting during frosty weather.

Tending.—The first necessary attention is the cleaning of weeds or rough herbage likely to smother the young plants. This kind of work is best done with a hand-sickle, care being taken not to injure the leaders of the plants. Weeding should be done yearly until the young plants have outgrown the risk of being suffocated by weeds.

Another important matter is the filling up of blanks caused by death or otherwise during the first and second years after planting. Inattention to this at the proper time is the chief cause of the open and uneven-aged plantations that are so common in this country.

Once the young crop is completely established, the only attention it will require for a number of years is the occasional cleaning out of the drains, and frequent inspection by the forester to see that it is keeping free from insect pests or fungous diseases.

If the young crop is being damaged by the Pine-Weevil, steps must be taken to trap the Weevil in beds of sawdust or in rough bark placed at convenient centres in the plantation, and regularly visited to collect and destroy the insects.

The larvæ of the Pine-Sawfly are generally found in large clusters feeding on the young needles, and the damage they do is easily detected by the needles of the young pine-shoots being completely stripped off the branches. When Pine-Sawfly caterpillars attack a young plantation, the only remedy is for boys, supplied with strong gloves, to go carefully over the young trees and destroy the larvæ, wherever found, by crushing them with the gloved hand.

Thinning.—Generally speaking, pure crops of Scots pine and

spruce require little or no thinning until they have passed their twentieth year. Much depends, however, upon the nature of the soil on which they have been planted, as well as the climatic conditions which influence their annual growth, as these determine the vigour and annual growth of the young trees. One plantation may be benefited by thinning when it is only in its sixteenth year, while another of the same kind may need no thinning before its twentieth year, or even later.

Scots pine being light-demanding, will require earlier and more frequent thinning than spruce.

Under no circumstances, however, should either species be thinned until the "struggle for existence" is well begun, and until a fair proportion of the side branches are dead and the stems have begun to clean themselves naturally. From neither of these species can a proprietor hope to derive any profit until after they have reached their twentieth year.

Larch, when grown as a pure crop, requires to be thinned earlier than either Scots pine or spruce, because it needs more air and light than do either of these other two trees.

In an agricultural district where there is always a demand for sheep-netting stakes, or for hop or other poles, young larch thinnings of about sixteen years' growth will not only pay for the cost of cutting, but will also leave a balance.

Among *Hardwoods*, only ash and Scots elm can be expected to yield any profit from the first thinning, which, in ordinary circumstances, will take place when the crop is from sixteen to eighteen years old. Ash and Scots elm (as also birch among softwoods) can in many places be sold profitably for making scavengers' brooms and crates, and for stakes for horticultural purposes.

In thinning any kind of wood, the trees to be specially protected are those which are intended to form the mature crop ultimately. British woodlands have suffered greatly in the past from proprietors and foresters having been naturally desirous to procure money from thinnings which have been undertaken to suit the requirements of the time being. Thinnings have therefore often been made heavily, without sufficient thought being paid to what influence they might exercise on the future yield and value of the crop.

As a rule, and especially in young plantations, it is better to thin lightly once every five or six years, than to make heavy thinnings every eight to ten years. Until crops are approaching

their maturity, it is usually best to maintain close canopy overhead, so as to prevent deterioration of the soil.

Before interfering to any great extent with the density of a pure crop of spruce or Scots pine, the trees should be allowed to have attained their main growth in height. Always try to get them to grow high first, then let them thicken in girth afterwards.

While it may be taken that in most districts the first thinnings from young plantations are of little or no money value, the later returns from these must by no means be underestimated.

Unfortunately we have as yet no reliable average returns of what may be expected from thinnings in British plantations grown for profit and on a definite rotation. Hence we must still look to the Continent to see to what general extent thinnings may be expected from crops of normal density for any given kind of tree.

In a conifer wood to be felled at ninety years of age, thinnings may be assumed to take place every ten years after the plantation is twenty-five years old, and Burckhardt's yield tables for Hanover furnish useful data as to the number of cubic feet which may be expected as thinnings before the final crop is cleared.

Where the soil is good, and where the crop is of normal density, he reckons that the thinnings from pure *spruce* woods would give an annual average yield of 30 cubic feet per acre, or a total for thinnings alone of 2700 cubic feet (true cubic contents) per acre. This is equal to 2120 cubic feet square-of-quarter-girth measurement, which at 3d. per cubic foot is worth £26, 10s. in all.

The number of spruce trees growing on an imperial acre at ninety years of age may reasonably be calculated at 280. Each of these would average about 16 cubic feet, or a total of 4480 cubic feet of timber as representing the final yield, the money value of which may be moderately estimated at 4½d. per cubic foot, or £84 in all. This sum added to the value of the thinnings brings the total returns for ninety years up to £110, 10s. per imperial acre. Estimating the cost of fencing, draining, and planting, etc., at £5, 13s. 9d., and the tending, management, and payment of rates and taxes at 3s. per acre per annum, this leaves a net average annual revenue of about 23s. 3d. per acre, although, of course, the only proper method is to prolong all the items (except the value of the final yield) at compound interest up to ninety years of age.

From a pure *Scots pine* plantation grown on suitable soil, the average annual returns are slightly more favourable. Taking

Burckhardt's figures again for the expected yield from thinnings, these may be estimated at about 24 cubic feet per acre per annum; making a total for thinnings during a ninety years' rotation of 2145 cubic feet (true contents), or about 1685 cubic feet British measurement, worth about 4d. per cubic foot, or £28 in all.

The number of Scots pine per imperial acre at ninety years should be about 230. Each of these would average about 18 cubic feet, yielding a total of 4140 cubic feet of timber, worth about 5d. per cubic foot, or £86, 5s. in all, and making the total returns about £114, 5s. per acre. Allowing for expenditure as before, this leaves an average annual revenue of 24s. 4d. per acre.

The above estimates as to the market price for spruce and pine are slightly below those at present obtainable in this district.

It is unnecessary to make similar estimates of the expected yield from other trees; but it may be asserted that the net annual revenue to be derived from well-managed plantations of larch, or from oak, ash, elm and other hardwoods will probably be at least one-third more than that derived from either pure crops of Scots pine or spruce. And it may further be asserted that land, the value of which is not more than 10s. per acre per annum for agriculture or pasturage, will prove more profitable in growing timber, the demand for which is constantly increasing, while the supplies are diminishing.

XV. *The Colorado Variety of the Douglas Fir* (Pseudotsuga Douglasii, Carr.), with Photograph. By the Assistant Editor.

In British gardens and pineta fully half-a-dozen varieties of the Douglas fir occur which differ from the type in their habit or in the colour of their foliage. Most of these varieties have been derived from plants under cultivation, but one, the so-called Colorado variety, is a well-known geographical form, while another, *taxifolia*[1] (formerly occasionally met with under the varietal name *Drummondii*), which differs from the type in its longer, deeper-green leaves, and in its less spreading habit, is also said to occur in a wild state.[2] A third plant, formerly regarded as a variety of the Douglas fir, but now raised to the rank of a species, inhabits a somewhat restricted area in Southern California. This is *Pseudotsuga macrocarpa* (Mayr), a species which, according to authorities, is still rare in British collections.[3]

Within the last few years the form known in British nurseries as the Colorado variety has received a good deal of attention from planters, and it has been recommended for planting in some parts of Britain[4] in preference to the ordinary green or, as it is often called, Pacific type on account of its greater hardiness of constitution; but there are reasons why planters should exercise caution in regard to the formation of extensive plantations of this variety. For one thing, the ordinary green or Pacific type of the tree is quite hardy enough for all parts of

[1] *Pinus taxifolia* (Lambert) is the oldest name of the Douglas fir. The name was applied by Lambert (in 1803) to the herbarium specimen collected by Menzies, the discoverer of the tree, in 1792.

[2] In Veitch's *Manual of the Coniferæ* (new ed., 1900), *taxifolia* is mentioned as a "local form which has been somewhat vaguely stated to occur in Oregon and Mexico, but more definite information respecting its origin is wanting." In his *Silva of North America*, Professor Sargent takes no account of *taxifolia* as a geographical form.

[3] It is stated in Veitch's *Manual* that, "with the exception of *macrocarpa*," all the varieties therein mentioned are occasionally met with in British gardens. Since the publication of the *Manual*, however, *Pseudotsuga macrocarpa* has been introduced into the Arboretum collection at Kew (*Hand-list of Trees and Shrubs grown in Arboretum*, 2nd ed., 1902). A third species (*P. japonica*) has recently been discovered in Japan.

[4] Professor Schlich (see *Transactions R.S.A.S.*, Vol. XVII. p. 196) recommends the Colorado variety for planting in Scotland and the north of England.

Britain excepting, perhaps, a few of the coldest or most exposed localities. Its rate of growth, in the earlier stages at any rate, far outstrips that of the Colorado variety, and in all probability it produces a better quality of timber than that tree; and there is also the fact to be taken into account that the growing of the Colorado variety is, as yet, only in the experimental stage in this country, and, as a timber producer, it is therefore an unknown quantity.

But there seems to be some doubt as to the identity of this Colorado variety of British nurseries. In his *Silva of North America* Professor Sargent refers to the failure which attended the first attempts to introduce the Douglas fir into the eastern United States by means of plants raised in England from seeds collected in Oregon, or produced from trees grown in Europe, and to the subsequent success of the project by means of plants raised in the Botanic Garden of Harvard University from seeds collected by Dr C. C. Parry, in 1862, on the outer ranges of the Rocky Mountains in Colorado. Sargent speaks of the plants raised from these Colorado seeds as having grown "rapidly and vigorously" in the neighbourhood of Boston, and of their giving promise of "surpassing all other exotic conifers in permanent beauty and usefulness." There is nothing in Sargent's statement to indicate that the rate of growth of these trees is slow; in fact, it seems to point in the opposite direction. But the plants grown in British nurseries as the Colorado variety are of extremely slow growth, in some cases so slow as to render it difficult to reconcile their identity with that of the Colorado plants referred to by Sargent as growing at Boston. And this question of identity has become still further complicated by a statement made by Professor Schwappach in his report on the result of experiments with exotic trees conducted in Prussia, expressing the opinion that the distinctive characters of the plants grown by English nurserymen (who, he says, define Douglas firs as of the green and blue or glaucous varieties) agree with those of the ordinary green type of the Douglas fir and *Pseudotsuga macrocarpa* respectively. Whether Professor Schwappach is right in his conjecture remains to be seen, but Kent[1] states that it is the variety *glauca* which "is known in many gardens as the Colorado variety in reference

[1] Veitch's *Manual of the Coniferæ* (new ed.), p. 484. The opinion of Kent that the Colorado plant is the variety *glauca* is concurred in by Mayr and other authorities.

to its origin, although it is not found exclusively in that State, but along the Rocky Mountains almost from north to south," while *P. macrocarpa* is described[1] "as a local form inhabiting the San Bernardino mountains in South California, and their continuation into northern Mexico."

In his *Silva of North America* Professor Sargent places the Douglas fir under *Pseudotsuga mucronata* (Sudworth), and in his conspectus of the North American species he gives the following as their distinguishing characters:—

Leaves usually rounded and obtuse at the apex, dark yellow-green or rarely blue-green; cones small, their bracts much exserted. 1. *P. mucronata.*

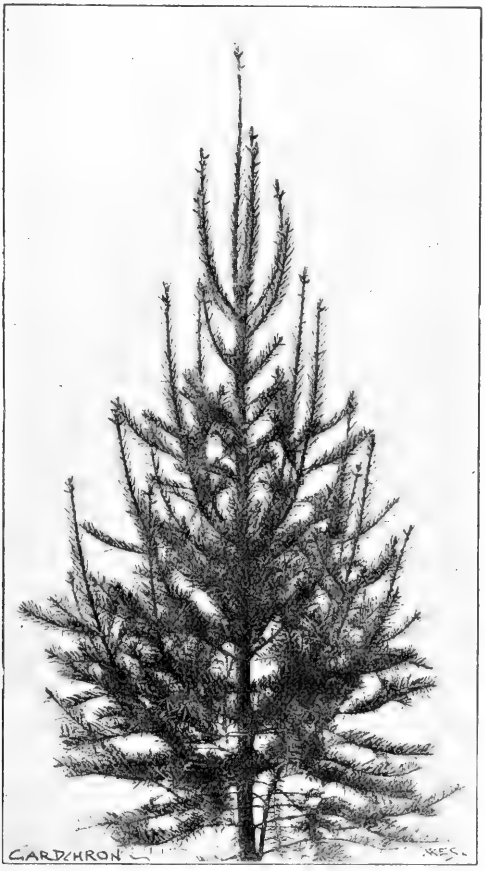
Leaves acuminate at the apex, bluish grey; cones large, their bracts slightly exserted. 2. *P. macrocarpa.*

What seems to favour Professor Schwappach's view that the glaucous-leaved plants grown in British nurseries belong to *P. macrocarpa* is that, in not a few instances,[2] the plants have markedly sharp-pointed, blue-grey leaves, and winter-buds which seem to agree more closely in their characters with those of *P. macrocarpa*, as described by Sargent, than with those of the Douglas fir; and in yet another particular is there a similarity between the two plants, for, according to Sargent, *P. macrocarpa* is not only a comparatively small tree, but it is also of slow growth. But as the glaucous-leaved plants which occur in plantations in this country are as yet comparatively young, and as Sargent's descriptions no doubt apply only to plants of more mature growth, too much importance ought not to be attached to such variable characters as the form of the leaf and the shape of the winter-bud, and until the plants reach the cone-bearing stage the question of identity must remain in doubt. Of more importance, perhaps, from a sylvicultural point of view, is the rate of growth of these so-called Colorado plants, as compared with the ordinary type of the Douglas fir, and with other kinds of forest trees; and it may be of interest to give here some particulars relating to the rate of growth of some of these glaucous-leaved plants which have come under my observation recently.

[1] *Loc. cit.*

[2] The possibility of two or more distinct forms occurring in nurseries under the name "Colorado variety" has to be kept in view.

Three years ago Mr Annand sent me from the Haystoun estate, near Peebles, specimens of a Douglas fir which exhibited very slow height-growth, and regarding the identity of which he expressed some doubt; and subsequently I had an opportunity of seeing the plantation, which consists of a mixture of



GLAUCOUS-LEAVED FORM OF DOUGLAS FIR.
Age 8 years; height above ground 4½ feet.

this plant and common spruce, from which the specimens came. When I visited the plantation I endeavoured to secure a photograph of one of the plants *in situ*, but owing to their unsuitable surroundings I was not successful in obtaining satisfactory results. In the beginning of last year, however, by the favour

of Mr Massie, to whom the plant was sent from the south of England for identification, I was able to obtain a satisfactory photograph of a plant which seemed identical in its characters with the Haystoun plants, and by the courtesy of the proprietors of the *Gardeners' Chronicle* I am able to give here a reproduction of the photograph, from which it will be seen that the plant is quite distinct in habit from the ordinary green type of the Douglas fir. In this plant the main side branches, instead of spreading out horizontally, as in the ordinary green type of the Douglas fir, take a more or less erect course which, coupled with the short intervals between the whorls of branches, gives it a bushy appearance, with a branch-habit not unlike that of the Scots pine when of the same age. Regarding the source from which either this or the Haystoun plants emanated I can say nothing, but in both cases the leaf and bud characters seem to agree closely with those of the species *macrocarpa* as described by Sargent in his *Silva*.

By the favour of Mr Annand, who has kindly obtained the particulars for incorporation in this note, I am able to give here some information relating to the growth of these glaucous-leaved Douglas firs at Haystoun, and of the spruce with which they are associated; and also of the plant sent to Mr Massie for identification. The plants selected for measurement by Mr Annand were average specimens, and they therefore give a fair idea of the height-growth over the whole plantation. The plantation, which is small, grows on a rather stiff, clayey soil, varying to sandy clay, and on a site which was formerly occupied by a heavy crop of spruce, with a few larch and silver fir intermixed.

Both the Douglas fir and the spruce in the Haystoun plantation are at least thirteen years old, while the English plant sent to Mr Massie was at least eight years old; but owing to the difficulty of accurately ascertaining the age at the lowermost part of the stem, the ages given in the following Table must be taken as approximate only.[1] At 6 inches above the ground

[1] In all three cases the age of the stem at 6 inches above the ground was scertained by counting the number of annual rings, and a year was added to this for the age of the plant. Possibly two years should have been added, but as Mr Annand states that he has had two-year-old seedlings of the Colorado variety 6 to 7 inches high, the age has been fixed on the assumption that these plants were over 6 inches high when two years old.

the diameter of the Haystoun Douglas fir plant which was measured was $1\frac{1}{2}$ inch, while that of the English plant was $\frac{3}{4}$ inch at the same height; and Mr Annand states that, in the case of the Haystoun plants, so far as diameter-growth goes the advantage lies with the spruce.

HAYSTOUN PLANTS.

	Spruce. Inches.	Douglas Fir. Inches.
13th Year (1904),	20	$14\frac{1}{4}$
12th „ (1903),	15	$12\frac{1}{2}$
11th „ (1902),	20	11
10th „ (1901),	18	$9\frac{3}{4}$
9th „ (1900),	14	$7\frac{1}{2}$
8th „ (1899),	9	9
7th „ (1898),	6	9
First 6 years,	16	17
Total,	118	90

ENGLISH PLANT.

	Douglas Fir. Inches.
8th Year (1903),	$14\frac{1}{2}$
7th „ (1902),	13
6th „ (1901),	$6\frac{1}{2}$
5th „ (1900),	4
4th „ (1899),	$2\frac{1}{2}$
First 3 years,	$13\frac{1}{2}$
Total,	54

From these measurements it will be seen that in the case of the Haystoun plants growing under precisely similar conditions, the spruce grew more slowly before the eighth year than the Douglas fir, but more rapidly afterwards, and that in the case of the English plant the growth in the seventh and eighth years was better than that of the Haystoun plant. Mr Annand states that there is none of the ordinary green type of Douglas fir at Haystoun of the same age as these glaucous-leaved plants, but that at about half-a-mile distant from this plantation, on the same kind of soil and under similar conditions, plants of the green form about twenty years old have made annual growths varying from 2 feet 6 inches to 3 feet for the past six years.

XVI. *The Douglas Fir Plantation at Taymount* (with Photograph).

By the Assistant Editor.

Statistics relating to the growth of this plantation have been published in the *Transactions*,[1] but, so far, no illustration of it has appeared therein; and as there are, no doubt, many members of the Society who have not had an opportunity of seeing this unique example of coniferous sylviculture to whom such an illustration would be welcome, I take the opportunity to give here a reproduction of a photograph taken in the interior of the plantation which, by the courtesy of the Earl of Mansfield, I was able to obtain in the summer of 1901, two years before the data for the statistics last published in the *Transactions* were collected.

The plantation was formed in 1860, and it consisted originally of a mixture of Douglas fir and larch, arranged on a system of squares according to the following plan:—

D	L	D	L	D
L	L	L	L	L
D	L	D	L	D
L	L	L	L	L
D	L	D	L	D

The Douglas firs were planted in lines 12 feet apart, and at intervals of 12 feet in the lines, and the intervening spaces were filled up with larch, as indicated in the above plan, making the common distance between the plants composing the plantation 6 feet. Previous to 1897, however, all the larch and a considerable number of the Douglas fir were removed, and the trees now stand in lines 12 feet apart, and at varying distances apart in the lines.

The photograph was taken from a point in one of the lines formerly occupied by the larch, the stools of which, as may be seen from the illustration, still remain to indicate the positions of the trees; and it is to the fact of its having been taken from this position that the avenue-like appearance presented by the lines of Douglas fir in the illustration is due.

[1] Vol. XII. p. 226; Vol. XVII. p. 269.

[*Photo, A. D. R*

DOUGLAS FIR PLANTATION, TAYMOUNT, 1901.

XVII. *An Account of a Chafer Infestation* (with Plan). By FREDERICK MOON, Forester, Mount Trenchard, Foynes, Co. Limerick.

I came here in October 1900, and in December following I broke up for the formation of a permanent nursery part of a field which, within the memory of the oldest inhabitant, had been continuously under pasture. The site was plough-trenched, was four times re-ploughed, and was well harrowed before drilling for potatoes in March 1901. A fairly good crop of potatoes was harvested, but it was damaged more or less, in patches, by wire-worms. No sign of chafers was seen during the foregoing operations, all of which took place during the season of hibernation of the insect. In late autumn and early winter the walks and roads were laid off and soled, and the soil in the breaks and borders was then dug to the depth of a foot, levelled, and ridged up. Towards the end of March and throughout April, 1902, the various plants were lined out, seed was sown in beds in May, and all went well till July.

Mount Trenchard demesne is situated in County Limerick, on the left bank of the Shannon estuary. It overlies the Coal Measures, and the soil consists of a stiff tenacious loam, of an average depth of about two feet. The underlying stratum is shale, locally called "pencil," and it forms outcrops in various parts. The aspect, exposure, and prevailing winds are north-westerly.

In the nursery there are three outstanding types of soil, as follows:—

I. Hard, stony, or brashy soil in the north-east corner.
II. Medium stiff loam, which occupies the central part, and comprises fully three-fourths of the whole area.
III. Very stiff loam in the lower or west end, and this is stiffest at the north-west corner.

As regards relation to soil, the grubs were most numerous in Class II., absent in the worst parts of Classes I. and III., and gradually changed from a less to a greater degree of infestation as the soil changed from the 1st and 3rd classes to the 2nd; that is, the grubs were most numerous in the medium soil, and gradually decreased in number with the change from medium

till they vanished in the stiff tenacious soil on the one hand, and the hard brashy soil on the other.

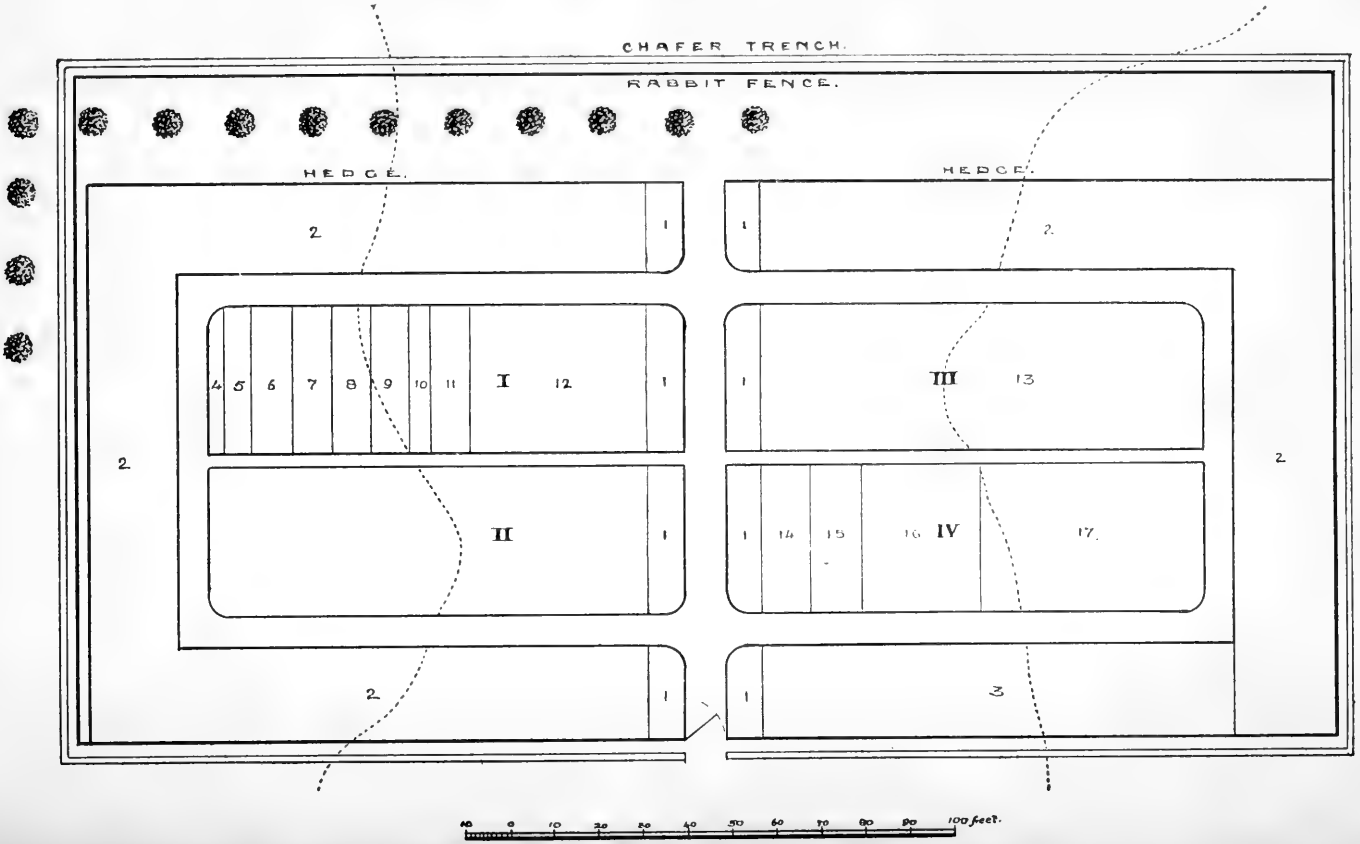
The total nursery area included within the fence is about 1 acre, but a strip on the north side 8 yards wide is planted on the lower half, alternately with *Cupressus macrocarpa* and common silver fir, as shelter to the nursery from cold spring winds, and these are continued for a short distance along the west side. The nursery proper contains about 3 roods 24 poles.

In the spring of 1902 the nursery was planted as follows (see Plan):—

Break I. 3-feet cherry plum (*Prunus mirobalana*) (4), 2-feet beech (5), 2-feet ash (6), 3-feet oak (7), 3-feet elm (8), 3-feet *Cotoneaster Simonsii* (9), 2-year 1-year Scots and Austrian pines (10), 3-year seedling spruce (11), 2-year seedling Scots pine (12). Break II. was sown with tares, in order to keep the land clean and to act as manure, as were also the borders (2) round the outside of the nursery, with the exception of a portion (3) on the south side which was used for seed-beds. Break III., 2-year seedling larch (13). Break IV., 2-year seedling silver fir (14), 2-year seedling spruce (15), 2-year seedling Scots pine (16), and 1-year seedling larch (17). In the main borders (1) on either side of the centre walk cypresses were planted.

I first noticed signs of damage to the various plants in the first week of August 1902, on returning from a three weeks' holiday. By the end of that month the damage had become serious, and in order to save the undamaged plants, I was obliged to lift first the Scots and Austrian pine and the spruce in Break I., then the Scots pine in Break IV., and the cypresses in the main borders. Following this came the seedling *Cupressus macrocarpa* and *Pinus insignis*, from seed sown in the previous May. By this means we exposed, counted, and destroyed a large number of chafer grubs.

Finding that the roots of the pasture outside the nursery on the north and south sides were simply alive with grubs, I made a trench, 2 feet deep, right round the nursery, in order to prevent them coming in, which they unquestionably did. I then stripped all the turf on the nursery side of the trench, and got a large number by this means. A point worth noting is the fact that the grubs which had been feeding on the roots of the grass seemed better nourished than those which had fed on the forest-tree roots. In all we destroyed three thousand large grubs.


CHAFER TRENCH.
RABBIT FENCE.
HEDGE.
HEDGE.
2
1
1
2
4
5
6
7
8
9
10
11
I
12
1
1
III
13
2
2
II
1
1
14
15
16
IV
17.
2
1
1
3
10
0
10
20
30
40
50
60
70
80
90
100 feet.

Throughout the summer and autumn the chafer grubs seemed to feed from the points of the roots upwards to about 1 inch from the surface of the ground, but we got more at from 3 to 4 inches from the surface than at any other depth.

One Sunday towards the end of August, while walking in the nursery, I noticed a 2-year 1-year Scots pine transplant in Break I. making part of a revolution on its axis and then returning. This motion was kept up until, by digging the earth from the stem of the plant with my penknife, I discovered a chafer grub at a depth of 3 inches with the stem of the plant between its mandibles. The root was completely severed from the stem just below that part, but it must have taken a considerable amount of energy to turn and re-turn the plant, which was not a large one, in 3 inches of soil.

In November, while lifting 2-year 1-year larch, we got a number of grubs at a depth of about 1 foot from the surface. Once, in September, while bastard-trenching the break which had been in tares for the following year's seedlings, one of the men noticed a vertical burrow, and following it downwards, got a fully-developed male chafer at a depth of 18 inches.

August I found to be the month in which most damage was done by the grub to the roots of the plants.

With large plants, say of 2-year 1-year and over, the most economical and at the same time the most effective way of exposing the grubs is to lift the plants wholesale and transplant to ground free from the pest, choosing for this operation, when possible, showery or wet weather; and with good luck the plants may be none the worse for the unseasonable removal. I also tried trapping with potatoes sunk below the surface of the ground, and examined once a day. By this means we trapped over two thousand wire-worms which were destroying seedlings, but these potato traps seemed to be a failure so far as the capture of chafers was concerned. Another plan, which was also a failure, was to lay willow rods with sappy bark below the surface of the ground and between the lines of plants.

The following, applicable to 1- or 2-year seedlings recently lined out in the break, was the most successful plan tried. Towards the end of May 1903 I noticed that in the case of 2-year 1-year plants and upwards, the chafer grubs invariably confined their attack to the rind of the roots, injuring the woody part but slightly. In the case of 1-year and 2-year seedlings,

however, the roots were completely devoured, the severance being made at about one inch below the collum. For two or three days, according to the strength of the sun, after being destroyed in this manner, it was impossible to detect any difference in the foliage of the injured plants, and there was, therefore, within the time mentioned, no visible indication of the grub's presence at any particular plant; but although this was the case when the air was still, a moderate breeze was sufficient to bowl over the injured plants like ninepins. I therefore instructed a boy to go over daily the plants in the infested borders, and in the following manner:—Four lines were taken at a time. The plants were grasped lightly at the neck between the fingers and thumb, and at the same time the hand was raised in such a way as to allow the uninjured plants to slip through the fingers, all those with severed roots being removed. On coming to an injured plant, the earth was cleared away with a small trowel, and as a rule the chafer was got at work on the next plant in the line. Occasionally the chafer could not be found. In such cases the spot was marked, and on the following morning the chafer was usually found in either of the adjoining lines of plants, having crossed over in the interval. By this means I got rid of all the chafers, 38 in number, at work among the transplanted seedlings before much damage was done to the plants. It is of course essential to the successful working of this plan that the plants be gone over regularly from the time the chafers begin to rise to the surface to feed in spring, until they are all trapped, but if this be attended to, it is surprising how little damage will be done to the plants.

As showing how difficult a matter it is to clean ground thoroughly of this pest, it may be interesting to note that the soil in both the borders in question had been carefully dug five times in search of grubs, three times in autumn before the grubs hibernated, and twice in spring before the plants were lined out, and numbers were got each time. The soil requires to be thoroughly pulverised, as a very insignificant knot of earth may contain a chafer curled up in the centre.

As regards the natural enemies of the cockchafer, I have occasionally seen a crow at work in the nursery, but whether or not it was grubbing for chafers I am unable to say. No other birds have been observed at this work. There are no starlings here; in fact, in comparison with, say, Perthshire, this

district is decidedly poor in birds. There are no moles, and I have only once seen a hedgehog during my four years' stay here.

The following quotation from *Yarrell's British Birds*, 4th ed., p. 148, may be of interest:—"An examination of 210 pellets composed of the indigestible portions of food thrown up by the 'Brown owl' showed remains of 6 rats, 42 mice, 296 voles, 33 shrews, 48 moles, 18 small birds, 48 beetles, besides a countless number of cockchafers."

Damage to the various species was done in the following order:—

Most Injured.— Transplanted Scots and Austrian pine, and seedling *Cupressus macrocarpa*, *Pinus insignis*, Scots pine, and larch. All of these seedlings were devoured greedily.

Less Injured than above.—2- and 3-year seedling spruce transplants, 2-year seedling larch transplants, and seedling spruce.

Injured.— 1-year seedling larch transplants.

Scarcely Injured. — 2-year silver fir transplants, 3-feet *Cotoneaster Simonsii*, and beech.

Uninjured.—Oak, ash, elm, and cherry plum.

Recuperative power of the various plants.—In cases where the chafer grubs had not stripped the bark to less than 4 inches or so from the surface, larch showed the greatest power of recovering from the mutilation of its roots, more especially where it had been attacked after making a considerable amount of stem growth. Next, and almost equal to the larch in this respect, comes Lawson's cypress. When relaying these in September, I threw the worst damaged plants into the rubbish heap; the others I cut down almost to the ground, and every one so treated has recovered. Scots and Austrian pines and Norway spruce have practically no recuperative power if damaged even to a fairly moderate degree, and in any case it is not worth while throwing good money after bad in an attempt to restore these species to usefulness.

In the summer of 1903 I came to the conclusion that the swarm-year of that generation's parents was in the summer of 1900, before I came here. My reason for thinking so was that the grubs were more numerous in the pasture-field outside the nursery than in the nursery itself. The gardener also told me that in the garden, distant about 50 yards east, he had seldom

noticed a chafer grub, and in the old nursery, distant about 200 yards south-west, an occasional grub is all that has been seen. From these facts I concluded that the chafers preferred pasture to cultivated land for oviposition, and that therefore the generation must have commenced before the new nursery was broken out from pasture.

This year's (1904) experience has proved the foregoing to be correct. The swarm commenced on the evening of May 26th, and lasted till well on in June. The beetles for the first two or three evenings rose from the pasture round about the nursery in a steady, continuous stream, and after this the numbers gradually diminished. A peculiarity of the flight which was observed was that it took place from the north towards the south, and this was also noted by three of my men who lived about a mile distant from the nursery.

In order to (as far as possible) prevent a recurrence of this pest, I adopted three plans. These were—

(1st) I had several heaps of decomposed weeds and earth piled up loosely as traps; (2nd) I sowed flowers of sulphur over the seed-beds and breaks occupied by plants; (3rd) on the breaks thrown out for manuring (this, I may mention, is done by sowing tares in May and digging the crop in while in flower), instead of sowing tares at the usual time, I had the ground thoroughly consolidated by means of a roller until it was as hard as a road. Towards the end of July the ground so treated was carefully dug in search of young broods, but not a single grub or egg was got. Had it been otherwise, I would have applied a good dressing of gas lime. The breaks were then sown out in tares as usual.

An examination of the trap heaps and of the ground treated as indicated above shows no sign of a new generation, and I am inclined to believe that we are now clear of this pest.

In conclusion, I beg to tender thanks to Dr MacDougall for his valuable assistance and advice in this and other matters. Unquestionably one of the greatest benefits derived from membership of our Society is the advice we receive from our Honorary Scientists.

Note.—The approximate limits of the infested area are indicated on the Plan by the dotted lines.

REPORTS BY THE HONORARY SCIENTISTS.

1. *Report by* R. Stewart MacDougall, M.A., D.Sc., F.R.S.E., *Honorary Consulting Entomologist.*

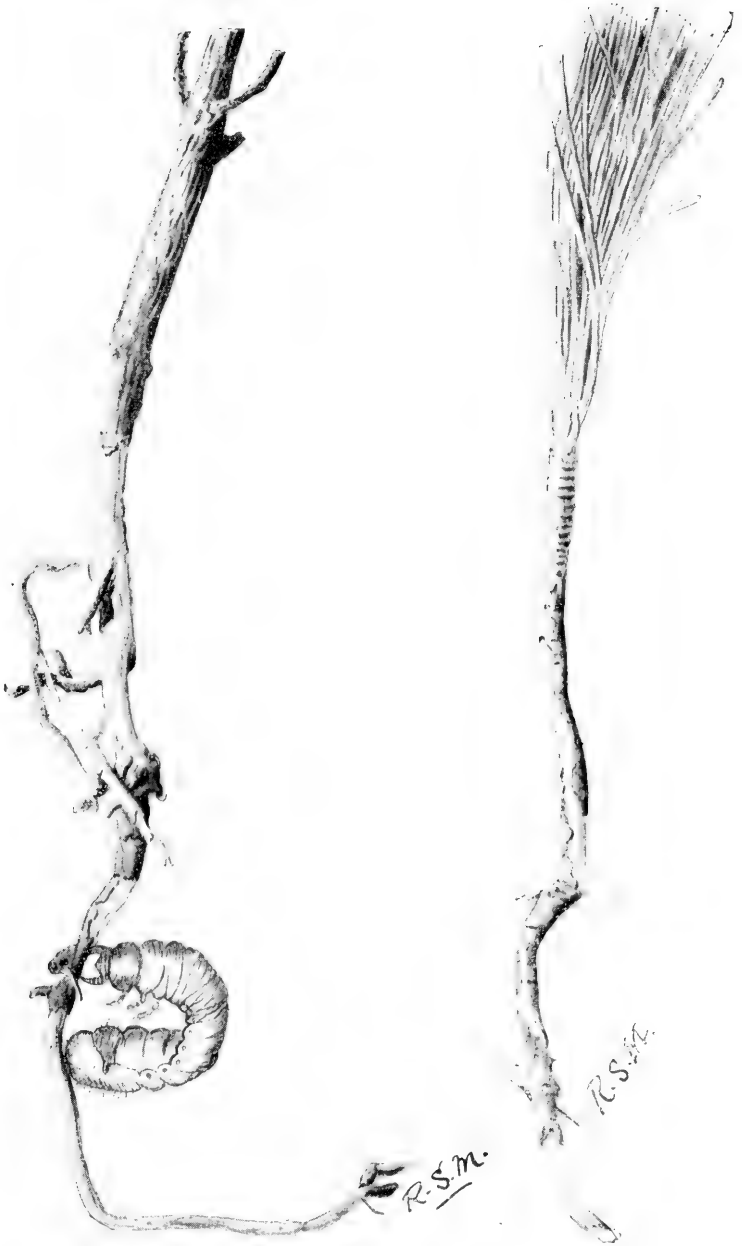
During the past year two insects, amongst others of minor importance, stand out for special reference, namely the Cockchafer and one of the Gall-Gnats injurious to willows.

The Cockchafer (*Melolontha vulgaris*), when present in numbers, is a very troublesome insect in forestry, both beetles and grubs being harmful. The beetles during their flight-time devour the leaves of trees, chiefly broad-leaved species, but the needles of larch, and the male cones of pine and spruce, are also eaten. The grubs are extremely harmful to the roots of young conifers, *e.g.*, pines of various species, spruce, larch, cypress, and in a less degree to silver fir; some broad-leaved species, *e.g.*, beech, are also attacked. The younger roots may be bitten clean through, while older and better grown ones have their bark gnawed away. The leaves of these attacked plants turn yellow, and the whole plant withers away. This discoloration of leaf and withering may not appear immediately in young conifers, and the grubs may have moved to other plants before those, whose roots have been destroyed, show marked signs of withering. That the grubs are at work may also be known by nursery plants being blown over by the wind, owing to their roots being bitten through.

Description of Insect.

The beetle is often an inch in length, with the head and front portion of the body black; the wing-cases are reddish brown, hairy, and with five raised lines on each; along each side of the abdomen are five white triangular marks. The abdomen ends in a prolongation downwardly curved, and not covered by the wing-cases or elytra. The end joints of the short antennæ form a kind of club or fan, made up in the male of seven leaves and in the female of six.

A good idea of the larva or grub may be had from the figure, where a grub is seen at work at the root of a plant.



Young Scots Pine killed by larva of Cockchafer; $\frac{1}{3}$ths natural size.

Young Austrian Pine showing characteristic damage by larva of Cockchafer; $\frac{2}{3}$rds natural size.

(Both Figures are reproduced by the courtesy of the Board of Agriculture.)

[*Photo, A. D. R.*

GALLS OF *CECIDOMYIA HETEROBIA* ON *SALIX TRIANDRA*.

Life-History.

The female beetle burrows into the earth and lays little heaps of eggs, from which, after four to six weeks, grubs hatch. May and June are the months for the adult beetle. The grubs hatching in the summer, feed during the summer and autumn of the year of hatching, and continue their feeding in spring, summer, and autumn of the two following years. Pupation then takes place in the soil, but the beetles do not appear above ground till the next May or June, *i.e.*, a new brood of beetles may be expected every fifth year, the generation lasting four years. In the cold part of the year the grubs go deeper into the soil for protection.

Preventive and Protective Measures.

(*a*) The beetles lay most willingly on light soil and on places exposed to the sun, that is, on land not covered by a tall crop; it is therefore advisable to avoid a clear cutting on a large area in a swarm-year or in the year before swarming.

(*b*) Grass land is often infested with the grubs; plantings therefore of young conifers adjoining such should be separated from the grass land by a narrow trench, to prevent the passage of grubs into the nursery.

(*c*) Ball-planting with vigorous plants.

(*d*) Collecting the grubs during the preparation and working of the soil. The diligent collection of grubs on quite a small area, both before and after planting, resulted, in the infestation mentioned by Mr Fred Moon in his paper in another part of the *Transactions*, in the discovery and destruction of 3000 grubs.

Destructive Measures.

(*a*) Collecting the beetles, taking care to begin with the earliest of the year's flight. The beetles, which fly in the evening, collect in the early morning and daytime on trees, from which they can be shaken or beaten down, with long poles, on to cloths spread below. The beetles are easily killed by dropping them into a little paraffin or into boiling water.

(*b*) When the grubs have got to work, they can be dug up by a trowel or small spade. In addition to the symptoms of attack previously mentioned, where withering of the parts above ground has not yet revealed itself, badly infested plants will be found to come away in the hand, with gentle pulling, and the grubs will

be found either at the roots of these or neighbouring plants. On removal of the grubs from the roots of attacked plants, there is some chance of recovery for the plant if the damage already done has not been excessive.

(*c*) Traps. The larvæ may be trapped. For this purpose pieces of turf, from 8 to 12 inches broad, are laid on the surface of the ground, with the grass downwards; beneath these traps the larvæ collect. Holes may be made here and there, and filled with alternate layers of moss and dung or earth. These holes, especially if prepared in the autumn, may serve as places of hibernation for the grubs, and later as places of egg-laying for the swarming beetles.

(*d*) On a small scale, sowing lettuce and strawberry plants between the rows of young conifers has been found successful. The cockchafer grubs attacked these in preference to the young trees, and the withering of the attacked plants called attention to the presence of the grub.

(*e*) There have been experiments with a view to killing the grubs, by injecting into the soil certain insect-killing fluids, but although there are favourable records of this practice being successful against the cabbage maggot, for instance, little success has been reported against the cockchafer. A similar want of success attended experiments that had for their object the inoculation of the grubs with a disease-causing fungus.

Galls on Willow.

In the month of June 1904 I received several specimens of willow from Mr Alexander M'Rae, Castlecomer. The willows were attacked in a way similar to an attack in 1903. Examination of a sent shoot showed a gall at its apex, and this gall, on dissection, was found to contain a number of the maggots or larvæ of a gall-gnat.

The Cecidiomyidæ, or Gall-gnats, belong to the order Diptera, or two-winged flies. The family is a large and interesting one, numerous in species. The flies of the family are small and extremely delicate; the hairs on body and wings are very easily rubbed off, and this makes determination of the species a matter of great difficulty, and, because of this, examples of the galls (in the gall-making species) are always desired as an aid to identification. The larvæ or maggots, which hatch from the eggs of the female flies, are found in very diverse places accord-

ing to the species, *e.g.*, under bark, in fungi, in flowers and fruits, and in galls on leaves or stems. Some of the best known and most injurious are not found in marked swellings or galls, *e.g.*, the Hessian fly maggots, so destructive to the stems of wheat and barley, and the maggot of the wheat midge, injurious to the young grain. The gall-making species are the commonest, and the galls inhabited by the maggot are to be found on many different plants, both herbaceous plants and trees. More than one species may attack the same tree, and it is not common for the same species to lay on plants far apart in relationship.

Of the gall-gnats whose galls are found on trees, several are not uncommon on the willow, the galls being found on the youngest shoots, or in two-year-old and older twigs, or in the bud at the apex of the twig, or on the willow leaves, or on willow flowers. The galls examined in the specimens sent in, were all terminal. The galls contained small maggots. I bred out the adult insects from the galls, and they proved to be *Cecidomyia heterobia*, as determined by Kieffer. I also bred out along with the gall-gnats a number of beautiful little four-winged Chalcis flies. These latter lay their eggs in the galls, and their maggots on hatching feed off the maggots of the gall-gnat.

The attack of this gall-gnat on willows that were being grown for wicker-work was very severe, and the money loss was considerable.

As to the plants attacked, Mr M'Rae wrote me: "Attack is entirely confined to our best hard brown-skinned varieties, viz., Black Norfolks, Black Mules, and Spaniards, and these sorts, especially Norfolks, are the very best osiers grown for buff wicker-work." These are all varieties of *Salix triandra*, well known in basket-making.

Later Mr M'Rae wrote me as follows: "We cut the whole crop down early in the summer, and burned it. The plants threw up a fairly strong second growth, and they were also badly affected, but not quite to the same extent as the early crop."

Pupation in the case of some species of the gall-inhabiting maggots is in the ground, but, as I have written above, the pupal stage of *C. heterobia* is passed inside the gall. The remedy, therefore, is to cut away the galls and burn them before the maggots have come to maturity. Mr M'Rae has fought this pest strenuously, and it will be interesting in another year to see whether the infestation repeats itself.

Report by A. W. Borthwick, D. Sc., *Honorary Consulting Cryptogamist.*

A considerable number of queries and specimens for identification have been sent in during the past year, but in most cases the damage turned out to be due to fungi which have already been reported on in the *Transactions*, and need not be further noticed here.

It may be well, however, to call attention to a fungus, *Cryptomyces maximus*, which caused widespread damage to willow cultures. It was reported to have destroyed about two acres of willow known to the trade as "Norfolks," and to have also attacked "Black Mules" and "Spaniards." The presence of this fungus is first indicated by the appearance of yellow spots on the epidermis of the shoot; later black centres, due to the formation of the fruit-bodies of the fungus, appear in these spots; and finally the spots become covered by black cushions. In these black cushions arise the spores by which the disease is propagated and spread. It is necessary that a sharp lookout be kept on the beds, and any plants which show the first symptoms of the disease should be removed and burned.

A certain proportion of the cases submitted were caused by unfavourable climatic conditions, such as cold, drying winds, frost, and the like.

Two specimens are still under investigation, one, a *Peziza* parasitic on *Abies grandis*, sent by Mr John F. Annand from Haystoun, Peebles, and another, a resupinate *Polyporus* on a young Scots pine, submitted by Mr W. Davidson from Margam, Port Talbot, Wales.

LARCH DISEASE INQUIRY.

REPORT BY SUB-COMMITTEE APPOINTED *10th December* 1904.

In compliance with a remit to the Council, with powers, from the Annual General Meeting of 31st January 1902, to take such steps as may seem necessary to inquire into and experiment as to the cause and effect of the disease of the larch, and to report to a future meeting, a committee of inquiry was duly appointed; and as a preliminary to further investigation, a series of questions was drawn up by a sub-committee appointed for the purpose, consisting of the Convener, Dr Borthwick and Dr MacDougall, and issued to observers throughout Scotland, in the spring of 1904. The number of schedules issued was over 500, and the number of returns received was, after deducting duplicate returns from some estates, 66, or 13 per cent. of the number issued, a proportion which the committee feel to be disappointingly small in comparison with the importance of the subject of investigation. And further, the committee, while acknowledging their indebtedness to the observers for the great amount of trouble they have taken in connection with the inquiry, and for the large amount of valuable information which they have placed at the committee's disposal, regret to say that the value of the returns as a whole has been materially lessened by the facts that in a number of instances observers, instead of stating, as the committee desired, the results of actual observation, have given general opinions which do not seem to be borne out either by observation or experiment, and that in a few instances there has been total misapprehension of the meaning of the questions.

Returns were received from the following counties:—

Aberdeen,	5	Edinburgh,	1	Peebles,	2
Argyll,	3	Fife,	4	Perth,	11
Ayr,	4	Forfar,	4	Renfrew,	2
Banff,	1	Haddington,	4	Ross,	3
Berwick,	1	Inverness,	2	Roxburgh,	3
Bute,	1	Kincardine,	2	Stirling,	2
Dumbarton,	2	Kirkcudbright,	1	Sutherland,	2
Dumfries,	2	Lanark,	2	Wigtown,	2

The questions submitted to observers were as follows:—

A.—Common Larch (*Larix europæa*).

General.

1. Is the disease known as "Canker" or "Blister" common in your crops?
2. On what geological formation or formations do the crops grow?
3. On what kinds of soil do they grow?
4. On what aspects do they grow?
5. Is the natural drainage of the soil good?
6. Have you found the disease to be more prevalent on trees growing on low-lying ground or in hollows than on those growing on high exposed ground?
7. Do you consider that the wetness or dryness of the soil in which the plants grow has any effect on the disease?
8. Is there any particular age at which the tree seems most liable to attack?
9. What is the earliest age at which you have observed plants to be attacked?
10. Have you ever observed diseased trees to recover?
11. Do you know of any crop which is quite free from disease?
12. Do you consider that the disease is increasing or diminishing?

Climatic and other Physical Agencies.

13. Have you ever observed disease to follow—(*a*) A severe late spring, summer, or early autumn frost? (*b*) A violent hailstorm? (*c*) A heavy fall of snow causing bending of the branches? (*d*) Any other climatic agency? (*e*) Any physical agency other than climatic?

Insects and Other Animals.

14. Have you ever observed disease to follow attack by Aphis, the caterpillar of the larch-mining moth, or other insect?
15. Have you ever observed disease to follow injury from animals other than insects?

Sylvicultural Treatment.

16. Under similar conditions as to elevation, aspect, soil, etc., have you observed whether disease is more prevalent—(*a*) In pure or in mixed crops? (*b*) In dense pure crops or in open ones? (*c*) In planted or in self- or artificially-sown crops? (*d*) In plantations formed with plants raised from home-grown seed, or in those formed with plants raised from foreign-grown seed? (*e*) In pure crops on shallow soils or in those on deep soils?
17. What particular mixture (or mixtures) of other species with the larch seems to be most effective in warding off disease?
18. What is your experience of the disease in a mixture of larch and spruce?
19. Have you ever observed crops to be badly attacked by Aphis, although no spruce existed in the locality?
20. Have you observed whether there has been less liability to disease when in a mixture the larch plants have been planted in advance of the other species?
21. Have you observed whether the tree was specially susceptible to disease when planted on land which had previously been under agricultural crops?
22. Under similar conditions as to age, density, soil, etc., is disease more prevalent in pure crops on certain aspects than on others, and, if so, on which?
23. Have you observed whether the growing of successive crops of larch on the same ground has any effect in inducing the disease?

Miscellaneous.

24. Have you observed whether, on soils on which the trees seemed particularly susceptible to the disease, there was also a tendency for them to become affected by "heart-rot"?
25. Have you observed whether wounds made on the stems of healthy trees during the growing season heal by occlusion as readily as when made in the resting season?
26. Have you ever observed wounds produced on the stem to remain unhealed for several years, and to continue to

produce a flow of resin, but giving no evidence of fungous growth?

27. Have you any knowledge of the first appearance of disease in your locality?

28. Have you ever received diseased plants from a public nursery?

B.—Siberian Larch (*L. sibirica*).

1. Is this more, or less, liable to disease than the common European species?

2. Is it more, or less, liable to injury from frosts than the common European species?

3. Is it liable to attack by Aphis or other insects?

C.—Japanese Larch (*L. leptolepis*).

1. Have you observed disease on this species?

2. Is it liable to injury from late spring, summer, or early autumn frosts?

3. Is it liable to attack by Aphis or other insects?

Note.—In this Schedule, wherever the term "disease" occurs, it refers to the diseased condition of the stem and branches of the larch known as "Canker" or "Blister."

In giving a short resumé of the replies to the questions submitted to observers, the sub-committee desire to say that this is not intended to deal with all the points touched upon, but merely to indicate the general trend of the result of the investigation—so far as it has gone. Many of the observations recorded in the replies are of such a nature as to suggest cases for further investigation, a process which may involve considerable time, and until this is accomplished the committee cannot hope to place before the Society the final result of their inquiry.

Common Larch.

One point which has been brought out in connection with disease of the common larch is that it is more or less prevalent in all the localities from which reports have been received, and that it occurs on all kinds of geological formations, and on all kinds of soil; but in a few cases, which seem to call for further investigation, the character of the formation, as reported, seems

to have some influence on the intensity of the disease. As regards the effect of aspect, no definite conclusions are possible, individual observers citing cases where the disease seems equally prevalent on all aspects; and as regards the natural drainage of the soil, the evidence appears equally conflicting. There seems to be a concensus of opinion, however, amongst observers, that disease is more prevalent on trees growing on low-lying ground than on those growing on elevated ground; but there is much difference of opinion as to whether the actual amount of moisture in the soil has any marked effect on the disease.

Regarding the age at which trees seem most liable to attack, there is great diversity of opinion, ages ranging from two to thirty years being given. The youngest age at which plants have been observed to be attacked is given as two years, while one observer states that he has seen it "in nursery lines," but without giving the age of the plants.

On one estate, several woods are reported in which no disease has been observed, and from a few localities woods practically free are reported; and, of course, as was to be expected, several mature crops are reported as being free. It must be said, however, that where the age of the trees is not given, investigation seems necessary. As to whether the disease is on the increase or otherwise, no definite conclusion can be arrived at from the reports, there being a direct conflict of opinion on this point.

As regards climatic agencies, frost, bending of the branches by snow, and strong winds are given as the chief causes of disease, while other physical agencies, such as gunshot wounds, and tying of the plants in bundles, are given in a few instances only.

Among insects, a considerable number of observers report outbreak of disease after attack by Aphis and the caterpillar of the larch miner moth; and one observer records an outbreak after attack by pine-weevil. Among animals other than insects, horses, cattle, roe-deer, rabbits, squirrels, black game, and vermin of all sorts are cited as contributing causes.

As regards sylvicultural treatment, opinions as to whether disease is more prevalent in pure than in mixed crops are conflicting, but there seems to be general agreement that in pure woods disease is worse where the crop is dense, although several hold to the opposite opinion. The general opinion is decidedly to the effect that less disease is observable in naturally-sown crops than either artificially-sown or planted ones; but as regards

the statements as to the relative merits of plants raised from home and foreign-grown seed as disease-resisters, no deduction can be made; and the same may be said of the statements regarding the depth of the soil in which the crops grow. Nothing of a definite nature can be stated, generally speaking, from the information regarding mixtures, but a spruce and larch mixture does not seem to meet with much favour among the observers generally. The majority of the observers are of opinion that there is greater liability to disease in crops which have been planted on land which has been under agricultural crops, especially if it be deep and rich; but the statements regarding the effect of growing successive crops of larch on the same ground are in direct conflict, as are also those relating to the association of "heart-rot" with the disease.

One observer states that the disease was first observed about 1838.

Four cases only are instanced of diseased plants having been received from public nurseries.

Siberian Larch.

Very little information is given regarding this species. The majority of the observers state that it is less liable to disease, but more liable to injury by frost, than the European species; and as to its liability to Aphis attack, the very few particulars given are conflicting.

Japanese Larch.

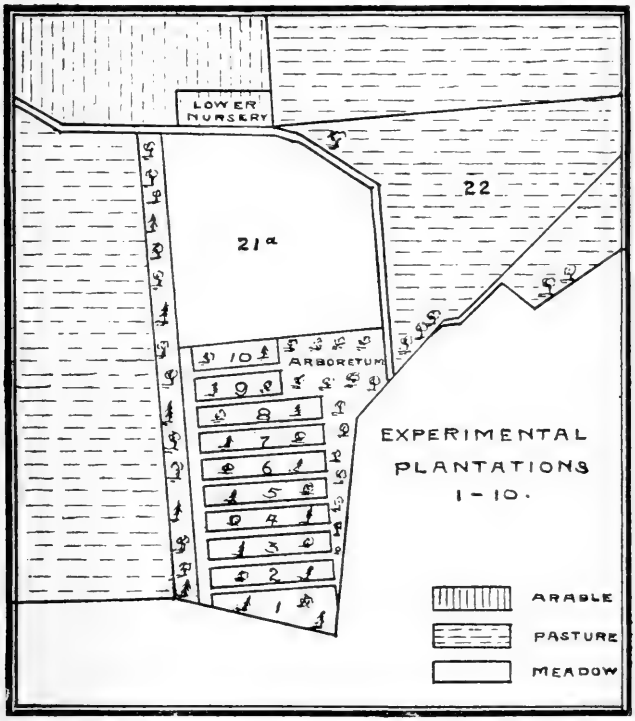
Six cases of disease are recorded in the case of this species; but these seem to be, for the most part, isolated cases, and the conclusion, therefore, is that the species is as yet practically free from any serious attack by disease. The majority of the observers state, however, that it is more liable to damage by frosts, especially those of late summer or early autumn, than the European species. Observations on Aphis attack are conflicting, and of attack by other insects, one observer records damage by pine-weevil.

A. D. Richardson, *Convener.*
A. W. Borthwick, D.Sc.
D. F. Mackenzie, F.S.I.

NOTES AND QUERIES.

Experimental Plots at Cockle Park.

In view of the recommendation made in paragraph 15 of the Report of the Departmental Committee on Forestry, 1903, regarding the establishment of 3-acre experimental plots, it may be of interest to note what has already been done in this direction



at the County of Northumberland Demonstration Farm, Cockle Park. The *Guide to Experiments in Progress*, 1904 (pp. 32, 33), gives the following information on this point:—

"*Forestry*.—In the southern portion of Broomy Hill ten plots of ground have been laid off and planted with forest trees for the purpose of illustrating certain principles of sylviculture. Plots 2 to 8 are each about half an acre, and the three remaining plots

somewhat less. The trees were set out in triangles $3\frac{1}{2}$ feet apart. Plots 1 to 7 were planted in the spring of 1898, Plots 8 to 10 in the spring of 1899. The trees were *pitted* in Plots 6, 9, and 10, and *notched* in the other sections.

Plot.	Trees planted.	Remarks.
1	Norway spruce and ash	Mixture of shade-bearing and light-demanding species.
2	Scots pine	A "pure" wood of "light" trees.
3	Douglas fir (green and glaucous)	One of the most valuable exotic conifers.
4	Sitka or Menzies spruce	These sections will not be thinned heavily. The intention is to grow pit-wood on a 30-40 years' rotation.
5	Norway spruce ...	
6 (*a*)	Beech, German larch, Scots pine	These are examples of mixtures of "shade" and "light" trees.
(*b*)	Beech, oak	
7	Scots, German, and Japanese larches in alternate rows	A pure wood of light-demanding species.
8	Norway spruce, German larch	A "light" and "shade" mixture for comparison with Plot 7.
9 (*a*)	Japanese larch, German larch, silver fir	A "light" and "shade" mixture.
(*b*)	Black Italian poplar ...	A pure wood of "light" trees.
10 (*a*)	Japanese larch, German larch, silver fir	Manured at the rate of 16 cwts. of basic slag per acre before planting. Compare Plot 9 (*a*).
(*b*)	Black Italian poplar, silver fir	Compare with Plot 9 (*b*).

The foregoing plantations are protected on the west side by a shelter-belt of Scots pine 20 yards wide. The shelter-belt is divided into eight sections, each of them 40 yards long, which have been planted in the following manner:—

Sections A and E—Trees planted in pits 12 in. by 12 in.
,, B ,, F—Trees planted in **T**-shaped notches.
,, C ,, G—Turfs 15 in. by 15 in. removed, soil stirred with pick, trees planted and turfs slit, inverted, and replaced.
,, D ,, H—Planted in the same way as last, except that the soil was stirred by means of a special German implement.

"A small arboretum has been formed on the S.E. corner of Broomy Hill, consisting of conifers, deciduous trees, and shrubs. Three trees of each variety are planted in close proximity with

the view of removing two, and leaving the best to form a specimen tree in the future.

"Shelter-belts have been planted on the N.W. boundary of the farm, and around the N.E., N., and N.W. sides of the cottages near the homestead. The trees planted consist principally of Corsican pine, Scots pine, beech, larch, and sycamore.

"Most of the trees are now getting established, and some are making good growth. The Japanese larch (*Larix leptolepis*) is doing extremely well on Plot 7.

"During the past winter all the saleable young trees in the forest nurseries have been disposed of. Seeds of the following trees were sown in the nursery in the spring of 1903, and will be transplanted this autumn:—Common larch, Japanese larch, silver fir, Douglas fir, Scots pine, oak, beech, and small plots of *Pinus monticola* and *Pinus Cembra*."

Parliament and Forestry.

On Friday, February 19, 1904, a debate took place in the House of Commons, on the following amendment to the Address by Mr Keir Hardie:—

"And, further, we desire humbly to express our regret that, in view of the distress arising from lack of employment, your Majesty's advisers have not seen fit to recommend the creation of a department and Minister of Labour, fully empowered, *inter alia*, to deal effectively, acting in conjunction with local administrative authorities, with such lack of employment, mainly by the execution of necessary public works, afforestation, and, further, by encouraging an increase in the numbers of those employed in agricultural pursuits."

In the course of his remarks, Mr Hardie said the Government could also do much by undertaking a scheme of afforestation, and here they would have the recommendations of Royal Commissions and Parliamentary Committees behind them. In Germany the profits each year from these State forests ranged from 15 to 18 million pounds sterling. In India the profits were from 5 to 6 millions a year, and this had been accomplished since 1863, when systematic planting was first introduced. There was in Great Britain an area of land out of cultivation of 21 million acres, on a large part of which afforestation could

be undertaken. The Government might take for the purpose 10 million acres. Such land could be secured for 10s. an acre, for it was mostly bog or hill-land. That meant a capital expenditure of £5,000,000. The cost of planting would be probably for this country £3 per acre, making a further expenditure of £30,000,000, or a total outlay of £35,000,000. Assuming that the 10 million acres only increased in value to the extent of 10s. per acre per annum, at the end of 50 years the £35,000,000 invested would produce a return of £250,000,000. These 10 million acres would find profitable life-giving employment for 150,000 men.

Mr Munro Ferguson pointed out that we were importing timber and timber products of the value of nearly 30 millions sterling a year. Our home production was small, but the area available for the growing of timber was enormous. It could not properly be grown unless the State took direct action in the matter, providing facilities for learning the art, and holding woodlands of its own. State action abroad had rendered it very profitable, four millions of the population of Germany being dependent upon the woodlands. He was confident that if the area suitable for timber in the United Kingdom were afforested, we could have a population of three quarters of a million dependent upon those who would be employed, and have great incidental industries, which would support still more people. In Scotland he believed it would make good the whole of the loss of rural population. He knew of no other way except afforestation by which it would be possible to restore the great country population we had lost.

Mr H. Lewis pointed to the success of experimental afforesting in Wales, and urged that, to the advantage of Wales and the country generally, the area of these experiments might be extended.

Mr Field said that in former times Ireland was well wooded. Scientific men held that if the country were properly wooded and drained, the temperature might be raised at least two or three degrees.

Replying for the Government, Mr Long said the Government were being asked to embark upon an undertaking such as they had never been asked to embark upon before. They had always believed that private enterprise would undertake such work if it was remunerative. But did anyone believe

that by a scheme of this sort they would really deal with the unemployed difficulty as it confronted us from day to day? Such employment was the last kind of employment suitable for the skilled or partially skilled workman, who was generally the one to be in difficulties.

Subsequently Mr Keir Hardie's amendment was rejected by 231 votes to 151.

St Louis Exhibition.

Royal Scottish Arboricultural Society's Exhibit.

The Exhibit sent by the Society consisted of twelve photographs of North American *Coniferæ* grown in Scotland. The photographs, for which a Silver Medal was awarded, were enlargements from half-plate negatives, and measured 32 ins. by 22 ins. within the frames, which were of oak. The following list gives the names, dimensions, etc., of the trees of which photographs were sent, and the estates on which they grow:—

Name of Tree.	Height of Tree.	Girth of Stem at 5 ft. from ground.	Age of Tree.	Estate where Growing.	Proprietor of Estate.
	feet.	ft. in.	Years.		
Abies Lowiana, Murray, . . .	64	6 3	42	Scone, Perthshire.	The Right Hon. the Earl of Mansfield.
Abies nobilis, Lindley, . . .	77	8 0	61		
Cupressus nootkatensis, Lambert, .	50	...	42		
Cupressus Lawsoniana, Murray, .	62	...	42		
Libocedrus decurrens, Torrey, . .	45	...	42		
Picea sitchensis, Trauttvetter and Meyer,	90	13 2	61		
Thuya gigantea, Nuttall, . . .	61	...	42		
Tsuga Mertensiana, Carriere (= *Abies Albertiana*, Murray),	68	8 10	42		
Pinus monticola, Douglas, . . .	77	6 4	54	Murthly, Perthshire.	W. Steuart Fothringham, Esq.
Pseudotsuga Douglasii, Carriere, .	97	10 0	57		
Sequoia gigantea, Torrey, . . .	79	11 0	47		
Tsuga Pattoniana, var. *glauca*, Engelmann (= *Abies Hookeriana*, Murray),	41	4 0	42		

The Creosoting of Spruce, Larch, Oak, and Scots Pine.

Office of the Engineer in Chief,
General Post Office (West), London, E.C.,
13th January 1904.

My Dear Sir,—In further reference to your letter of the 1st instant, I beg to say that in speaking of Baltic whitewood, when giving evidence before the Committee on British Forestry, I referred to common spruce, or Norway spruce as it is often called; and I was speaking of round, not square timber. As you will doubtless be aware, this timber is very largely imported for pit-props, which are classified by the timber importers as "whitewood mining timber," or "redwood mining timber," as the case may be, but no doubt it is sometimes mixed with silver fir.

If Norway spruce could be creosoted, it would be particularly suitable for telegraph poles, as it is usually very straight and shapely, and we have, consequently, from time to time endeavoured to creosote it; but even when the timber has been seasoned many months, and put under the greatest obtainable pressure, say 80 lbs. to the square inch, the creosote has not penetrated more than half an inch below the surface of the wood. Mr Havelock says: "Spruce takes the creosote worse than any timber I know;" and by this I understand that his experience is the same as my own, viz., that the creosote can only be injected to a very limited extent. Spruce, so creosoted, would be more durable than untreated timber, but it would have a very short life as compared with properly creosoted redwood.

I believe that in the case of all timbers which do not readily take creosote, the difficulty is due to the structure, and if you have a microscope available, it will give me great pleasure to endeavour to obtain for you sections of redwood, larch, and spruce, mounted as microscopic slides, showing the difference in the structures.

Of course, creosoting is very much a question of degree. It is my experience that to satisfactorily creosote timber, about 10 lbs. of oil per cubic foot should be injected: oak and red-fir will very readily take this quantity, or a much larger quantity, whereas larch and spruce, which only absorb creosote to a depth of about half an inch, will take from $2\frac{1}{2}$ to 6 lbs. of oil per cubic foot, according to the age and growth of the timber—and this quantity is insufficient to thoroughly preserve it.

I am not sure if I have quite answered your letter, but if not, I shall be very happy to furnish any further information in my power.—Yours faithfully, M. F. ROBERTS.

RAILWAY SLEEPERS FROM IRISH-GROWN TIMBER.

Tenders are asked for 30,000 sleepers, to be cut from Irish-grown timber, for the Midland Great Western Railway of Ireland. They are to be of Scots, silver, spruce or larch fir, beech, or Spanish chestnut, but the quality should be good, and the timber clean. This is a step in the right direction, and the conditions of delivery are good, for smaller quantities than 30,000 may be offered. Were such a tender, especially for silver fir, Scots and spruce fir, open to England or Scotland, satisfaction would be great.—Abridged from *The Timber News and Saw-mill Engineer*, December 3, 1904.

CHILTERN HILLS BEECH.

No finer beech timber than that which clothes this famous hill-side can be found, and for the particular trade of chairmaking it cannot well be surpassed. The upper reaches are clothed with a generally heavy crop of timber, the trees individually being of small size; but lower down huge specimens, containing over 100 feet of timber, are not uncommon.

Such is the difference between the high and low-lying woods as regards size of the individual specimens, that the average price per cube foot of those in the former was this season 11½d. per foot, while special trees, growing principally at the base of the hills, and containing a large quantity each of excellent timber, fetched as much as 3s. per cube foot.—Abridged from *The Timber News and Saw-mill Engineer*, June 25, 1904.

SCIENTIFIC TREE-BUTT BLASTING.

The new system of blasting tree butts by electricity and "Geligonite" (a safety explosive) appears to be an efficient way of getting rid of these troublesome encumbrances.

Some very successful experiments in blasting butts have recently been carried out on the Right Hon. Lord Leigh's Stoneleigh Abbey Estate, near Kenilworth. The tree butts comprised elm, ash, alder, and oak, some of the latter estimated (with earth attached) to weigh 10 tons.

The last two butts to be taken in hand were elm of immense size. A hole $1\frac{1}{4}$ inch in diameter was bored with a Gilpin auger into each butt, and this being charged up with Geligonite, an electrical detonator was inserted and attached to the main cable of the battery. All being ready, the operator retired some 50 yards away behind a huge oak tree, gave the handle of the battery a few turns, when the monster butt was blown into suitable pieces for loading up.—Abridged from *Timber Trades Journal*, October 22, 1904.

British oak for Wood-paving.

Though the jarrah wood of Australia continues to gain in popularity as a hardwood paving for our large towns, there has arisen lately a competitor to it—British-grown oak. A paving block 9 by 4 by 3 is made up of six or seven small pieces of oak joined together by staples, and it is claimed that these have a much longer "life" than the solid blocks made from other woods now on the market.—Abridged from *The Timber News and Saw-mill Engineer*, June 18, 1904.

Jarrah and Karri.

In their recently issued report, the Royal Commissioners who were appointed in June 1903 to inquire into the Western Australian forests, estimate the extent of the virgin jarrah forest north of the Blackwood river, suitable for milling, at about 2,000,000 acres. South of the Blackwood river there are also considerable supplies of this timber, but, being so constantly intergrown with karri, blackbutt, and red gum, no fair estimate of the quantity can be given.

Karri is limited to the country between the Margaret River and the Porongorup river. Of this area some 150,000 acres have been cut over at Karridale, Torbay, and Denmark, leaving

an area of over 1,000,000 acres of virgin forest which cannot be exploited until tapped by a railway.

The cut-over area of jarrah is about 530,000 acres, of karri about 150,000 acres. Jarrah is being depleted at the rate of about 60,000 acres per annum; of karri, present leases having been practically cut over, no more can be cut pending the opening of new forests.

Sweden's New Forestry Laws.

Mr F. S. Clarke, secretary of the British Legation at Stockholm, records in his report on the trade and finances of Sweden that a series of laws for the better preservation of woods and forests in the country came into force on 1st January last. Among the principal provisions of these new measures are: That timber on private properties is not to be felled in a measure detrimental to reproduction, and that the soil is not to be treated so as to hinder the fresh growth of trees; that the felling of timber in woods exposed to the action of shifting sands is to be under official control; the creation and organisation in certain districts of "forest boards," with officials to whom various functions are assigned; that leases of forests are not to exceed 50 years, and that where timber is concerned the leases are to be limited to 5 years. The total area of forests in Sweden in 1902 was computed to be some 80,000 square miles, of which about 13,000 square miles belong to the State.—*The Timber News and Saw-mill Engineer*, March 26, 1904.

The Forests of Poland.

In spite of the Forest Preservation Law, which came into force in 1898, the area under forests in Poland is steadily decreasing. The total area under forests in Poland is now 7,358,607 acres, of which 29 per cent. are Government property, 62 per cent. belong to large estate owners, and the remainder to peasants and small holders. Of this, only on the forests belonging to Government, and on some few of the larger estates, is replanting properly carried out. The proportion between the area of forests and the number of inhabitants in Poland is only 0·68 acres of forest per head, whereas in Central Russia the proportion is 2·7 acres per head.

The export of all sorts of wood for consumption in Germany is increasing, but the demand for wood from this district for the United Kingdom and France, especially oak, is diminishing on account of American competition.—Abridged from *Timber Trades Journal*, August 6, 1904.

Russia's Timber Trade with the United Kingdom.

Mr Consul Wardrop, in his Report on the trade of Russia in 1903, says that the United Kingdom is Russia's best customer for timber, as the latter country supplies about one-quarter of the total amount imported into the United Kingdom. The annual value of the trade is nearly £6,000,000. The export from Cronstadt and St Petersburg in 1903 was well above the average for the last ten years, and was only exceeded in 1901. Prices were on the whole higher than they had been for some years.—*Timber Trades Journal*, August 20, 1904.

The Timber Resources of European Russia.

Of so much of the vast empire of Russia as lies within the geographical confines of Europe, no less than 510,300,000 acres are forest land, giving an area of nearly five acres for every inhabitant. Of this great woodland area the State is the largest owner, possessing no less than 234,900,000 acres, private individuals own 108,000,000 acres, and peasant communities 43,200,000, while 14,800,000 acres are under the administration of the Appanage Ministry.[1] From its forests the Government derives a revenue of about seven millions per annum, and the timber exported represents about 9 per cent. of the total exports.

One of the main objects of the Forestry Laws of Russia is the protection and creation of forests serving purposes of general public utility, such as consolidating shifting sands, protecting land from erosion by water, or, in the neighbourhood of sources of rivers, contributing to the regular supply of water. Such

[1] From the forests belonging to the Russian Imperial family the best "redwood" and "whitewood" which finds its way into the British markets is derived. It is superior to the Gromoff brand, which is usually specified in contracts for the best class of work.—Asst. Ed.

forests are termed "protective," and may not be disafforested. Another important feature of the law is the creation in each government of a committee, comprising both officials and forest owners, having for its object the conservation of forests. It is the duty of these committees to decide what forests are to be declared "protective," to put a stop to reckless or wasteful felling, to approve or modify plans of management which have been submitted by private owners, etc. Owners of forests not declared "protective" may draw up plans of management in accordance with certain regulations laid down, and, if the plans are sanctioned, the owner is not subject, in the development of his timber, to any other restrictions than those designated and sanctioned in his plan of management. The regulations provide that cycles of felling shall be for plantations of conifers not less than forty years. In plantations of conifers with fir trees predominating, if among the latter there are not less than a thirtieth reproductive more or less regularly distributed over the area for cutting, the breadth of the annual felling is decided by the owner.—Abridged from the *Timber Trades Journal*, July 23, 1904.

The Forests of the United States.

Some interesting information has been received respecting the timber resources of the United States. Two or three years ago there was, we believe, an official inquiry into the rate at which certain districts were being denuded of their timber. The report containing the results of investigations which were then set on foot has produced a growing sense of the importance of forest preservation. As throwing a light upon this feature of American forestry, it is interesting to learn that during the last Congressional year, very nearly three million acres were added to the national forest reserves, which at the end of the year covered, it is said, something like sixty-three million acres.—*Timber Trades Journal*, August 6, 1904.

American Forestry Congress.

The meeting of the American Forestry Congress, held at Washington, D.C., 2nd to 6th January 1905, undoubtedly marks

an epoch in the development of a rational policy in the treatment of the American forests. The seven hundred delegates coming together from every part of the United States, and representing, as they did, every kind of industry which is dependent directly or indirectly on the forests, indicated by their presence that, at last, the nation appreciated that the time had come when active measures for the conservation of what remained of the forests, and for the reafforestation of such areas as had been denuded, and which are unsuited for agriculture, were to be undertaken.

A feature of the Congress was the very able address delivered by President Roosevelt, on Thursday afternoon, on "The Forest in the Life of the Nation." Speaking of the uses of timber, he pointed out that, notwithstanding all the substitution of wood by steel, cement, brick, and stone which has taken place in recent times, it was, nevertheless, a fact that the use of wood was not only on the increase, but greatly on the increase, and that if restorative measures on an adequate scale were not immediately undertaken, a timber famine was inevitable, "and," he added, with masterful emphasis, "the period of recovery from the injuries which a timber famine would entail would be measured by the slow growth of the trees themselves."

Another feature of the meetings was the spontaneous gathering together of the foresters in the evenings, in a very informal way, for the discussion of practical forest problems. These evening meetings gave the foresters a chance to discuss the day's doings together, and made up in a measure for the notable lack of opportunity for discussion during the regular meetings of the Congress.

The matter of paramount interest in the present American forestry situation is the Bill now before Congress for the transfer of the nearly 70,000,000 acres of forest reserves from the Department of the Interior to the Department of Agriculture. There is every reason that the transfer should be made, and the prospect is that it will be. This will place a large area, exhibiting a very great variety of forest conditions, in the hands of the Bureau of Forestry for administration, and will make the real beginning of professional forestry in America.—Abridged from *The Farmer's Advocate*, January 19, 1905.

Influence of Forests on Climate.

The influence of forests upon climate was the subject of discussion at the Annual Meeting of the German Meteorological Society in Berlin recently. The conclusion reached assigned much less influence to the forests than has been hitherto assumed. Professor Schubert, of Gottingen, gave a summary of the results of his four years' observation at Prussian forestry stations throughout the extended wooded region of the north-western part of Brandenburg. Two observations were taken daily at numerous points within the forests, in clearings and other points. The result was that from the minimum variations of temperature and humidity in the forests, and at more remote points, it was concluded that the forests had no appreciable influence upon the rainfall and general climate.—*The Timber News and Saw-mill Engineer*, May 28, 1904.

The Uses of Wood in Japan.

A very large majority of Japanese houses, both in town and country, are built entirely of wood, with tiled roofs. The timber used is mainly coniferous—red pine for the poorer class, and *Cryptomeria* and *Thuya* where the more valuable kind of timber is required. In the rural districts the roofing is often of bark, especially that of *Cryptomeria*.

The woodwork is simple, and, except in the north, very neat and artistic, and often beautifully polished. Strange to say, it is almost all done by hand, there being only some five or six saw-mills in the country. Much of the best woodwork of large dimensions is seen in the numerous Buddhist and Shinto temples, where large beams and pillars of *Cryptomeria* and *Zelkowa* are to be seen.

Among some of the other principal uses of wood, barrel staves are split in the forest from pine and *Cryptomeria*, matches are made in Kobé from wood from private forests, tea-boxes, now being largely exported to Ceylon, and chopsticks are made of the wood of *Abies firma*. Shingles are also largely turned out. Little paper pulp is made at present, paper being prepared chiefly from mulberry bark and straw. Charcoal is burnt from

twenty different species, including oaks, and is very largely used for heating and smoking urns. Clogs, which with grass-sandals are almost universally used instead of boots, are made from the wood of "kiri," a fast-growing tree which is largely grown in open groves round villages.

The demand for wood of all kinds is thus very great, and, at least in private forests, there is a continual tendency towards lowering the cutting rotation. The prices of timber are somewhat high, those of *Cryptomeria* and *Cupressus* being roughly 6d. per cubic foot, and pine about 3d. Railway rates are approximately ½d. per mile per ton.

Japan is essentially a great forest-growing country. If all the possible culturable land, or that required for pure grazing, is taken out, a very large area suitable only to forest remains. Furthermore, the "leads" to the sea are short. Its future, therefore, as a great timber-exporting country, seems absolutely certain, as China alone will absorb all the timber offered to her. For the present Japan will probably find the machine-cut wood from the Western States of America competing severely in the markets with her products, and, besides, she has not, or ought not to have, much to offer.—Abridged from *Timber Trades Journal*, May 14, 1904.

Forestry Education at The Imperial University of Tokio.

The University, covering a large area of ground, is situated in the district of Hongo, an outlying suburb of the capital of Japan, and the College of Agriculture is in the suburb of Komaba, about six miles distant.

The College of Agriculture did not become a school of the University until 1890. For many years attention had been paid to the study of agriculture in an institution devoted to the subject, which from 1881 had been carried on directly under Government supervision. Since 1895 the College has received three valuable endowments from the Government in the form of land for the teaching of practical forestry, amounting in all to 68,636 acres. This treatment of the subject affords a striking contrast with that which it receives in this country.—Abridged from *The Times*.

Teaching of Forestry in the Provinces.

Under the auspices of the County Councils of Fife, Perth, Linlithgow, and Selkirk, and by arrangement with the Edinburgh and East of Scotland College of Agriculture, courses of instruction in forestry were conducted by Dr A. W. Borthwick, the Lecturer in Forestry at the College, at Cupar, Perth, Kirkliston, and Selkirk, during the winter of 1904-05. The initial attendances on these courses were—Cupar 24, Perth 49, Kirkliston 30, Selkirk 23, and as the courses proceeded these figures rose to 44, 62, 42, and 33 respectively. At Cupar the course was an advanced one, dealing with Special Forest Botany, Forest Protection, Structure of Timber, etc., while at the other centres general Sylviculture was treated of.

Forestry at the Edinburgh University.

During the course of the current session, a separate class-room has been provided for the use of the Forestry Class; and the Lecturer has now, for the first time, the means of accommodating and making use of a portion of the apparatus, such as specimens and diagrams, without which class-room teaching cannot be efficiently carried on. He will gratefully receive and acknowledge objects of the above nature, such as,—

Fruits and seeds of forest trees.
Seedlings and young plants of various species.
Specimens of timber of various species.
Slides and photographs illustrating matter of sylvicultural interest.
Examples of damage by fungi, insects, birds, game or other animals; or of damage by frost, sun, hail, wind, and other atmospheric causes.
Examples of defects in timber.

Gentlemen who may be willing to contribute to the University Class Collection are requested to address their contributions to the Lecturer at the Forestry Class-room, University of Edinburgh. But in order to avoid the sending of more than a sufficient

number of objects of the same kind, it is suggested that, before despatch, reference should be made to the Lecturer, in order to ascertain what his requirements are. Exhibitors at the Forestry Section of the Highland Society Show are invited to offer a portion of their exhibits to the University Collection. F. B.

Appointments to Forestry Lectureships, etc., in 1904.

Mr Fraser Story, Lecturer on Forestry at the Edinburgh and East of Scotland College of Agriculture, and Examiner in Forestry in the University of Edinburgh, has been appointed to the recently instituted Lectureship in Forestry at the University College of North Wales, Bangor.

Dr A. W. Borthwick, Honorary Consulting Cryptogamist to the Society, has been appointed Lecturer on Forestry at the Edinburgh and East of Scotland College of Agriculture, in succession to Mr Story.

Mr A. C. Forbes, Forester on the Marquis of Bath's estates at Longleat, has been appointed to the Lectureship in Forestry at the Durham College of Science, Newcastle-on-Tyne.

Mr E. Battiscombe, who passed at the head of the Edinburgh University Forestry Class in 1902-3, and was elected an Honorary Associate Member of the Society, has been appointed an Assistant Conservator of Forests under the Government of British East Africa.

Edinburgh University Forestry Class.

The prizeman for Session 1904-05 was Mr Robert M. Wilson, Laws Cottage, Duns.

UNIVERSITY OF EDINBURGH.

LIST OF NAMES OF STUDENTS AND GRADUATES WHO HAVE OBTAINED EDUCATIONAL OR ADMINISTRATIVE APPOINTMENTS IN FORESTRY OR AGRICULTURE, AND WHO, WITH THE EXCEPTION OF THE LAST FIVE ON THE LIST (ONE OF WHOM WAS THE FIRST LECTURER ON FORESTRY) WERE STUDENTS OF THE FORESTRY CLASS IN THE UNIVERSITY.

Appointments in Forestry.

1. LEGAT, C. E., B.Sc.Agr., Conservator of Forests (Head of Department) to Transvaal Government.
2. BATTISCOMBE, E., Assistant Conservator of Forests, British East Africa.
3. LESLIE, JOHN, B.Sc.Agr., Assistant Conservator of Forests, Southern Nigeria.
4. SAMPSON, H. C., B.Sc.Agr., Forest Department, Cape Colony; now Lecturer, Normal College, Pretoria.
5. STORY, FRASER, Lecturer on Forestry, University College of Wales.
6. CROMBIE, A. T., } Practical Foresters holding Raith Bursary,
7. FEAKS, M., } obtained appointments as Head
8. SCOTT, FRANK, } Foresters on Private Estates.

Appointments in Agriculture.

9. ALLSEBROOKE, A., B.Sc.Agr., Estate Agent to Earl Beauchamp.
10. ASHBY, S. F., B.Sc.Agr., Carnegie Scholar, Rothampstead.
11. BRUCE, W., B.Sc.Agr., County Lecturer, Edinburgh and East of Scotland College of Agriculture.
12. COLEBATCH, W. J., B.Sc.Agr., Lecturer and Resident Veterinary Surgeon, Canterbury Agricultural College, New Zealand.
13. FRASER, A., B.Sc.Agr., Lecturer on Agriculture, Chelmsford.
14. LONG, H. C., B.Sc.Agr., Assistant to Head of Intelligence Department, Board of Agriculture, London.
15. MASON, W. G., B.Sc.Agr., Manager of a District Chartered Company, Bechuanaland.
16. NOBBS, E. A., B.Sc.Agr., Adviser in Agriculture, Government of Cape Colony.
17. PATERSON, JAMES, B.Sc.Agr., Professor of Chemistry, West of Scotland Agricultural College.

18. Peet, J. O., B.Sc.Agr., Agricultural Adviser and Director of Agricultural Education to County Council of Hereford.
19. Rabagliati, D. S., B.Sc.Agr., Investigator into Cattle Plague, Government of Egypt.
20. Smith, Frederick, B.Sc.Agr., Deputy Director of Agriculture, Bengal Government.
21. Walker, F. P., B.Sc.Agr., Principal of Government Agricultural College, Elsenberg, Cape Colony.
22. Daine, H. S., Lecturer of Agriculture, Lancashire County Council.
23. Burness, Charles, Factor, Kilroy Estate, Ross-shire.
24. Punch, Cyril, Commissioner and Superintendent of Forests, British West Africa.
25. Wilson, J. H., D.Sc., Lecturer on Agriculture and Rural Economy, St Andrews University.
26. Carter, Cuthbert, B.Sc.Agr., Carnegie Scholar, Rothampstead.
27. Oldershaw, A. W., B.Sc.Agr., Lecturer under Irish Board of Agriculture, Co. Monaghan.
28. Shearer, Ernest, M.A., B.Sc.Agr., Lecturer on Agriculture, Imperial College, Bengal.
29. Thompstone, Edward, B.Sc.Agr., Assistant Lecturer on Biology, Agricultural College, Ontario, Canada.
30. Sangster, Alexander, Assistant, Aboukir Land Reclamation Company, Egypt.

* * * * *

31. Gordon, J. S., B.Sc.Agr., Chief Inspector, Department of Agriculture and Technical Instruction, Ireland.
32. Campbell, J. R., B.Sc.Agr., Assistant Secretary, Department of Agriculture and Technical Instruction, Ireland.
33. Middleton, T. H., M.A. Cantab., B.Sc.Agr. Edin., Professor of Agriculture, University of Cambridge; formerly Professor of Agriculture, Baroda, India.
34. Somerville, William, M.A., D.Sc., B.Sc.Agr.Edin., Assistant Secretary, Board of Agriculture, London; formerly Professor of Agriculture, University of Cambridge, and Lecturer on Forestry, University of Edinburgh.
35. Wilson, James, M.A., B.Sc.Agr., Professor of Agriculture, Royal College of Science, Dublin.

February 1905.

The Brechin Arboricultural Society.

For the copy of the Laws from which the following reproduction is made, the Society is indebted to Mr Wm. Davidson, forester, Margam, Port Talbot, Wales, whose father, the late Mr John Davidson, was one of the original members of the Brechin Society, and succeeded Mr Philip, the secretary and treasurer of the Society, as forester at Aldbar.

LAWS

OF THE

BRECHIN ARBORICULTURAL SOCIETY.

1. The object of the Society shall be the promotion of Arboriculture in all its branches, by periodical meetings of the Members for the reading of papers, and by such other means as may be found advisable.

2. Each member shall pay an annual subscription of 2s. 6d., and, in addition to the annual subscriptions above stipulated, the Society shall receive, from those friendly to its objects, donations of larger or smaller amount.

3. All annual subscriptions shall be payable in advance at the term of Martinmas yearly.

4. The affairs of the Society shall be conducted by a President, Secretary and Treasurer, and a Committee of three Members, —these office-bearers to be elected annually at the General Meeting in November.

5. Half-yearly Meetings shall be held on the second Tuesdays of May and November annually, for the reading of papers on Arboriculture, and discussing the same, and at the meeting in November the election of Office-bearers shall also take place.

Office-Bearers.

President.—Mr James Westland, Forester, Finhaven.
Secretary & Treasurer.—Mr Robt. Philip, Forester, Aldbar.

Committee.

Messrs Henderson, Nurseryman, Brechin;
,, Alex. Pirie, Nurseryman, Brechin; and
,, James Fennie, Forester, Leuchland.

IMPORTS OF TIMBER INTO THE UNITED KINGDOM, 1903 AND 1904.

	QUANTITIES.		VALUES.	
	1903.	1904.	1903.	1904.
Timber (*Hewn*).	Loads.	Loads.	£	£
Russia,	291,665	279,249	650,511	664,819
Sweden,	35,537	33,647	63,839	59,712
Norway,	64,686	56,009	117,586	104,746
Germany,	185,069	126,514	548,750	380,940
United States,	191,995	172,555	1,024,063	914,078
British East Indies,	54,109	30,879	705,203	425,805
Canada,	66,559	51,798	443,744	296,952
Other Countries,	26,450	24,710	290,893	227,358
Total,	916,070	775,361	3,844,589	3,074,410
Hewn: Pit-Props or Pit-Wood,	2,321,348	2,332,577	2,535,365	2,485,113
Total Wood, Hewn,	3,237,418	3,107,938	6,379,954	5,559,523
Timber (*Sawn or Split, Planed or Dressed*).				
Russia,	1,964,295	1,963,536	5,072,868	4,693,327
Sweden,	1,683,678	1,515,556	4,062,574	3,401,589
Norway,	559,596	493,932	1,550,540	1,341,531
United States,	700,257	580,701	2,308,264	1,927,894
Canada,	1,508,172	1,280,598	4,268,886	3,497,456
Other Countries,	326,235	231,839	929,387	643,828
Total,	6,742,233	6,066,162	18,192,519	15,505,625
Total of Hewn and Sawn,	9,979,651	9,174,100	24,572,473	21,065,148
Staves, all sizes (lds.),	129,773	132,178	570,859	527,696
Mahogany (tons),	88,942	103,770	797,125	892,728
Other Sorts (lds.),	175,724	197,937	1,182,499	1,152,500
Grand Total of Wood and Timber,	....	....	27,122,956	23,638,072

MANUFACTURED WOOD.

	£	£
Furniture and Cabinet Ware,	707,414	588,219
House Frames, Fittings, Joiners' and Cabinet Work,	469,227	332,627
Other Sorts (including Wood Ware and Wood Turnery),	1,168,621	1,162,475
Total,	2,345,262	2,083,321

Timber Trades Journal, January 14, 1905.

REVIEWS AND NOTICES OF BOOKS.

English Estate Forestry. By A. C. Forbes, F.H.A.S., Lecturer on Forestry, Durham College of Science, Newcastle-on-Tyne. London: Edward Arnold, 1904. Price, 12s. 6d. net.

The above publication forms a recent addition to our existing literature on forestry. The author points out in his preface that it is neither a text-book nor a planter's guide, but a work intended to be suggestive rather than instructive to the practical forester. He sets to work by giving a true estimate of English estate forestry, pointing out its defects and its much-needed remedies; and while he wisely refrains from telling us how to make forestry pay, the author teaches something far more valuable, viz., correct principles which, if adopted, would of necessity tend to produce better timber and, therefore, more revenue.

The information contained in the pages of this book does not concern the forester so much as the land-owner and the land-agent. The author is not afraid to express his ideas in clear and forcible, though sometimes scathing, language. The opening chapter deals at considerable length with the history of English forestry. The author candidly admits that Brown's *Forester* was a wonderful book in its way, but at the same time he blames the too close copying of Brown's methods for spoiling the majority of woods in this country. With regard to recent developments, the author makes the following observations:—"During the last ten years or so, however, views on English forestry have undergone considerable change, and although it may not yet be regarded as a tempting commercial enterprise . . . It is evident that a large number of land-owners hold more economic views on the management of their woods than was the case before. This has been partly brought about by the dissemination of knowledge more or less derived from Continental sources. . . . But however valuable such knowledge may be . . . it is apparent to those who have closely studied the question, that English forestry must possess certain characteristics of its own, and any attempt to revolutionise English woodlands and to

adopt the Continental style in its entirety will end more or less in failure."

The author holds definite views regarding the present condition of English forestry, and the same may be said of his views regarding the men who have to carry it into practice. He goes on to point out that English forestry, as practised at the present day, is made up of samples of sylviculture, arboriculture, and landscape gardening; and it might be added that it is just this mixed character of English estate forestry which necessitates a good all-round training on the part of the forester.

Mr Forbes manages to reconcile game preserving and forestry fairly well, but he does not point out with sufficient clearness that well-managed woods, when young, are the best of all game coverts, and that, if woods were grown on a rotation of, say one hundred years, one-half, by judicious arrangement of the respective age classes, would afford suitable cover and give good shooting.

One of the most valuable chapters of the book is that dealing with Thinning and Pruning. The author blames Brown for attending too much to the requirements of individual trees rather than to the plantation as a whole, and the badly-grown woods in England at the present day he ascribes chiefly to:—"1st, The sylvicultural requirements of oak suitable for the navy; 2nd, the influence of Scotch foresters and Scotch forestry upon English wood-management; 3rd, the influence upon British forestry exercised by the extensive planting of larch; and 4th, the influence of intensive game-preserving in plantations."

It may be pointed out that Mr Forbes is rather severe on the Scots, as compared with the English, forester, but he wishes to establish his premiss that Scots forestry is different from English. It is rather an insult to Scots intelligence, however, to say, as Mr Forbes does, that Scotsmen are generally supposed to imbibe the art of forestry with their mother's milk.

Regarding valuation, we do not agree with the author when he says that "guessing" the cubic contents of a standing tree is "idle brag." An illiterate woodman will sometimes estimate the cubic contents of a standing tree with amazing accuracy, and both wood merchants and practical foresters are often quite expert in the art.

Some attention is given to the home nursery, and the protection

of forests against insect and fungous pests, and among the latter the larch canker disease receives by far the greatest amount of consideration.

It is impossible, in a short review, to do justice to this admirable book. We recommend its perusal by the land-owner, land-agent, and forester alike, but the price at which it is published will, it is to be feared, prevent the majority of foresters from taking full advantage of its iformnation. A. T. G.

Trees: a Handbook of Forest-Botany for the Woodlands and the Laboratory. By H. MARSHALL WARD, Sc.D., F.R.S., etc. Vol. I. "Buds and Twigs"; "Vol. II. "Leaves." Cambridge University Press, 1904. Price 4s. 6d. net each.

This is one of the Cambridge Biological Series of handbooks, and the volumes on "Buds and Twigs" and "Leaves" are the first of a series intended "to provide students of Forest-Botany with a guide to the study of trees and shrubs from the point of view of the out-door naturalist," but which the author hopes will also "interest them in certain methods of laboratory work." Each volume is divided into two parts, "General" and "Special," the general parts dealing with the structure, etc., of buds and twigs and leaves respectively, while the special parts deal with the method of using these parts of the plant for identification purposes.

It goes without saying that, coming from a botanist of Professor Ward's standing, the book is a valuable addition to Forestry literature, and it is, moreover, the first really scientific work of its kind in the English language. The author has striven to put his facts before his readers "in language devoid of technicalities," and in this he has fairly well succeeded; but, on the other hand, he has, in one instance at least, introduced unnecessary complication. According to Professor Ward's definition, a "shoot" is no longer a shoot after it has completed its growth in length. After growth in length has been completed, the shoot, whether evergreen or deciduous, becomes a "twig"; but the author himself demonstrates the difficulty that confronts one in drawing such a distinction as this, for he uses the terms "long-shoot" and "dwarf-shoot" (the latter in the case of a twig of beech eleven years old in one instance), where, to be consistent, the terms "long-twig" and "dwarf-twig" should be applied.

The second, or "Special," parts of the volumes are constructed very much on the plan adopted in the analytical tables of Schwarz's *Forstliche Botanik*. These parts are illustrated by many original drawings, which should prove of much service in the work of identification.

These volumes are to be followed by others dealing with Inflorescence and Flowers, Fruits and Seeds, Seedlings, and the Habit and Conformation of the Tree as a whole, and, when completed, will no doubt be of great use to the scientifically-trained student of forestry; but a work on Forest-Botany extending to six volumes is unlikely to appeal to the ordinary forester. A. D. R.

The Timbers of Commerce and their Identification. By HERBERT STONE, F.L.S., F.R.C.I. London: Wm. Rider & Son, Ltd., 1904. Price, 7s. 6d. net.

While written chiefly for those engaged in the foreign timber trade, whether merchants or manufacturers, this book will find favour with all who take an interest in commercial woods. The author has brought to bear on his labours a rare combination of scientific and practical knowledge of the subject, and a thoroughly reliable work of reference is the result. Two hundred and forty-five different kinds of woods are minutely described, and excellent photo-micrographs of one hundred and eighty-six kinds are given; and in order to still further facilitate the work of identification, in addition to the ordinary structural characters of the wood, such tests as smell, taste, the phenomena exhibited in the process of burning, etc., are introduced. The sources of supply, uses of the timber, and many other useful data are given, and, upon the whole, as a work of reference at a moderate price, the book is one of the best which has been written on the subject.

A curious fact which the author relates is that he was unable to identify any of the commercial mahoganies, either with the true mahogany (*Swietenia Mahogani*) of the new world, or with the African mahogany (*Khaya senegalensis*), and that the conclusion he came to was that most if not all the commercial mahoganies belonged to the genus *Cedrela*, a genus which also includes one of the commonest "cedar" woods of commerce.

The book is one which can with confidence be recommended to all interested in commercial timbers. A. D. R.

Forestry. Translated from the German of Dr ADAM SCHWAPPACH by FRASER STORY and ERIC A. NOBBS, Ph.D., B.Sc., F.H.A.S. The Temple Cyclopædic Primers. London: Dent & Co., 1904. Price 1s. net.

These *Primers* are small volumes of "condensed information introductory to great subjects." That before us is a translation, abridged in some parts and expanded in others, in order to better adapt it to English requirements, of Professor Schwappach's *Forstwissenschaft*. It commences by giving a short historical sketch of the development of forestry, and this is followed by chapters on forest statistics, forest influences, sylviculture, tending of woods, forest protection, forest utilisation, forest management, forest finance, and forest economics; and a number of illustrations have been added by the translators, which have considerably enhanced the value of the book. Alike to the practical forester, the student of forestry, and all those who take a general interest in the subject, this little book will prove of great use as a stepping-stone to the more elaborate treatises, and its price will bring it within the reach of all. A. D. R.

Schlich's Manual of Forestry. By W. SCHLICH, Ph.D., C.I.E., F.R.S., F.L.S. London: Bradbury, Agnew, & Co., Ltd. Vol. II., 3rd ed., 1904, price 8s. net; Vol. III., 3rd ed.,[1] 1905, price 9s. net.

Revised (third) editions of the above volumes of Professor Schlich's *Manual*, dealing with Sylviculture and Forest Management respectively, have been published since the last issue of the *Transactions*. In Vol. III. a number of changes occur, and considerable alterations have been made in the Appendices, especially in so far as these relate to yield tables.

[1] No 2nd ed. of Vol. III. has been published.—HON. ED.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON.

HIS MOST EXCELLENT MAJESTY THE KING.

PROCEEDINGS IN 1904.

THE JUBILEE MEETING.

The Jubilee Meeting of the Royal Scottish Arboricultural Society was held in the Hall of the Young Men's Christian Association, 14 South St Andrew Street, Edinburgh, on Tuesday, 16th February 1904, at 2 P.M. W. STEUART FOTHRINGHAM, Esq. of Murthly, President of the Society, occupied the chair, and there was a large attendance of Members from all parts of the United Kingdom.

APOLOGIES FOR ABSENCE.

The SECRETARY mentioned that owing to the recent opening of Parliament, a number of those invited to the meeting had been unable to attend. He intimated that letters of apology for absence had been received from the following:—The Right Hon. the Earl of Onslow, President of the Board of Agriculture; The Secretary for Scotland; The Right Honourable the Earl of Mansfield; The Right Honourable Lord Avebury; R. C. Munro Ferguson, M.P., Honorary Secretary; Sir John F. L. Rolleston, M.P.; E. Stafford Howard, C.B., Commissioner of Woods and Forests and Land Revenues; Professor Schlich, C.I.E., Coopers Hill; Professor J. R. Campbell, B.Sc., Department of Agriculture, Ireland; J. Herbert Lewis, M.P.; Sir Joseph Hooker; Professor Sargent, Harvard University, U.S.A.; Professor Schwappach, Eberswalde, Prussia; Jägmästare Nilson, Sweden; J. Sykes Gamble, C.I.E.; Professor Fisher, Coopers Hill; and Dr John Nisbet, D.Œc.

Minutes.

The Minutes of the General Meeting held on 27th July last, which had been printed and circulated amongst the Members, were held as read and approved of.

Reception of Delegates.

The President then welcomed, on behalf of the Society, the following delegates from other Societies and Institutions, namely:—Dr Wm. Somerville, from the Board of Agriculture and Fisheries: Bailie Murray and Bailie M'Michael, from the Corporation of Edinburgh: Treasurer Anderson, from the Edinburgh and District Water Trust; Colonel Bailey, from the University of Edinburgh; Sir Ralph Anstruther, Bart., from the Highland and Agricultural Society; P. Murray Thomson, S.S.C., Secretary Royal Caledonian Horticultural Society; Charles Comfort, Broomfield, Davidson's Mains, from the Scottish Horticultural Association; Councillor Macpherson, from the Edinburgh and East of Scotland College of Agriculture; John Davidson, Haydon Bridge on Tyne, Secretary English Arboricultural Society; I. Scott Kerr, from the Irish Forestry Society; Wm. Carruthers, F.R.S., from the Royal Agricultural Society of England; A. D. Webster, from the Royal Horticultural Society of England.

Election of Honorary Members.

After the reception of the delegates, the President moved that the following be elected Honorary Members of the Society, in consideration of their services to Forestry in Scotland, and in honour of the Society's Jubilee, viz.:—

The Right Hon. The Earl of Mansfield.

Colonel F. Bailey, F.R.S.E., Lecturer on Forestry, University of Edinburgh.

Wm. Somerville, M.A., D.Sc., D.Œc., F.R.S.E., Assistant Secretary, Board of Agriculture and Fisheries.

John Grant Thomson, Wood Manager to the Countess of Seafield, Strathspey.

James Kay, Wood Manager to the Marquess of Bute, Isle of Bute.

Donald F. Mackenzie, F.S.I., Factor, Mortonhall, Midlothian.

Mr Alexander Milne, Edinburgh, seconded the motion, which was unanimously adopted.

Report by the Council.

The Secretary was then called upon by the President to read the Report by the Council, as follows :—

Jubilee.

It was reported to the General Meeting in July last, that in connection with the Jubilee of the Society, a Conference, for the purpose of discussing the Report of the recent Departmental Committee on Forestry, would be held in Edinburgh as on this date, in addition to the usual Annual Meeting and Dinner. It was afterwards found, however, that owing to the opening of Parliament, Lord Onslow, President of the Board of Agriculture ; Lord Mansfield, Mr Munro Ferguson, Mr Stafford Howard, and others, would be unable to attend, and the Council accordingly decided to postpone the Conference, and at once took steps to secure Mr Fraser Story to deliver the lecture on German Forestry which has been announced. They hope that an interesting discussion will follow the lecture.

The Council now recommend that the Conference be held at Perth in July, in connection with the Society's Exhibition of Forestry in the Highland and Agricultural Society's Showyard there, and they propose to arrange for a short Excursion to Dunkeld, Murthly, and Scone at the same time.

Membership.

It is gratifying to be able to report that there has been a considerable addition to the Membership in the course of the year, in spite of numerous losses through deaths, resignations, and lapses. Amongst the deaths intimated were those of Sir James Campbell and Sir Robert Menzies, both Honorary Members of the Society, and of the Earl of Stair, Sir Wyndham Carmichael Anstruther, Mr C. L. Orr-Ewing, M.P., Mr David Keir, Ladywell, and Mr John Allan, Dalmeny.

It is with much regret that the Council have also to announce the death, on 12th December last, of Mr Andrew Boa, Great Thurlow, Suffolk, the oldest Member of the Society.

At last Annual Meeting the Membership was 955. One hundred and twenty-four new Members have been admitted in the course of the year, but 63 have been removed owing to the causes mentioned above, making a net gain of 61 Members and a total of 1016, made up as follows :—

Honorary Members, . .	18
Honorary Associates, . .	6
Life Members, . . .	250
Ordinary Members, . . .	742
	1016

Prizes for Essays, etc.

The Syllabus of Subjects for Essays in 1903, which was issued in January of that year, included 25 subjects. Five Essays were received in competition, each of which was awarded a Medal. The Medals awarded were—one No. 1 Silver Medal, one No. 2 Silver Medal, and three Bronze Medals. A model of a Shear Fence was also submitted to the Society, and, in accordance with the Report of Special Judges appointed to examine it, the Council awarded a Bronze Medal to the maker, Mr Frederick Moon, Mount Trenchard, Foynes, Co. Limerick, in respect of the workmanship of the model.

Donors.

The thanks of the Society are due to Messrs W. H. Massie, William Mackinnon, and D. P. Laird, for prizes offered by them for Essays on Subjects which will be found in the Syllabus printed at the end of last year's *Transactions*.

Transactions.

The *Transactions* for last year have now been in the hands of the Members for some time. In the course of the summer, the Council had to accept with much regret the resignation, owing to ill-health, of Colonel Bailey, the Honorary Editor, and Convener of the *Transactions* Committee. Previous to his resignation, Colonel Bailey had made some progress with the preparation of materials for the *Transactions*, but the bulk of the work had, unfortunately, to be carried out by the Secretary, without the benefit of his guidance. A Committee is now considering as to the arrangements to be made for editing the *Transactions* in future.

Until this Report has been received, the Council have arranged that the Secretary will carry on the work, and, meantime, communications offered for the *Transactions* should be sent to him. A special part of the *Transactions* will be prepared in connection with the Jubilee, which it is hoped will prove a suitable memorial of the occasion.

Departmental Committee's Report.

The Report of the Departmental Committee on Forestry was printed in last year's *Transactions*, and since then the Minutes of Evidence have been published by the Government. The work of the Committee has already produced some results.

The Council understand that the authorities of Edinburgh University are considering how effect may best be given to the recommendations of the Forestry Committee in regard to the teaching of Forestry, and that the granting of a degree in this subject is contemplated. The Edinburgh and East of Scotland

College of Agriculture have appointed Mr Fraser Story, Lecturer on Forestry to the College, and he is now delivering a course of lectures in Fife and in Berwickshire, to large audiences. Progress in connection with Forestry education has also been made in England, at the Agricultural College of Cirencester, and at the Forest of Dean. H.M. Commissioners of Woods and Forests, and the Board of Agriculture, are understood to be in full sympathy with the Society's desire for the establishment of a Demonstration State Forest in Scotland; and the Board of Agriculture have already taken up the matter of the afforestation of the Water Supply Catchment-areas belonging to municipalities, regarding which the Society has distributed literature to the large municipalities in Scotland. It is understood that the municipalities of Edinburgh and Dundee have the matter under consideration. The Members will have an opportunity of discussing the Committee's Report at the Conference in July, and it is hoped that by then further progress may have been made. Meantime a resolution on the subject will be submitted for approval to-day.

Larch Disease.

The Committee on the Larch Disease have found some difficulty in arranging the details of the Schedule which they propose to issue with the view of collecting statistics, but the Schedule is now in proof, and it is expected that it will be issued before long to those who are most likely to be in a position to supply the information desired.

Forestry Exhibitions.

It was rather disappointing to find that the Exhibition at Dumfries was not so well patronised by Exhibitors as those held at Aberdeen and Inverness, even although, on this occasion, prizes were offered for various exhibits. There were only 7 Members who sent articles for exhibition, and 12 who entered in the prize section. The Judges were Mr James Cook, Arniston, and Mr A. T. Gillanders, Forester, Alnwick Castle, and they awarded £5 out of the £20 voted by the Highland and Agricultural Society, and 6 Medals—three of which were No. 1 Silver Medals and three No. 2 Silver Medals. A full Report of the Exhibition will be found at page 314 of last year's *Transactions*.

The Highland and Agricultural Society have again granted space for an Exhibition in their Showyard at Perth, and have also renewed their vote of £20 for prizes for home-grown timber exhibited at that Exhibition. The circulars in connection with the Exhibition have been issued to the Members. It will be observed that this year the Council have decided to repay, if asked, railway carriage and charges for delivering into and removing from the Showyard of the articles sent for Exhibition

only, but not of the exhibits of goods manufactured for sale, or sent in competition. The local Committee this year are—Mr Alexander Pitcaithley, Scone, Mr Alexander Murray, Murthly, and Mr James Forgan, Bonskeid.

Informal Meeting at Dumfries.

An Informal Meeting was held at Dumfries in connection with the Forestry Exhibition there, and the Minute of that Meeting will be found printed in the *Proceedings* of last year.

Excursion to Sweden.

The preparation of the proposed Album of Views taken by the Members in the course of the Excursion in Sweden, was entrusted to Mr Richardson, the Society's Photographer. Considerable difficulty was experienced to begin with, in selecting views for the Album, and afterwards the dense character of some of the negatives, and the exceptionally unfavourable weather, have combined to make the progress of the work exceedingly slow. Mr Richardson hopes that the Album will be ready for distribution by the end of April or the beginning of May.

Excursion to Woburn, etc.

The Excursion to Woburn, etc., was attended by about ninety Members. It proved a very interesting and instructive tour. On the return of the party, the thanks of the Society were formally communicated to the various proprietors whose estates had been visited, and to those who had assisted in connection with the arrangements. A full report of the Excursion will be found at page 301 of last year's *Transactions*.

The accounts in connection with this Excursion show a surplus of almost £30, but out of this sum there fall to be paid the auditor's fee, and also the expense of a presentation copy of the group taken at Woburn, which the Committee decided should be sent to each member of the party and to those who assisted. Most of the photographs have already been sent out, and the remainder will follow very soon. After these payments have been made, there will be a balance of about £7 to be added to the previous credit balance of £22.

Excursion to France.

As the Members are aware, the Council propose that the Society should visit some of the State Forests in France in the course of the present summer. It is hoped that those Members who desire to attend that Excursion will comply with the Council's request by sending their names to the Secretary as soon

as possible. About one hundred cards have already been returned. If considered desirable, the Council will endeavour to arrange that those Members who cannot spare the time to undertake the whole trip, may return home after inspecting the Forest School at Nancy and the State Forests in that neighbourhood. The expense of this part of the trip would be rather more than half the expense of the whole tour, but this cannot be ascertained for some time.

Register of Foresters.

The Society's Register of Foresters and others is now in operation, and a considerable number of men, wishing either employment or promotion, have sent their names to the Secretary. The Council appeal to proprietors and others requiring Estate men to make use of the Society's Register.

St Louis Exhibition.

At the General Meeting in July, it was remitted to the Council to procure photographs of American Conifers grown in this country, to send to the St Louis Exhibition, and Mr RICHARDSON, the Society's Photographer, was authorised to prepare the photographs, a sum of £20 being voted for the purpose.

It is understood that, owing to the unsuitable weather, Mr Richardson has as yet been unable to procure all the photographs required, but that he hopes to get the remainder in the course of next month.

Railway Rates.

In the course of the year, the Council appointed a Committee to collect information on the subject of alleged preferential Railway Rates on Foreign timber. The result of their labours has been recorded in a note which will be found at page 318 of last year's *Transactions*. Further communications on the subject will be welcomed.

Coopers Hill.

At a recent meeting of the Council, Mr MUNRO FERGUSON mentioned that a Committee of Inquiry was then sitting, in connection with the Forestry Branch of the Engineering College at Coopers Hill. He thought that the Coopers Hill establishment should be transferred to a University centre, and he recommended that the Council should lay before the India Office a representation in favour of Edinburgh being made that centre. The Council approved of Mr Ferguson's suggestion, and he was authorised to make such a representation, which he did by calling personally at the India Office and the Board of Agriculture.

Royal Institution, Edinburgh.

The Members are all aware that owing to rebuilding operations at No. 5 St Andrew Square, the Society's Headquarters have been temporarily changed to 12 York Buildings. It is understood that the new premises at 5 St Andrew Square will be ready for occupation at Whitsunday, and the Society will doubtless, if desired, find accommodation there as before. There has, however, been a movement going on for some time amongst the various Scientific Societies in Edinburgh, with the view of obtaining central premises for their joint accommodation. This movement, which at one time was found unworkable, owing to the expense involved, has been revived in connection with the Report which was issued by the Departmental Committee to investigate into the administration of the funds at the disposal of the Board of Manufactures. This Committee recommended that, amongst other things, new Art Schools should be built in Edinburgh, which if carried out would result in all the rooms in the Royal Institution being vacated, with the exception of those at present occupied by the Royal Society. The Royal Society therefore convened a meeting of the various Scottish Scientific Societies having their Headquarters in Edinburgh, and laid before them a scheme, which may be briefly outlined as follows:— They suggest that the Royal Society should retain the rooms at present occupied by them; that the Royal Scottish Geographical Society and the Scottish Meteorological Society, which both have a permanent staff of officials, should also have permanent rooms for their exclusive use; that the other Scientific Societies should have the joint use of rooms for their Council and Committee meetings; that a large hall, accommodating 700 to 800, should be at the disposal of all the Societies for their large meetings; that a reading-room containing the current literature of all the Scientific Societies, and publications received by them, should be available for the Members of these Societies; and that the libraries of all the Societies should be accommodated in one large library, to which all the Members of these Societies should have free access. In this way the whole of the Royal Institution building would be used exclusively by the various Societies, who should only be asked to bear the expense of the internal upkeep and management, the Government maintaining the fabric of the building. The Secretary for Scotland was communicated with, and agreed to receive a deputation from the Societies, which waited upon him and explained the scheme to him on 19th January last, and the matter is now under his consideration. The Honorary Secretary and the Secretary accompanied the deputation on behalf of this Society.

Assuming that the scheme can be successfully carried out, it will not be known exactly what contribution towards the annual expense would be required from this Society, until it is ascer-

tained how many Societies are to co-operate, but it is estimated that the amount would not exceed £10 per annum.

Dunn Memorial Fund.

This Fund consists of £100 Edinburgh Corporation Redeemable Stock, bearing interest at 3 per cent., and a balance of uninvested capital of £1, 10s. 2d. The income received during the year was £3 less income tax, which, however, may be recovered from the Government. The actual sum at present in hand is therefore £4, 7s. 6d. A Committee was appointed to consider as to the disposal of this sum, and they have recommended that in the event of accommodation being obtained in the Royal Institution, the sum in hand and the future income of this Fund should be expended in the purchase of Forest Literature for the library and reading-room.

Library and Museum.

A list of the publications received by the Society since the last list was published will, as usual, be printed in an Appendix to the Proceedings of this Meeting. (See Appendix C.)

Annual Meeting.

At last Annual Meeting the motion brought forward by Mr Leven, to the effect that the Annual Meeting of the Society should be held alternately in Edinburgh, Glasgow, and Perth, was rejected. Mr Boyd gave notice that he would bring up a similar motion at the present Meeting, but, subsequent to the Meeting, he withdrew his motion. He, however, brought up the matter at a recent meeting of the Council, and by a majority the Council decided to recommend, for the approval of this meeting, that the next Annual Meeting should be held in Perth.

The Council.

It was reported that in 1902 the Council had resolved to meet on Saturday afternoons instead of on Wednesdays as in previous years. The matter was again brought up in the beginning of last year, when it was decided to hold the meetings alternately on Wednesday and Saturday, and this decision has been acted on during the past year.

Jubilee Dinner.

Members are reminded that the Jubilee Dinner will be held in the Royal British Hotel this evening at 6 o'clock, and will be presided over by Mr Fothringham, the President.

After the Report had been read, the President invited Members to express their views regarding the various points raised, and said that each point would be dealt with separately.

Conference and Exhibition.

The Meeting approved of the Council's suggestion, that the Conference should be held at Perth in connection with the Exhibition, and that a two days' Excursion should be organised in connection with it.

Departmental Committee's Report.

The President, on behalf of the Society, submitted the following Resolution, which was seconded by Mr A. Pitcaithley, and was passed unanimously, namely:—

"That it is the opinion of the Members of the Royal Scottish Arboricultural Society, assembled in Annual Meeting, that the Board of Agriculture should now take steps to give effect to the recommendations of the Departmental Committee on Forestry, as far as regards Scotland, by providing an Estate to serve as a State Forest Demonstration Area, and also by providing Example Plots in connection with Edinburgh University: and further, that Forestry Education in this country will not be adequately provided for until the foregoing are supplied, and a thoroughly equipped Forest School is established in Scotland."

It was agreed that a copy of the Resolution should be sent to the President of the Board of Agriculture, the Commissioner of Woods and Forests, the Secretary for Scotland, and to the Societies and Institutions that sent delegates to the Meeting. The delegates present were also invited to bring the subject before their respective Societies.

Excursion to France.

Mr Laird moved that the Council's suggestion that the Excursion might be divided into two parts should be carried out, and this was agreed to.

Railway Rates.

The President invited Members and others to send in particulars of any cases of injustice which came under their notice, so that they might be tabulated and sent to the Board of Agriculture.

Place of Meeting.

With regard to the recommendation by the Council that the Annual Meeting should be held at Perth next year, Mr Pitcaithley moved, and Mr Hay seconded, that this recommendation be given effect to. Mr A. Milne moved, and Mr James Kay seconded, that the Annual Meeting be held in Edinburgh as hitherto. On a vote being taken, Mr Milne's motion was carried by a large majority.

Adoption of the Council's Report.

Sir Kenneth Mackenzie then moved the adoption of the Report. He expressed the satisfaction with which the Council had seen the increase in the Membership, which denoted an increase of interest taken in Forestry in this country. He thought that was a very satisfactory thing. They all most urgently hoped that funds might be obtained and an estate bought, in which a State-aided School for the instruction of young foresters might be established, and that growing trees upon a forest system, apart from the system on which many people grew their woods—which was for pleasure, appearance, and shooting—might be established in this country.

The Report, as amended by the foregoing discussion, was unanimously agreed to.

Finances.

Mr John Methven, Edinburgh, Convener of the Finance Committee, formally submitted the Abstract of the Accounts, which had already been printed and circulated amongst the Members. (An Abstract of the Accounts will be found in Appendix A.)

Mr Methven pointed out that the income from all sources, exclusive of the balance brought forward, was £411, 5s. 3d., and the expenditure, £264, 14s. 1d., leaving a balance of £146, 11s. 2d. The balance of Revenue carried forward last year was £329, 3s. 11d., whereof they had carried to Capital £276, 1s. 7d., and the amount carried forward was £199, 13s. 6d. Out of this sum fell to be paid the cost of the *Transactions*, etc., leaving a net balance belonging to the Society of about £90. By transferring the £276, 1s. 7d. of surplus Revenue to the

Capital Account, the amount of Capital had been raised to £1229, 7s. 6d., as compared with £944, 17s. 2d. at the close of the previous account. It was interesting to note that if they went back to the end of 1894 they were only possessed of £61, and out of that £50 was due to the Forestry Chair Endowment Fund. He thought it was exceedingly gratifying that after an interval of nine years their Capital account had reached £1229.

Mr Charles Buchanan, Penicuik, seconded, and the Report was adopted.

Excursion Fund.

The Secretary submitted the following Abstract of Accounts for the past year:—

Excursion to Woburn, etc., 27th to 31st July 1903.

RECEIPTS.

Balance in hand at close of last Account,		£22 13 11
Contributions to Common Purse, including Deposits,		296 12 11
Sums received in advance for Swedish Album,		4 4 0
		£323 10 10

PAYMENTS.

Auditor's Fee for 1902 Accounts,	£2 2 0		
Printing Programmes, etc.,	3 6 9		
Hotels,	186 11 6		
Hiring and Railways,	72 9 9		
Gratuities and Miscellaneous Outlays previous to and throughout the Tour,	5 8 7		
		269 18 7	
Balance carried forward to next Year, being Sum in National Bank of Scotland on Account Current,		£53 12 3	

Note.—The above Balance includes £4, 4s. received in advance for the Swedish Album, and is subject to the cost of the presentation copies of the Excursion Group taken at Woburn, estimated at about £20.

Edinburgh, *6th February* 1904.—Examined with Vouchers and Memorandum Books and found correct. Bank Certificate of above balance of £53, 12s. 3d. also exhibited to me.

John T. Watson,
Auditor.

The Malcolm Dunn Memorial Fund.

The following Abstract of Accounts in connection with this fund for the past year was submitted and approved of:—

RECEIPTS.

Balance in Bank at close of last Account,	£1	10	2
Dividend on £100 3 per cent. Redeemable Stock of Edinburgh Corporation, payable at Whitsunday and Martinmas 1903, £3, *less* Tax 2s. 8d.,	2	17	4
	£4	7	6

PAYMENTS.

Nil.

Balance carried forward, being Sum in National Bank of Scotland on Account Current,	£4	7	6

Note.—The Capital belonging to the Fund consists of £100 3 per cent. Redeemable Stock of Edinburgh Corporation.

Edinburgh, *6th February* 1904.—Examined and checked with Memorandum Book and found correct. Bank Certificate of above £4, 7s. 6d., also Stock Certificate Edinburgh Corporation for £100 exhibited.

John T. Watson,
Auditor.

Election of Office-Bearers.

On the motion of Mr D. P. Laird, and seconded by Mr G. Mackinnon, the Office-Bearers as recommended by the Council in lieu of those who retired by rotation were unanimously elected as follows:—*President*—W. Steuart Fothringham of Murthly, Perthshire. *Vice-Presidents*—Charles Buchanan, Overseer, Penicuik Estate, Penicuik; Sir Kenneth J. Mackenzie, Bart. of Gairloch, 10 Moray Place, Edinburgh. *Councillors*—John Boyd, Forester, Pollok Estate, Pollokshaws, Glasgow; Sir Thomas Gibson Carmichael, Bart. of Castle Craig, Malleny House, Balerno; James Cook, Land Steward, Arniston, Gorebridge; George U. Macdonald, Forester, Raith, Kirkcaldy; William Mackinnon, Nurseryman, 75 Shandwick Place, Edinburgh; R. V. Mather, Nurseryman, Kelso; Adam Spiers, Timber Merchant, Warriston Saw-mills, Edinburgh; and Sir Robert D. Moncreiffe, Bart. of Moncreiffe, Perth, who subsequently intimated his inability to accept office The

Honorary Secretary, the Secretary and Treasurer, the Auditor, the Honorary Scientists, the Photographer, and the Local Secretaries, with the addition of Mr W. R. Brown, Heckfield, Winchfield, Hants, were re-elected.

In thanking the Meeting for re-electing him to the position of President, Mr Fothringham said that he had tried to do what little he could for the Society, and he hoped to continue his efforts to advance its objects. He could only say that his own experience of the other Office-Bearers was that they all had the interests of the Society very much at heart. In their name and in his own, he begged to thank the Society for their renewed confidence.

Judges and Transactions Committee.

Mr M'Hattie moved that this Committee be re-elected. Mr Pitcaithley moved, and Mr Hay seconded, that the election of this Committee be remitted to the Council, and on a vote being taken Mr Pitcaithley's motion was carried.

President's Address.

The President then delivered his address, a full report of which will be found in the *Transactions*.

Votes of Thanks.

Hearty votes of thanks were accorded to the President for his address, and to the Delegates for their attendance, which concluded the formal business of the Meeting.

Lecture on German Forestry.

At the close of the Business Meeting, Mr Fraser Story, The Glen, Innerleithen, Lecturer on Forestry to the Edinburgh and East of Scotland College of Agriculture, delivered a lecture on German Forestry, which was illustrated by lantern slides, prepared from photographs taken by himself and Mr Nobbs, another Member of the Society, during their stay in Germany. The lecturer was introduced by the President, and after the lecture an interesting discussion took place. A full report of the lecture and discussion will be found in the *Transactions*. On the motion

of the President, Mr Story was cordially thanked for his very interesting and instructive lecture. Mr Story thanked the Members for their attention and courtesy.

THE JUBILEE DINNER.

The Jubilee Dinner of the Society was held in the Royal British Hotel, Edinburgh, the same evening, at 6 P.M. W. STEUART FOTHRINGHAM, Esq. of Murthly, etc., President of the Society, occupied the Chair, and the croupiers were Sir KENNETH MACKENZIE, Bart., Mr JOHN METHVEN, and Mr ALEX. PITCAITHLEY, Vice-Presidents of the Society. There were over one hundred gentlemen present. The guests included the delegates who were present at the Jubilee Meeting in the afternoon, the new Honorary Members, the Rev. D. C. Stewart, Mr Fraser Story, and Mr James Macdonald, Secretary of the Highland and Agricultural Society. The toast of the evening—"The Royal Scottish Arboricultural Society"—was proposed by Dr Wm. Somerville, of the Board of Agriculture, and was replied to by the President. A detailed report of the proceedings will be found in the *Transactions*.

THE GENERAL MEETING.

A General Meeting of the Royal Scottish Arboricultural Society was held in the Lecture Room of the Perthshire Society of Natural Science, Tay Street, Perth, on Friday, 22nd July 1904, at 12 noon. There was a large attendance of Members, and W. STEUART FOTHRINGHAM, Esq. of Murthly, President of the Society, occupied the chair.

Apologies for absence were intimated from Sir Kenneth Mackenzie, Colonel Bailey, and Mr Munro Ferguson, M.P.

MINUTES.

The Minutes of the Jubilee Meeting, held on 16th February last, were held as read and approved of.

Confirmation of Election of Councillors.

On the motion of the President, the election by the Council of Colonel Bailey and Dr Borthwick to the seats on the Council, rendered vacant by the non-acceptance of Sir Robert Moncreiffe and the resignation of Mr A. D. Richardson on his appointment by the Council as Assistant Editor, was duly confirmed.

Chairman's Remarks.

In the course of his remarks, the Chairman referred to the satisfactory condition of the Society as regards finance and membership. He expressed the hope that the membership would still increase, so that they might be able to do more towards furthering the objects of the Society. He referred also to the Exhibition held in the Highland and Agricultural Society's Show, and said that he thought it would encourage those in the south and farther north of Scotland, when the Exhibition visited them in turn, to have a better Exhibition each year than the present one, and to see if they could vie with them in Perth in having a real good Exhibition in the Highland and Agricultural Society's Show.

Report by the Judges on Essays.

The Report of the Judges on the Essays received in competition was submitted, and the following awards were made, in terms of their recommendations:—

Class I.

(1) "Output of an Acre of Nursery Ground."

Award—Bronze Medal, to Gilbert Brown, Beaufort Cottage, Kiltarlity, by Beauly.

(2) "The Utilisation of Forest Produce." By "March Wind."

No Award.

(3) "The Sylvicultural Advantages of Underplanting," with specified examples.

Award—No. 2 Silver Medal, to Archibald E. Moeran, Palmerston, Portumna, Co. Galway.

Class II.

(1) "Diseases affecting Trees, or Injuries caused to Trees, by Fungi, Insects, and Animals."

Award—No. 2 Silver Medal, to John M. Murray, Assistant Forester, Kingswood, Murthly.

(2) "Diseases affecting Trees, or Injuries caused to Trees, by Fungi, Insects, and Animals." By "Coup d'Essai."

No Award.

(3) "The Best Method of Protecting Trees from Injury by Ground Game." By "Axeman."

No Award.

Forestry Exhibition at Highland Society's Show.

The Secretary read the Report of the Judges, as follows:—

We beg to submit the following Report and Awards made by us on the articles in competition at the Forestry Exhibition.

It is with great pleasure we report that the Forestry Exhibition of 1904 has been a great success: as regards merit, highly creditable to the individual exhibitors, and also to the Society.

The general excellence and the variety of timbers in some classes rendered the placing of awards a much more arduous task than had been anticipated, the difficulty being greatly intensified, owing to the fact that the work had to be done after the Show-yard had been opened to the public. We would therefore respectfully ask the Council to consider the advisability in future of having the judging done previous to the opening of the Show-ground.

In Competitions Nos. I. and II., it transpired that the exhibits placed third in the former, and first in the latter, were from Ireland, by "Fidelite est et Dieu," and, in accordance with the conditions, were not eligible, therefore in the list of awards they are not mentioned; but, in compliance with the wish of the Committee, we recommend that special prizes, to the value of those originally awarded, be given to the competitor.

In Competition No. VIII., the exhibits of two competitors being equal, we award a No. 1 Silver Medal to each.

In Competitions Nos. XII. and XIII., there being no practical

way in the Exhibition of testing the usefulness and accuracy of the instruments exhibited (to decide on which, we consider they should have been sent in previous to the Show, along with the Reports), we are not in a position to make any awards, but we recommend the Council, for the purpose of encouraging competitors in these competitions, to submit the instruments to experts and practical men, who have opportunities of accurately testing them. The question of awards could then be considered by the Council.

In Competition No. XV., where two competitors were again equal with their exhibits,—the first prize in this case being £3, and the second prize a medal,—we recommend that one competitor receive the special prize, £3, and the other the value of a No. 1 Silver Medal, £3.

In all other cases we recommend that the medals be given without option.

Awards.

Competition No. I.

A Collection of Three Varieties of Timber grown in Scotland, viz.:—(1) Scots Pine, (2) Larch, (3) Norway Spruce.

1st Prize,	. .	Earl of Mansfield.
2nd Prize,	. .	W. Steuart Fothringham of Murthly.
3rd Prize,	. .	H. J. Younger of Benmore.

Competition No. II.

A Collection of the Timber of any other Three Varieties of Conifers grown in Scotland.

1st Prize,	. .	Earl of Mansfield.
2nd Prize,	. .	J. Chalmers, Ayton, Abernethy.
3rd Prize,	. .	C. L. Wood of Freeland.

Competition No. III.

A Collection of Three Varieties of Timber grown in Scotland, viz.:—(1) Ash, (2) Oak, (3) Elm.

1st Prize,	. .	Earl of Mansfield.
2nd Prize,	. .	Wm. Smith, Forester, Camperdown.
3rd Prize,	. .	Sir Neil Menzies, Bart. of that Ilk.

Competition No. IV.

A Collection of the Timber of any other Three Varieties of Broad-leaved Trees grown in Scotland.

1st Prize, . . W. Steuart Fothringham of Murthly.
2nd Prize, . . Earl of Mansfield.
3rd Prize, . . Earl of Mansfield.

Competition No. V.

Report on the Damage done by Insect Pests to Forests Trees, and the measures that have been successfully adopted for their extermination, with specimens.

Silver Medal (No. 2), J. M. Murray, Assistant Forester, Kingswood, Murthly.

Competition No. VI.

Model of a Portable Saw-mill. (No Entries.)

Competition No. VII.

A Gate for Estate or Farm Use, manufactured from Home-grown Timber, shown in working order.

Silver Medal (No. 2), Alex. Lamb, Forester, Freeland.
Highly Commended, Earl of Mansfield.
Commended, . . W. Steuart Fothringham of Murthly.

Competition No. VIII.

Full-sized section of Rustic Fence made from Larch or other Thinnings.

Silver Medals (No. 1) to the Earl of Mansfield, and to James Forgan, Forester, Bonskeid, both being equal.

Competition No. IX.

Specimens showing the comparative quality of Larch Timber grown on different soils and situation, and the respective ages at which it reaches marketable size and maturity, with Report.

Gold Medal, . . Earl of Mansfield.
Silver Medal (No. 2), James Forgan, Forester, Bonskeid.

Competition No. X.

Examples showing the Best Methods of Utilising Small Wood in the manufacture of Fancy Wood Articles, Turnery, Woodwool, etc.

Gold Medal, . .	James Forgan, Forester, Bonskeid.
Silver Medal (No. 2),	John Smith, Coachbuilder, Peebles.
Highly Commended,	Alex. Pollock, Rustic Builder, Tarbolton.

Competitions Nos. XII. and XIII.

For a Scientific Instrument for expeditiously obtaining the Diameter of Trees at a given height, and for any other useful Invention or marked Improvement on any of the Implements used in Forestry. (2 Entries.)

Not Judged. See Report.

Competition No. XIV.

For a Water-Gate suitable for crossing a stream 30 feet wide.

Silver Medal (No. 2), . . Earl of Mansfield.

Competition No. XV.

For Timber preserved by any process that is practical and economical, with Report, etc.

Earl of Mansfield and George Leven, Forester, Auchencruive, Ayr, equal. See Report.

(Signed) John Boyd.
,, Colin Chisholm.
,, Adam Spiers.

Note.—On appeal, the Award in Competition No. XV. was altered by the Committee, Mr Leven being placed first and the Earl of Mansfield second.

St Louis Exhibition in 1904.

The Secretary read the following list of photographs of American Conifers grown in this country, which had been sent to the Exhibition. He explained that at the close of the Exhibition the Royal Commission would return the photographs to the Society, or the Society might dispose of them in America if they so desired, provided this is notified to the Commission.

List of Photographs of American Conifers grown in this Country sent to St Louis International Exhibition, 1904.

No. of Photo.	Scientific Name of Tree.	Where Growing.	Proprietor of Estate.	Age of Tree.	Height of Tree.	Girth of Stem at 5 feet up.
1	*Cupressus nootkatensis*, Lambert.	Scone, Perthshire.	Earl of Mansfield.	42 years.	50 feet.	...
2	*Cupressus Lawsoniana*, Murray.	,, ,,	,, ,,	42 ,,	62 ,,	...
3	*Thuya gigantea*, Nuttall.	,, ,,	,, ,,	42 ,,	61 ,,	...
4	*Libocedrus decurrens*, Torrey.	,, ,,	,, ,,	42 ,,	45 ,,	...
5	*Sequoia gigantea*, Torrey.	Murthly, Perthshire.	W. Steuart Fothringham, Esq.	47 ,,	79 ,,	11 ft. 0 ins.
6	*Picea sitchensis*, Trautt and Meyer.	Scone, Perthshire.	Earl of Mansfield.	61 ,,	90 ,,	13 ,, 2 ,,
7	*Abies Lowiana*, Murray.	,, ,,	,, ,,	42 ,,	64 ,,	6 ,, 3 ,,
8	*Abies nobilis*, Lindley.	,, ,,	,, ,,	61 ,,	77 ,,	8 ,, 0 ,,
9	*Pseudotsuga Douglasii*, Carriere.	Murthly, Perthshire.	W. Steuart Fothringham, Esq.	57 ,,	97 ,,	10 ,, 0 ,,
10	*Tsuga Pattoniana*, Engelm, and var. *glauca* (= *Abies Hookeriana*, Murray).	,, ,,	,, ,,	42 ,,	41 ,,	4 ,, 0 ,,
11	*Tsuga Mertensiana*, Carriere.	Scone, Perthshire.	Earl of Mansfield.	42 ,,	68 ,,	8 ,, 10 ,,
12	*Pinus monticola*, Douglas.	Murthly, Perthshire.	W. Steuart Fothringham, Esq.	54 ,,	77 ,,	6 ,, 4 ,,

Oak Leaf-Roller Moth.

Colonel Smyth of Methven said he had asked leave of the President to call the attention of the Society to the destruction caused by this moth, and to suggest that the Society should make an inquiry into the matter. Dr Nisbet said a great deal had been written on the subject already, and suggested that the literature might be collected and a précis made of it for the *Transactions*. He thought the Hon. Entomologist might do this for the Society. Mr Pitcaithley suggested that the Perthshire Society of Natural Science should be asked to co-operate with them. Mr William Forbes supported Colonel Smyth's suggestion. On the motion of the Chairman, the matter was remitted to the Council, with powers to take what steps they should consider advisable.

Excursion to Dunkeld.

It was reported that there had been a large turn out of members at the Excursion to Dunkeld, Kincairney, Murthly, and Scone, which had been held during the previous two days. The thanks of the Society were awarded to the Duke of Atholl, Lord Kincairney, W. Steuart Fothringham, Esq., and the Earl of Mansfield, for their kindness in allowing their woods to be visited, and for their hospitality to the Members on that occasion.

Excursion to France.

The Secretary reported that a large company had intimated their intention to take part in the Excursion to France, which was to set out on the following day. He said that by the time Nancy was reached, the company would number seventy members. The thanks of the Society were due to Colonel Bailey for the very great trouble he had taken in connection with the programme and the details of the arrangements, and also to Professor Fisher for the assistance rendered by him in the same way, and for the notes on the forests to be visited in the neighbourhood of Paris, which had been prepared by him. The Secretary reported that he had conveyed to the French Government the thanks of the Society for granting permission to visit the State Forests in France, and for the notes on the forests near Nancy and in the Vosges which they had been good enough to supply. The Secretary then read a message which had been received, through Colonel Bailey, from

Professor Henry of the Forest School at Nancy, with whom the correspondence relating to the Forests in the East of France had been conducted. Professor Henry wrote:—"The Director desires me to tell you that he and the other officers of the School will do our best to render your countrymen satisfied with their visit, which both honours and pleases us, and which tends to rebind the bonds of sympathy which for a long time united British and French foresters. Be good enough to interpret to the Royal Scottish Arboricultural Society these sentiments of the Director and Professors of the School at Nancy." The President was charged to convey the thanks of the Society to the Director, Professor Henry, and the other Professors when at Nancy.

Excursion in 1905.

The President mentioned that the Council had agreed to suggest that the Excursion next year should be held in North Aryshire and the neighbourhood of the Clyde. He invited suggestions from the Members present, when Cumberland, Ireland, and the vicinity of Glasgow were mentioned. It was stated that as the Highland and Agricultural Society's Show was to be held in Glasgow next year, it might be possible to combine Glasgow and North Ayrshire. On a vote being taken, the large majority were in favour of Glasgow and North Ayrshire, and it was remitted to the Council to arrange details.

This concluded the formal business.

The Conference.

After the Business Meeting a Conference was held, the subject of discussion being the recent Report of the Departmental Committee on Forestry, etc. The President occupied the chair. A Report of the Conference held under the auspices of the Society, between the representatives of the Universities and the Agricultural Colleges of Scotland and the Scottish Education Department, was submitted; and thereafter Mr J. Sykes Gamble, C.I.E., etc., Honorary Member of the Society, opened the discussion on Forestry Education, Dr Nisbet, the Society's Honorary Editor, Dr Wilson, St Andrew's University, Dr Borthwick, the Society's Honorary Cryptogamist, Mr Pitcaithley, Scone, Mr A. T. Gillanders, Alnwick, Mr G. Leven, Auchencruive, and others took part in the discussion. A detailed Report of the Conference will be found in the *Transactions*.

APPENDIX A.

ABSTRACT OF ACCOUNTS for Year ending 31st December 1903.

I.—CAPITAL.

CHARGE.

1. Funds at 31st December 1902,			£944 17 2
£486 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 126,	£612 7 2		
£250 Caledonian Railway Company 4 per cent. Debenture Stock, at 133,	332 10 0		
2. Life Members' Subscriptions in 1903,			121 9 0
New Members,	£108 3 0		
Ordinary Members by commutation,	13 6 0		
3. Sum transferred from Revenue to meet price of Stock,			276 1 7
			£1342 7 9

DISCHARGE.

1. Proportion of Life Members' Subscriptions transferred to Revenue,			£66 9 7
Unexhausted: £555 14 5, 74 19 3	$\frac{1}{15}$ of Full Life Subscriptions,	£53 17 9	
	$\frac{1}{10}$ of Commuted Subscriptions,	12 11 10	
2. Price of Stock purchased, viz.:—			
£250 Caledonian Railway Company 4 per cent. Debenture Stock, at 124$\frac{7}{8}$,		£312 3 9	
£14 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 121,		16 18 9	
		£329 2 6	
3. Expenses in connection with above purchase,			1 18 6
4. Decrease in value of Railway Stocks at 31st December 1903,			44 12 2
5. Funds at 31st December 1903,			1229 7 6
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 121,		£605 0 0	
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 124$\frac{7}{8}$,		624 7 6	
			£1342 7 9

II.—REVENUE.

CHARGE.

1. Balance in hand at 31st December 1902,			£329 3 11
2. Ordinary Members' Subscriptions,			293 0 6
Arrears at 31st December 1902,	£34 8 0		
Add Arrears written off but now received.	2 15 6		

DISCHARGE.

1. Printing, Stationery, etc.,			£123 11 3
Part 1 of Vol. XVII. of *Transactions*, including Plates, Blocks, etc.,		£112 6 9	
And Authors' Reprints,		4 8 0	
		£116 14 9	

	£348 2 6		
Deduct—			
Cancelled or written off as irrecoverable at 31st December 1903, . £23 1 0			
Arrears at 31st December 1903, . . 32 1 0			
	55 2 0		
	£293 0 6		
3. Proportion of Life Members' Subscriptions transferred from Capital, ...		66 9 7	
4. Dividends and Interest, ...		37 0 5	
5. *Transactions*, etc., sold, ...		12 19 0	
6. Income Tax Recovered, ...		1 15 9	
		£740 9 2	

	£123 11 3		
2. Prizes (Money, £10; Medals, £6, 3s.), .	£16 3 0		
Less Contributions by the Highland and Agricultural Society, being Prizes awarded for Home-grown Timber exhibited at Dumfries, . . .	£5 0 0		
		11 3 0	
3. Forestry Exhibition at the Highland and Agricultural Society's Show at Dumfries, . . .		15 18 6	
Printing, ...	£10 12 0		
Advertising, ...	1 5 0		
Other Outlays, . . .	4 1 6		
4. Expenses of Management, . . .		114 1 4	
Rent, ...	£3 7 6		
Auditor, ...	3 3 0		
Secretary and Treasurer, . . .	65 0 0		
Advertising, Insurance, and Premium on Secretary's Bond of Caution, . .	6 3 0		
Postages and Miscellaneous Outlays, viz.: Postages of 1902 *Transactions*, £12 16 9			
General Postages, Commissions on Cheques, and Petty Outlays, . . . 23 11 1			
	36 7 10		
	£114 1 4		
5. Sum transferred to Capital to meet price of Stocks bought,		276 1 7	
6. Balance of Revenue carried to next year (being sum in National Bank of Scotland, Limited), (*a*) £197, 0s. 6d. on Deposit Receipt, and (*b*) £2, 13s. on Account current, subject to payment of cost, etc., of 1903 *Transactions*, .		199 13 6	
		£740 9 2	

EDINBURGH, *4th February* 1904.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1903, of which the foregoing 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.

Office-Bearers for 1904:—

PRESIDENT.

W. Steuart Fothringham of Murthly, Perthshire.

VICE-PRESIDENTS.

John Methven, Nurseryman, 15 Princes Street, Edinburgh.
The Right Hon. the Earl of Mansfield, Scone Palace, Perth.
Alexander Pitcaithley, Forester, Jeanie Bank, Scone.
Charles Buchanan, Overseer, Penicuik Estate, Penicuik.
Sir Kenneth J. Mackenzie, Bart. of Gairloch, 10 Moray Place, Edinburgh.

COUNCIL.

John Hay, Overseer, Dollars Estate, 8 Rennie Street, Kilmarnock.
George Leven, Forester, Auchencruive, St Quivox, Ayr.
Sir John Stirling Maxwell, Bart. of Pollok, Pollokshaws.
Edward P. Tennant, Yr., of The Glen, 31 Lennox Gardens, London, S.W.
John Annand, Overseer, Woodbine Cottage, Peebles.
Colin Chisholm, Forester, Lundin and Montrave Estates, Hattonlaw House, Largo, Fife.
James Crabbe, Forester, Glamis, Forfarshire.
Robert Forbes, Estate Office, Kennet, Alloa.
A. T. Gillanders, F.E.S., Forester, Park Cottage, Alnwick, Northumberland.
John W. M'Hattie, Superintendent of City Parks, City Chambers, Edinburgh.
D. F. Mackenzie, F.S.I., Estate Office, Mortonhall, Liberton.
W. H. Massie, Nurseryman, 1 Waterloo Place, Edinburgh.
John Boyd, Forester, Pollok Estate, Wood Cottage, Kennishead, Thornliebank.
Sir Thomas Gibson Carmichael, Bart. of Castle Craig, Malleny House, Balerno.
James Cook, Estate Office, Arniston, Gorebridge.
George U. Macdonald, Forester, Raith, Kirkcaldy.
William Mackinnon, Nurseryman, 75 Shandwick Place, Edinburgh.
R. V. Mather, Nurseryman, Kelso.
Adam Spiers, Timber Merchant, Warriston Saw-Mills, Edinburgh.
Colonel F. Bailey, 7 Drummond Place, Edinburgh.
Dr A. W. Borthwick, Royal Botanic Garden, Edinburgh.

HON. SECRETARY.

R. C. Munro Ferguson, M.P., of Raith and Novar, Raith House, Kirkcaldy.

SECRETARY AND TREASURER.

Robert Galloway, S.S.C., 5 St Andrew Square, Edinburgh.

HON. EDITOR.

Dr JOHN NISBET, Royal Societies Club, 63 St James Street, London, S.W.

ASSISTANT EDITOR.

A. D. RICHARDSON, 8 Sciennes Gardens, Edinburgh.

AUDITOR.

JOHN T. WATSON, 16 St Andrew Square, Edinburgh.

TRUSTEES.

The EARL OF MANSFIELD, R. C. MUNRO FERGUSON, M.P., and W. STEUART FOTHRINGHAM of Murthly.

JUDGES AND TRANSACTIONS COMMITTEE.

Dr JOHN NISBET, Royal Societies Club, 63 St James Street, London, S.W. (*Convener*).
Colonel F. BAILEY, University Lecturer on Forestry.
D. F. MACKENZIE, F.S.I., Estate Office, Mortonhall, Liberton.
JOHN ANNAND, Estate Overseer, Woodbine Cottage, Peebles.
A. T. GILLANDERS, F.E.S., Park Cottage, Alnwick, Northumberland.
ANDREW SLATER, Stobs Estate Office, Hawick; and
THE SECRETARY, *ex officio*.

HONORARY CONSULTING SCIENTISTS.

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

Consulting Chemist.— * * * *

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

Consulting Entomologist.—ROBERT STEWART MACDOUGALL, M.A., D.Sc., Professor of Entomology, etc., Royal Veterinary College, Clyde Street, Edinburgh.

Consulting Geologist.—JOHN SMITH FLETT, M.A., B.Sc., M.B., C.M., Geological Survey, 28 Jermyn Street, London, S.W.

Consulting Meteorologist.—ROBERT COCKBURN MOSSMAN, F.R.S.E., F.R.Met.Soc., 10 Blacket Place, Edinburgh.

PHOTOGRAPHIC ARTIST.

A. D. RICHARDSON, 8 Sciennes Gardens, Edinburgh.

LOCAL SECRETARIES.

Scotland.

Counties.	
Aberdeen,	JOHN CLARK, Forester, Haddo House, Aberdeen.
	JOHN MICHIE, Factor, Balmoral, Ballater.
Argyle,	WALTER ELLIOT, Manager, Ardtornish.
	JOHN D. SUTHERLAND, Estate Agent, Oban.
Ayr,	ANDREW D. PAGE, Overseer, Culzean, Maybole.
	A. B. ROBERTSON, Forester, The Dean, Kilmarnock.
Banff,	JOHN BRYDON, Forester, Rothes, Elgin.
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.
	JOHN HAYES, Dormont Grange, Lockerbie.
	JOHN NEWBIGGING, Nurseryman, Dumfries.
East Lothian,	W. S. CURR, Factor, Ninewar, Prestonkirk.
Fife,	WM. GILCHRIST, Timber Merchant, Ladybank.
	EDMUND SANG, Nurseryman, Kirkcaldy.
Forfar,	R. CAIRNS, The Gardens, Balruddery, near Dundee.
	JAMES CRABBE, Forester, Glamis.
	JAMES ROBERTSON, Forester, Panmure House, Carnoustie.
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,	W. HARROWER, Forester, Tomnacroich, Garth, Aberfeldy.
	W. A. MACKENZIE, Factor, Faskally, Pitlochry.
	ALEX. PITCAITHLEY, Jeanie Bank, Old Scone, 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, . .	JOHN ALEXANDER, 46 Clarendon Road, Bedford.
	FRANCIS MITCHELL, Forester, Woburn.
Berks, . .	W. STORIE, Whitway House, Newbury.
Cheshire, .	WM. ELDER, Cholmondeley Park, near Malpas.
Devon, . .	JAMES BARRIE, Forester, Stevenstone Estate, Torrington.
	WM. STORIE, Forester, Gulworthy, Tavistock.
Durham, .	A. C. FORBES, Professor of Forestry, Armstrong College, Newcastle-on-Tyne.
Gloucester, .	GEORGE HANNAH, Over House, Over Almondsbury, Bristol.
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.
Northumberland,	JOHN DAVIDSON, *Secretary*, English Arboricultural Society, Haydon-Bridge-on-Tyne.
Notts, . .	W. MICHIE, Forester, Welbeck, Worksop.
	WILSON TOMLINSON, Forester, Clumber Park, Worksop.
Salop, . .	FRANK HULL, Forester, Lillieshall, Newport.
Suffolk, . .	ANDREW BOA, junior, Agent, Great Thurlow.
Surrey, . .	PHILIP PEEBLES, Estate Office, Albury, Guildford.
Warwick, .	A. D. CHRISTIE, The Gardens, Ragley Hall, Alcester.
York, . .	ADAM MAIN, Forester, Rose Cottage, Loftus.
	D. TAIT, Estate Bailiff, Owston Park, Doncaster.

Ireland.

Dublin, . .	JAMES WILSON, B.Sc., Royal College of Science, Dublin.
Galway, . .	THOMAS ROBERTSON, Forester and Bailiff, Woodlawn.
Kilkenny, .	ALEX. M'RAE, Forester, Castlecomer.
King's County,	ARCH. HENDERSON, Forester, Clonad Cottage, Tullamore.
Tipperary, .	DAVID G. CROSS, Forester, Kylisk, Nenagh.
Wicklow, .	ADAM JOHNSTONE, Forester, Coollattin, Shillelagh.

APPENDIX C.

Presentations to the Society's Library since the Annual Meeting on 20th July 1903.

Books.

1. *Country Gentlemen's Association Estate Book* for 1903-04.
2. *Thompson's Gardeners' Assistant.* New Edition, 2 vols.
3. *Sylviculture:* 3rd Edition revised of Dr Schlich's *Manual of Forestry.*
4. *Forestry in the United Kingdom.* By Dr Schlich.
5. *Sweden: its People and its Industry.* Presented by Jägmästare Elis Nilson, Sweden.
6. *Trees: A Handbook of Forest Botany for the Woodlands and Laboratory.* Vol. i. By H. Marshall Ward, F.R.S., etc.
7. *English Estate Forestry.* By A. C. Forbes, F.H.A.S.
8. *The Timbers of Commerce and their Identification.* By Herbert Stone, F.L.S., etc.
9. *Forestry.* By Professor Schwappach, translated by Fraser Story.
10. *Calendar of University College of North Wales* for 1903 and 1904.
11. *New Zealand Official Year-Book,* 1903.

Reports, Transactions, Etc.

12. *Annual Report of the Smithsonian Institution,* for Years 1896-97 to 1898-99.
13. *Transactions of the Highland and Agricultural Society* for 1903-04.
14. *Transactions of the Royal Agricultural Society of England,* 1902-03.
15. *Transactions of the English Arboricultural Society,* vol. v., part 3.
16. *Transactions of the Nova Scotian Institute of Science,* vol. x., part 3.
17. *Annals of Andersonian Naturalists Society,* vol. ii.
18. *Transactions of the Massachusetts Horticultural Society,* 1902, parts 1 and 2; 1897, part 3; 1903, parts 1 and 2.
19. *Transactions of the Royal Dublin Society,* vol. vii., parts 14 and 16; vol. viii., parts 1 and 2-5.
20. *Proceedings of the Royal Dublin Society,* vol. ix., part 5; vol. x., part 1.
21. *Economic Proceedings of the Royal Dublin Society,* vol. i., parts 3 and 4.
22. *Annual Report of the Secretary for Agriculture, Nova Scotia,* 1902-03.
23. *Minutes of Evidence on British Forestry,* 1903.
24. *Report of the Madras Forest Department,* 1901-02.
25. *Journal of the Royal Horticultural Society,* vol. xxviii., parts 1, 2, 3, and 4.
26. *Fourth Annual Report of Canadian Forestry Association,* 1903.
27. *Report of Conservator of Forests for South Australia,* 1902-03.
28. *Annual Report of Experimental Farms in Canada.*
29. *Report of the Department of Lands and Survey, New Zealand,* 1902-03.
30. *Agricultural Returns,* 1903.
31. *Reports of Conservators of Forests of Cape of Good Hope,* 1902.

32. *Annual Report of Medical Officer of Health*, 1903.
33. *Transactions and Proceedings of the Botanical Society of Edinburgh*, vol. xxii., part 1, 1901.
34. *Journal of New York Botanical Garden*, No. 38 of vol. iv., Feb. 1903.

Reprints, Etc.

35. *The Forestry Problem in the United Kingdom.* Lecture by Dr Schlich.
36. *Report on the Results obtained in* 1902 *from Trial Plots and Experimental Farms—Canada.*
37. *Report on the Results obtained in* 1903 *from Trial Plots and Experimental Farms—Canada.*
38. *Evidence of Dr Saunders before Select Committee—Canada*, 1903.
39. *Recently Recognised Species of Cratægus in Eastern Canada and New England*, parts 1, 2, 3, 4, and 5. By Professor C. S. Sargent.
40. *The Genus Cratægus in Newcastle County, Delaware.* By Professor C. S. Sargent.
41. *Cratægus in Rochester, New York.* By Professor C. S. Sargent.
42. *Cratægus in North-Eastern Illinois.* By Professor C. S. Sargent.
43. *Les Mycilium Truffiers Blancs.* By M. Emile Boulanger.
44. *La Geographie et la Végétation du Languedoc entre L'Herault et le Vidourle.* By Marcel Hardy.
45. Bulletin No. 6. *Materia Medica Americana.* Lloyd Library, Cincinnati.
46. *Mycological Notes.* Nos. 10-14. Lloyd Library, Cincinnati.
47. *Some Aspects of South African Forestry.* By D. E. Hutchins.
48. *An Introduction to the Study of Forestry in Britain.* By Sir H. G. Hewett, Bart.
49. Bulletins of Department of Agriculture, Victoria:—
    Take-all and White-heads in Wheat.
    Codlin Moth Experiments.
    Swine Plague.
    Two New Fungi Parasitic on Scale Insects.
    Field Experiments in Manuring, 1903-04.
    Survey of Work and Progress of the Department.
    Position of Chemistry as a Factor in Agricultural Advancement.
    Black Spot of the Apple and Spraying for Fungus Diseases.
50. *Journal of Forestry* (several unbound parts); *Transactions of the Society* (several parts), presented by Thomas Kinghorn, 12 Nithsdale Gardens, Crossmyloof, Glasgow.
51. *Forestry Quarterly.* New York.
52. *Journal of Agriculture of Victoria.*
53. *Skogsvårdsföreningens Tidskrift.* Stockholm.
54. *Timber Trades Journal.*
55. *Timber News.*
56. *Agricultural Economist.*

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON.

HIS MOST EXCELLENT MAJESTY THE KING.

PROCEEDINGS IN 1905.

THE ANNUAL MEETING.

The Fifty-second Annual Meeting of the Royal Scottish Arboricultural Society was held in the Goold Hall, 5 St Andrew Square, Edinburgh, on Friday, 10th February 1905, at 2.30 P.M., and was presided over by W. STEUART FOTHRINGHAM, Esq. of Murthly, President of the Society. There was a large attendance of Members.

MINUTES.

The Minutes of the General Meeting held at Perth on 22nd July last were held as read and approved of.

ELECTION OF AN HONORARY MEMBER.

On the motion of the President, AUGUSTE EDMOND HENRY, Professor of Natural Science, etc., National Forest School, Nancy, was elected an Honorary Member of the Society in recognition of his eminent services to Forestry, and in consideration of his kindness to the Society in connection with their tour in France.

REPORT BY THE COUNCIL.

The Secretary then read the following Report by the Council, viz.: - The Council are pleased to report that the Society has had another successful year.

Membership.

Although there have been the usual deductions owing to deaths, resignations, and lapses, there has been a substantial addition

to the Membership during the year. Among those whose death the Council have had to record are—Dr Aitken, Hon. Chemist to the Society; Mr George Paxton, formerly Photographic Artist to the Society; Mr A. Sclater, Seedsman, Edinburgh; Mr A. D. Forbes of Millearne; the Hon. George Waldegrave Leslie; Mr Walter Shoolbred of Wyvis; Mr W. Borthwick, Dunnichen; Mr C. H. Dundas of Dunira; and the Viscount Melville.

At the Jubilee Meeting it was reported that the Membership stood at 1016. One hundred and fifteen Members have been admitted in the course of the year, but 58 have been removed, owing to the causes mentioned above. There has therefore been a net gain of 57 Members, and the total Membership is now 1073, made up as follows:—

Honorary Members, . .	19
Honorary Associates, . .	7
Life Members, . . .	266
Ordinary Members, . . .	781
	1073

Prizes for Essays, etc.

The Syllabus of Subjects for Essays in 1904 was issued along with last year's *Transactions*. Twenty-five subjects were set for Essays, but only six Essays were received. Three of these received awards, and three obtained no award. The Medals awarded were:—Two No. 1 Silver Medals and one Bronze Medal.

Donors.

The thanks of the Society are due to Messrs W. H. Massie, D. W. Thomson, D. P. Laird, John Methven, and William MacKinnon, for prizes offered by them for Essays on Subjects which will be found in the Syllabus; to the President for his prize in connection with the Excursion to France; and to the Highland and Agricultural Society for their vote for prizes in connection with the Exhibition in their Showyard.

Presentation to Colonel Bailey.

As reported at last Meeting, Colonel Bailey, owing to the then state of his health, resigned his position as Honorary Editor and Convener of the *Transactions* Committee, and the resignation was accepted with much reluctance. The Council desired to make some presentation to Colonel Bailey in recognition of his valuable services to the Society for many years, and he having expressed his willingness to accept a gift for the benefit of his Forestry Class at the University, the Council sent him

a cheque for £10 to be expended in providing a lantern and other equipment. In acknowledging the gift, Colonel Bailey said, "The lantern will form a most valuable addition to my most scanty teaching apparatus, and will add much to enable me to give efficient instruction to my students."

Judges and Transactions Committee.

By the Laws this Committee should be appointed at the Annual Meeting, but at last Annual Meeting the Council were not in a position to recommend a Convener and Honorary Editor, and the matter was, therefore, remitted to the Council, who reappointed the Committee and made the Secretary Convener for the time. Afterwards it was intimated that Dr NISBET had agreed to act as Honorary Editor, provided he received an Assistant, and he was accordingly appointed to that position, with Mr A. D. RICHARDSON as paid Assistant Editor. The latter accordingly resigned his position as a member of the Council.

Council.

After his election at the Jubilee Meeting, Sir ROBERT MONCREIFFE intimated that he was not in a position to accept office, and Mr A. D. RICHARDSON having resigned his seat, there were two vacancies on the Council. To these vacancies the Council appointed Colonel BAILEY and Dr BORTHWICK, and their election was duly confirmed by the General Meeting, which was held at Perth.

Forestry Education.

It will be in the recollection of those Members who were present at the Jubilee Meeting last year, that a resolution was passed at that Meeting calling upon the Board of Agriculture to take steps to give immediate effect to the recommendation of the Departmental Committee on Forestry, as far as regards Scotland, by providing a demonstration area and example plots, and expressing the opinion that Forestry Education in Scotland would not be adequately provided for until these were supplied, and a thoroughly equipped Forest School established in Scotland. This resolution was forwarded to the President of the Board of Agriculture, the Commissioner of Woods and Forests, and the Secretary for Scotland, and also to the Societies and Institutions that had sent delegates to the Meeting. The resolution was acknowledged by the various public departments mentioned, and further communications were entered into with them on the subject. These negotiations brought out the following points:—(*First*) that a State Forest will be provided through the Office of Woods and Forests if an area suitable for the purpose can be obtained; (*Second*) that Forestry Education and Forestry

Demonstrations, including a Forest Garden (or example plots), come under the control of the Scottish Office; and (*Third*) that purely experimental work and research fall within the province of the Board of Agriculture. Following upon this, a circular was sent, by instruction of the Council, to Local Secretaries, pointing out that it would add greatly to the Society's representation if they were in a position to say where a suitable area could be obtained, and inviting the Local Secretaries to advise the Council if any suitable places were for sale in their respective districts. The Council then thought it advisable that the various educational bodies in Scotland should be asked to confer with the Scottish Education Department on the subject of Forestry Education, and they remitted the whole subject to the President, the Honorary Secretary, and the Secretary, with powers. A Conference was duly arranged, and was attended by representatives from all the Scottish Universities and the Agricultural Colleges, and by Sir Henry Craik on behalf of the Scottish Education Department. In the unavoidable absence of the President, the Council was represented by the Honorary Secretary and the Secretary. At a preliminary meeting of the educational bodies, the following resolutions were unanimously adopted:—

I. That it is desirable to advance education in Sylviculture in Scotland.

II. That it is desirable that a degree in Forestry be instituted in the Scotch Universities.

III. That a Demonstration Forest be provided by Government as near the centre of Scotland as possible, and be available on equal terms to all Students of Forestry in Scotland.

IV. That any educational institution which lays itself out to provide education in Forestry, and establishes an experimental area, or Forest Garden, in connection therewith, be entitled in respect thereof to Government support.

V. That a good grounding in Forestry form an integral part of the curriculum of the Colleges providing instruction in Agriculture, and that short courses of instruction suitable for the requirements of young foresters be also provided there.

VI. That instruction be given in neighbourhoods where there is a suitable area under wood, and that Scholarships be offered in such centres to enable working Foresters to attend courses of lectures.

At the afternoon Meeting these resolutions were submitted to Sir Henry Craik, and the representatives of the various

Universities and Colleges spoke on behalf of their various constituents. In his reply, Sir Henry Craik pointed out that he could only deal with the Universities through the Agricultural Colleges, and said that in the event of these Colleges using the Classes in the Universities in connection with their course, the Department would be willing to subsidise them. He also said that in the event of the Colleges contributing funds towards the maintenance of a Demonstration Forest and Forest Garden, and charging these items in their accounts, the Department would be willing to give grants for such expenditure. He then asked the representatives present to prepare and send him their proposals on the subject of Forestry Education, and said that when these were received the Department would consider the expediency of asking an expert to report thereon, who would probably visit Scotland in connection with the matter, and that full information would be given to the Society. Following upon this Conference, the Council, at their Meeting on 11th June last, passed the following resolution, namely:—"That in the opinion of the Council of the Royal Scottish Arboricultural Society the existing administrative machinery is insufficient to develop a full course of instruction in Sylviculture in Scotland, and that it is essential to make adequate provision to attain that end." This resolution was sent to the Secretary for Scotland and Sir Henry Craik, and was duly acknowledged.

Through the kindness of the Perthshire Society of Natural Science, a Conference of the Society was held in their rooms at Perth on 22nd July last, when the matter was further discussed. (A Report of this Conference will be found in the *Transactions*.)

Steps have been taken by the Council to endeavour to secure a suitable area for a Demonstration Forest, and various estates have been brought under the notice of the Board of Agriculture and the Commissioners of Woods and Forests. Up till now, however, these Departments have not been able to express approval of any of the estates submitted to them, and the Council are, therefore, still on the outlook for a suitable area.

Forestry Exhibitions.

The Forestry Exhibition held at Perth was considered to be a great advance upon any of the exhibitions previously held, the exhibits of timber being particularly good. The Judges were Mr Adam Spiers, Wood Merchant, Edinburgh; Mr John Boyd, Forester, Pollok Estate; Mr Colin Chisholm, Lundin and Montrave Estates. From their report, which has been printed in full in the Proceedings of the General Meeting held at Perth, it will be seen that they awarded £26 in cash, two Gold Medals, two No. 1 Silver Medals, and five No. 2 Silver Medals, besides commending various other exhibits. In their Report

the Judges mentioned that the exhibits of timber by Lord Powerscourt in Competitions Nos. I. and II., which had originally been placed third in the former and first in the latter competition, had been disqualified when it was found that the timber was grown in Ireland. The Committee recommended to the Council that these exhibits should receive special prizes equal in value to those previously awarded, and this was approved of. The total prize money awarded was therefore increased to £29, 10s. Appeals against the awards of the Judges were lodged by Mr James Forgan, Bonskeid; Mr Alexander Pitcaithley, Scone; and Mr George Leven, Auchencruive. The Committee having inquired into the matters complained of, dismissed the appeals by Messrs Forgan and Pitcaithley, but sustained that by Mr Leven. The Judges' award in Competition XV. was therefore altered, Mr Leven being placed first, and the Earl of Mansfield second.

As mentioned in their Report, the Judges did not deal with the two measuring instruments by "Tak' Mete" and "Hypsos," in Competitions XII. and XIII., and these were remitted by the Council to Messrs D. F. Mackenzie, J. W. M'Hattie, and A. D. Richardson, who reported that they could not make any award in either case. They, however, very highly commended "Hypsos" for the ingenuity and skill which he had displayed in constructing so efficient a Hypsometer, evidently without any knowledge of the existence of others of the same type. (A Report of the Exhibition will be found in the *Transactions*.)

The Directors of the Highland and Agricultural Society have again granted space for an Exhibition in their Showyard at Glasgow, and they have also renewed their vote of £20 for prizes for timber exhibits at that Exhibition. On the recommendation of the Council, they have this year agreed to open the competition to timber grown in the United Kingdom of Great Britain and Ireland. The Schedules in connection with the Exhibition, after being revised by a Committee and approved by the Council, have been issued to the Members. The Council having had it brought to their notice that the terms of some of the Competitions in last year's Schedules were not sufficiently clear, have taken steps to make them clear in the future. The Committee this year are—Mr John Boyd, Forester, Pollok Estate; Mr George Leven, Forester, Auchencruive; Mr John Hay, Dollars Estate Office, Kilmarnock; Mr James Farquharson, Forester, Inverkip; and Mr J. M. Stewart, Forester, Benmore; with the addition of the following Local Secretaries:—Mr James Whitton, Superintendent of City Parks, Glasgow; Mr S. MacBean, Land Steward, Erskine, Bishopton; Mr John Davidson, Forester, Dalzell, Motherwell; Mr A. B. Robertson, Forester, Kilmarnock; and Mr Robert Brown, Forester, Boiden, Luss, Dumbarton.

Excursions.

A short report in connection with the Excursion to Perthshire was made at the Meeting held at Perth, and it is therefore unnecessary to refer further to it.

The Excursion to France was also briefly referred to at that Meeting. The Company included the President, Professor Schwappach of Eberswalde; Mr Elis Nilson, Sweden; Dr Somerville, Professor Fisher, and Mr George Marshall, President of the English Arboricultural Society. The majority of the Members carried out the whole tour, only about a dozen returning from Nancy at the end of the first week. Mr Munro Ferguson was unfortunately unable to take part in the tour, but he was kind enough to meet the Members in London, and to conduct them over Kew Gardens. The French officers at the Forest School at Nancy, and at the various Forests visited, did all in their power to make the visit both pleasant and instructive. The President acted as leader of the party, and proved a most efficient interpreter. In the course of the tour the President intimated that he would give a prize for the best essay on the Excursion, and the Council agreed to offer a second prize. The Judges were Colonel Bailey, Professor Fisher, Dr Somerville, and Dr Nisbet. It was disappointing to find that only one essay was received, for which the Judges awarded a prize of £6, 10s., and this sum the President paid. On the return of the party, the Council unanimously agreed to recommend that the Honorary Membership of the Society should be conferred upon Auguste Edmond Henry, Professor of Natural Science, etc., National Forest School, Nancy, who had rendered such invaluable services to the Society in connection with their tour.

(A full report of both Excursions will be found in the *Transactions*.)

It was found, after paying all expenses of the tour, that there was a considerable balance of cash left over, and the Council decided that the Committee should dispose of this balance as follows:—(*First*) by presenting to each member of the party, and also to a number of French Forest Officers, a large photograph of the group taken at Celles, with the names of the Members printed on it, and (*Second*) by repaying 15s. to each Member who paid his full share of the expenses of the whole tour, and 10s. to each Member who paid his full share of the expenses of the half of the tour. The photographs are being prepared by Mr Richardson, the Society's photographer, and they will be forwarded by him to the Members of the party as soon as they are ready.

At the General Meeting held at Perth, it was decided that the Excursion this year should be made to the neighbourhood of Glasgow and North Ayrshire, in connection with the Exhibition at Glasgow, and the Committee are preparing a draft programme

for the approval of the Council. Mr YOUNGER of Benmore has been kind enough to intimate that he will be very pleased if the Society can arrange to visit Benmore.

Transactions.

The *Transactions* this year will appear under the editorship of Dr NISBET and Mr RICHARDSON. The Part will include a photograph of the King, who is Patron of the Society; plates showing all the past Presidents of the Society, an epitome of the history of the Society, an article by Dr Nisbet on Forestry during the past fifty years, Reports of the Jubilee proceedings and Conference, Reports of the Excursions and Exhibition, and other highly interesting matter by competent writers. In connection with the *Transactions*, the Council have agreed to take out one French and two German magazines, so that the Honorary Editor may be in a position to supply a digest of forestry matters of interest which have taken place in these countries during the year. The Editors report that the Part in preparation will be much larger than usual, and that it may be necessary to issue it as a single volume. If this is done, a Title-page and Table of Contents for Vol. XVII. will be appended. A general Index to the whole *Transactions*, to the end of Vol. XVII., will also be appended. Members will therefore be able to complete Vol. XVII. after the issue of the Part under notice. The Editors further report that considerable progress has been made with the Part, and they hope to be able to issue it about the beginning of March.

It may be mentioned that a suggestion was made by a Member of the Society that those old Parts of the *Transactions*, which are now out of print, should be reprinted, so as to enable Members to complete their sets, but as there did not appear to be an extensive demand for those back Numbers, the Committee did not see their way to recommend that this expense should be incurred meantime.

Larch Disease.

A large number of schedules for the collection of statistics was issued by the Committee to those whom they thought most likely to be in a position to give efficient assistance in the matter, and a fair proportion of these schedules have since been returned filled up. A small Committee has been appointed to go over the schedules for the purpose of tabulating the information received, which will then be printed in the *Transactions*. An Investigation Committee, consisting of Dr BORTHWICK, the Society's Hon. Cryptogamist, and Mr A. D. RICHARDSON, the Convener of the Committee, has also been appointed to visit selected areas with a local Member, and to report.

St Louis Exhibition.

As arranged, Photographs of American Conifers grown in this country were prepared and forwarded to this Exhibition. A list of these will be found in the Proceedings of the General Meeting, which was held at Perth. The following letter has since been received from Colonel Watson, Commissioner in General for Great Britain :—

ST LOUIS, U.S.A.,
22nd October 1904.

DEAR SIR,—I have the pleasure to inform you that I am advised, by the American Exposition Authorities, that the International Jury of Awards have awarded your Exhibit a Silver Medal in Group 112.

Yours faithfully,

C. M. WATSON,
Commissioner General for Great Britain.

Royal Scottish Arboricultural Society.

A further letter has since been received from Colonel Watson, asking whether the Society would be willing to present the photographs to the Forestry Museum which it was proposed to form at St Louis. The Council, having considered the matter, decided to ask the Royal Commission to return the photographs to the Society. The Silver Medal has not yet reached the Society.

Railway Rates.

The Honorary Secretary drew the attention of the Council to the appointment of a Departmental Committee on this subject, to be presided over by Lord Jersey, and the Secretary was instructed to forward any complaints received from Members of the Society and others regarding preferential rates on foreign timber. On communicating with the Committee, however, he received a reply from the Secretary to the effect that the Committee were of opinion that rates on timber did not come within the scope of their inquiry, which they thought was limited to rates on farm and market garden produce.

Laws.

At the request of the Council, a proof of the Laws, as amended by recent motions, was submitted to them for their

consideration, and they have now appointed a Committee to revise the Laws. Some progress has been made, but they are not yet in a position to report to the Council.

Register of Foresters.

The Council regret that greater advantage of the Society's Register is not taken by proprietors and others requiring estate men. The Council again appeal to them to make use of the Register.

Royal Institution.

Since last Report, the Council have not had an opportunity of taking any active steps with regard to this matter, but they believe that the Government are making inquiries with the view of obtaining a site for new art schools, and the Council are, therefore, hopeful that the proposal, fully explained in last Report, regarding the various scientific societies obtaining accommodation in the Royal Institution may ultimately be carried out.

General Meeting and Conference.

The Proceedings in connection with the General Meeting held at Perth are reported elsewhere, and a full report of the Proceedings at the Conference will be found in the *Transactions*.

Oak Leaf Roller Moth.

At the Meeting held at Perth, attention was drawn to this matter by Colonel Smythe, of Methven, who asked the Society to make an inquiry into the subject. It was suggested that the Society's Entomologist might deal with the matter, and the Council have arranged that he will prepare a report on the subject for publication in the *Transactions*.

Annual Dinner.

Members are reminded of the Annual Dinner, which is to be held in the North British Station Hotel at 6 o'clock this evening, and is to be presided over by Mr Fothringham, the President.

After the Report had been read, the PRESIDENT asked whether any Members wished to make remarks upon it.

Mr JAMES FORGAN, Bonskeid, Pitlochry, said that he thought the Conditions in the Exhibition Schedule should provide that the timber exhibited should be obtained from one estate only, and he moved accordingly. Mr ALEXANDER PITCAITHLEY, Scone, seconded. Mr A. T. GILLANDERS, Alnwick, moved that

the Conditions be allowed to remain as at present in the Schedule. Sir KENNETH MACKENZIE seconded, and on a vote being taken, Mr Gillanders' motion was carried.

Mr Alex. Pitcaithley complained that no notice had been taken in the Council's Report of Appeals and Protests against the Exhibition Committee's decisions which he had lodged with the Council, and he moved that a reference to these Appeals and Protests be made in the Report. Mr James Forgan, Bonskeid, seconded. The President explained that, according to the Conditions of the Exhibition, the Committee's decision in all matters must be accepted as final, and the Council accordingly held that these Appeals and Protests were incompetent. Mr D. F. MACKENZIE then moved the previous question, and Mr JOHN METHVEN seconded. On a vote being taken, the previous question was carried by a large majority, only six Members voting for Mr Pitcaithley's motion. The PRESIDENT thereupon moved, and Mr MUNRO FERGUSON seconded, the adoption of the Report, which was agreed to.

FINANCES.

Mr JOHN METHVEN, Convener of the Finance Committee, submitted the printed Abstract of Accounts, which had been circulated amongst the Members previous to the Meeting. In moving the adoption of the Accounts, he commented upon the gratifying result of the year's operations, and mentioned that a remit had been made to the General Purposes Committee to consider the various Schemes for developing Forestry Education in Scotland, and to report whether they considered it expedient that the Society should give any assistance. The matter would, no doubt, come before the Finance Committee also, and he was perfectly certain that they would give it their favourable consideration. The Accounts were approved of. (The Abstract of the Accounts will be found in Appendix A.)

The Malcolm Dunn Memorial Fund.

The Secretary submitted the following Abstract of Accounts in connection with this fund for the year 1904: –

RECEIPTS.

Balance in Bank at close of last Account, . . .	£4	7 6
Dividend on £100 3 per cent. Redeemable Stock of Edinburgh Corporation, payable at Whitsunday and Martinmas 1904, £3, *less* Tax 3s., ...	2	17 0
	£7	4 6

PAYMENTS.

Nil.

Balance carried forward, being Sum in National Bank of Scotland on Account Current, . .	£7	4 6

Note.—The Capital belonging to the Trust consists of £100 3 per cent. Redeemable Stock of Edinburgh Corporation.

Edinburgh, *6th February* 1905.—Examined and found correct. The Certificate by the Bank of above balance, and Edinburgh Corporation Stock Certificate, have been exhibited.

John T. Watson,
Auditor.

Excursion Fund.

The Secretary also submitted the following Abstract of Accounts in connection with the Excursion Fund for year 1904:—

Balance brought forward from last Account, . . .		£53	12 3
Add Further Sums received on Account of Cost of Swedish Albums, ...		18	18 0
		£72	10 3
Deduct—			
Payments to Mr A. D. Richardson for Swedish Albums, being amount collected to date, . .	£23 2 0		
Payments to Mr A. D. Richardson for Woburn Photographs, . . .	20 1 4		
Printing Names on Woburn Photographs, .	1 7 0		
Auditor's Fee for 1903 Accounts, . .	2 2 0		
		46	12 4
Carry forward . .		£25	17 11

Excursion Fund—*continued.*

Carry forward .		£25 17 11

Excursion to France, 1904.

RECEIPTS.

Contributions to Common Purse, . .	£953 4 1	
Less Repayments to Members, . . .	73 19 1	
	£879 5 0	

PAYMENTS.

Hotels and Hiring, . .	£444 3 7		
Railways, . . .	362 1 3		
Gratuities and Miscellaneous Outlays previous to and throughout the Tour, . .	18 14 6		
Fee to Courier, . . .	12 10 0		
Printing, Programmes, etc., .	9 15 6		
		847 4 10	
			32 0 2

Excursion to Dunkeld, etc., 1904.

RECEIPTS.

Contributions to Common Purse, . .	£53 16 6	

PAYMENTS.

Hotel, ...	£31 13 0		
Hiring, ...	18 6 0		
Printing, ...	1 6 3		
Miscellaneous Outlays, . .	1 5 0		
		52 10 3	
			1 6 3
Balance carried forward to next Year, being Sum in National Bank of Scotland on Account Current, .			£59 4 4

Note.—The above Balance is subject to the payment of the cost of the presentation copies of the Photograph taken at Celles, France, and the Auditor's Fee for the past year, estimated at about £27, 10s.

Edinburgh, *28th January* 1905.—Examined with Vouchers and Memorandum Books and found correct. Bank Certificate of above balance of £59, 4s. 4d. also exhibited to me.

John T. Watson,
Auditor.

Election of Office-Bearers.

On the motion of Mr J. W. M'Hattie, the following Office-bearers, recommended by the Council, were unanimously elected in room of those who retire by rotation:—*President*—W. Steuart Fothringham, Esq., of Murthly. *Vice-Presidents*—The Right Hon. The Earl of Mansfield and Sir John Stirling Maxwell, Bart. of Pollok. *Council*—John Annand, Overseer, Haystoun Estate, Woodbine Cottage, Peebles; Dr A. W. Borthwick, Royal Botanic Garden, Edinburgh; James Johnstone, F.S.I., Factor, Alloway Cottage, Ayr; George Leven, Forester, Auchencruive, St Quivox, Ayr; John Methven, Nurseryman, 15 Princes Street, Edinburgh; John Scrimgeour, Overseer, Doune Lodge, Doune; and David W. Thomson, Nurseryman, 113 George Street, Edinburgh. The Honorary Secretary, the Secretary and Treasurer, the Honorary Editor, the Assistant Editor, the Auditor, the Photographer, and the Local Secretaries, were re-elected. Mr Alexander Lauder, B.Sc., F.C.S., Chemist to the Edinburgh and East of Scotland College of Agriculture, was elected Honorary Chemist to the Society. The other Honorary Scientists were re-elected. The Judges and *Transactions* Committee were re-elected.

The President, on his own behalf, and on behalf of the other Office-Bearers, returned thanks to the Meeting for their election, and this concluded the business. (For a list of the Council, Office-Bearers, etc., for 1905, see Appendix B.)

Mr H. J. Elwes's Lecture.

At the close of the Business Meeting, H. J. Elwes, Esq., of Colesborne, delivered a lecture on "Japanese and North American Larch, and other trees from these countries likely to be useful as British Forest Trees." The lecture was illustrated with lantern views.

The President having invited questions, several Members put questions to Mr Elwes, to which he replied. It is proposed to print a full report of the Lecture and discussion in next year's *Transactions*.

On the motion of the President, a hearty vote of thanks was accorded to Mr Elwes for his Lecture, and on the motion of Mr M'Hattie, the President was also thanked for presiding at the Meeting.

THE ANNUAL DINNER.

The Annual Dinner of the Society was held in the North British Station Hotel, Edinburgh, the same evening at 6 P.M. Mr W. STEUART FOTHRINGHAM again presided. The Society's guests on the occasion were: Professor Rankine, Edinburgh University; Councillor Maxton, Convener of the Edinburgh Public Parks Committee; Principal Wright, of the West of Scotland Agricultural College, Glasgow; Mr H. J. Elwes, of Colesborne; Mr J. Macdonald, Secretary of the Highland and Agricultural Society; Mr W. Scott Stevenson, Secretary of the Edinburgh and East of Scotland College of Agriculture; Mr J. W. M'Hattie, President of the Scottish Horticultural Association; Mr P. Murray Thomson, Secretary of the Royal Caledonian Horticultural Society.

Mr John Methven proposed the toast, "The Lord Provost, Magistrates, and Town Council," and Councillor Maxton replied. Professor Rankine proposed "The Royal Scottish Arboricultural Society," to which the President replied. "Kindred Societies" was proposed by Mr Andrew Slater, Stobs, and was replied to by Mr J. Macdonald and Mr J. W. M'Hattie. Mr Buchanan proposed the "Landed Interest," to which Mr Elwes replied. Mr Munro Ferguson, M.P., proposed "Educational Institutions," and Principal Wright replied. "The Timber Trade" was proposed by Mr John Annand, and replied to by Mr A. Spiers. Mr Borthwick proposed the "Press," and Mr W. M. Gilbert of the *Scotsman* replied. Mr James Welsh proposed the "Chairman," and the meeting was concluded by the singing of "Auld Lang Syne."

APPENDIX A.

Abstract of Accounts for Year ending 31st December 1904.

I.—CAPITAL.

CHARGE.

1. Funds at 31st December 1903,			£1229 7 6
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 121,	£605 0 0		
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 124⅞,	624 7 6		
2. Life Members' Subscriptions in 1904,			153 0 0
New Members,	£136 10 0		
Ordinary Members by commutation,	16 10 0		
			£1382 7 6

DISCHARGE.

1. Proportion of Life Members' Subscriptions transferred to Revenue,			£77 4 7
Unexhausted: £629 4 8 / 77 4 5	1/15 of Full Life Subscriptions,	£62 19 9	
	1/10 of Commuted Subscriptions,	14 4 10	
2. Decrease in value of Railway Stocks at 31st December 1904,			20 12 6
3. Funds at 31st December 1904,			1284 10 5
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 117¾,	£588 15 0		
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 124,	620 0 0		
Balance of Capital, being sum in National Bank of Scotland, Limited,	75 15 5		
	£1284 10 5		
			£1382 7 6

II.—REVENUE.

CHARGE.

1. Balance in hand at 31st December 1903,			£199 13 6
2. Ordinary Members' Subscriptions,			313 6 0
Arrears at 31st December 1903,		£32 1 0	
Subscriptions for 1904,	£325 19 0		
Less Received in 1903,	7 17 0		
		318 2 0	
Subscriptions for 1905 received in 1904,		9 12 0	
		£359 15 0	
Deduct—			
Cancelled or written off as irrecoverable at 31st December 1904,	£13 2 0		

DISCHARGE.

1. Printing, Stationery, etc.,			£117 18 1
Part 2 of Vol. XVII. of *Transactions*,	£90 4 6		
And Authors' Reprints,	3 13 6		
	£93 18 0		
Larch Disease Schedule,	5 15 6		
General Printing, Binding, and Stationery,	42 17 10		
	£142 11 4		
Less Receipts for Advertisements in *Transactions*,	24 13 3		
	£117 18 1		
2. Prizes (Money, £36; Medals, £15, 8s. 3d.),		£51 8 3	
Less Donations:—			
(1) From the Highland and Agricultural Society, for Prizes awarded for			

3. Proportion of Life Members' Subscriptions transferred from Capital,					77 4 7
4. Dividends and Interest,					42 8 3
5. *Transactions*, etc., sold,		£15 0 6			
Less purchased,		1 8 0			
					13 12 6
6. Income Tax Recovered,					1 10 10
					£647 15 8

for Essay on Excursion to France,		6 10 0		
			29 10 0	
				21 18 3
3. Forestry Exhibition at the Highland and Agricultural Society's Show at Perth,				16 1 3
Printing,		£11 4 9		
Advertising,		1 5 0		
Other Outlays,		3 11 6		
4. St Louis International Exhibition,				20 0 0
(1) Expenses Photographing Conifers for Exhibition,		£2 7 0		
(2) Enlarging and Framing Photographs,		17 13 0		
5. Expenses of Management,				167 13 11
Rent,		£2 14 3		
Auditor,		3 3 0		
Reporter,		7 18 6		
Secretary and Treasurer,		65 0 0		
Do. do., Honorarium for 1903 *Transactions*,		20 0 0		
Advertising, Insurance, and Premium on Secretary's Bond of Caution,		7 18 3		
Outlays in connection with Jubilee Dinner:—				
(1) Printing Invitation and Menu Cards,	£7 2 6			
(2) Entertaining Guests,	8 6 0			
		15 8 6		
Outlays in connection with search for Forest Area,		4 13 6		
Postages and Miscellaneous Outlays, viz.:				
Postages of 1903 *Transactions*,	£12 4 6			
General Postages, Commissions on Cheques, and Petty Outlays,	28 13 5			
		40 17 11		
		£167 13 11		
6. Balance of Revenue carried to next year (being sum in National Bank of Scotland, Limited), subject to payment of cost, etc., of 1904 *Transactions*,				304 4 2
				£647 15 8

EDINBURGH, 28*th January* 1905.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1904, of which the foregoing 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.

Office-Bearers for 1905:—

PRESIDENT.

W. Steuart Fothringham of Murthly, Perthshire.

VICE-PRESIDENTS.

Alexander Pitcaithley, Forester, Jeanie Bank, Scone.
Charles Buchanan, Overseer, Penicuik Estate, Penicuik.
Sir Kenneth J. Mackenzie, Bart. of Gairloch, 10 Moray Place, Edinburgh.
The Right Hon. the Earl of Mansfield, Scone Palace, Perth.
Sir John Stirling Maxwell, Bart. of Pollok, Pollokshaws.

COUNCIL.

James Crabbe, Forester, Glamis, Forfarshire.
Robert Forbes, Estate Office, Kennet, Alloa.
A. T. Gillanders, F.E.S., Forester, Alnwick Castle, Northumberland.
John W. M'Hattie, Superintendent of City Parks, City Chambers, Edinburgh.
D. F. Mackenzie, F.S.I., Estate Office, Mortonhall, Midlothian.
W. H. Massie, Nurseryman, 1 Waterloo Place, Edinburgh.
John Boyd, Forester, Pollok Estate, Pollokshaws, Glasgow.
Sir Thomas Gibson Carmichael, Bart. of Castle Craig, Malleny House, Balerno.
James Cook, Land Steward, Arniston, Gorebridge.
George U. Macdonald, Forester, Raith, Kirkcaldy.
William Mackinnon, Nurseryman, 75 Shandwick Place, Edinburgh.
R. V. Mather, Nurseryman, Kelso.
Adam Spiers, Timber Merchant, Warriston Saw-Mills, Edinburgh.
Colonel F. Bailey, 7 Drummond Place, Edinburgh.
John Annand, Overseer, Haystoun Estate, Woodbine Cottage, Peebles.
Dr A. W. Borthwick, Royal Botanic Garden, Edinburgh.
James Johnstone, F.S.I., Factor, Alloway Cottage, Ayr.
George Leven, Forester, Auchencruive, St Quivox, Ayr.
John Methven, Nurseryman, 15 Princes Street, Edinburgh.
John Scrimgeour, Overseer, Doune Lodge, Doune.
David W. Thomson, Nurseryman, 113 George Street, Edinburgh.

HON. SECRETARY.

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.

HON. EDITOR.

Dr JOHN NISBET, Royal Societies Club, 63 St James Street, London, S.W.

ASSISTANT EDITOR.

A. D. RICHARDSON, 8 Sciennes Gardens, Edinburgh.

AUDITOR.

JOHN T. WATSON, 16 St Andrew Square, Edinburgh.

TRUSTEES.

The EARL OF MANSFIELD, R. C. MUNRO FERGUSON, M.P., and W. STEUART FOTHRINGHAM of Murthly.

JUDGES AND TRANSACTIONS COMMITTEE.

Dr JOHN NISBET, Royal Societies Club, 63 St James Street, London, S.W. (*Convener*).
Colonel F. BAILEY, University Lecturer on Forestry.
D. F. MACKENZIE, F.S.I., Estate Office, Mortonhall, Liberton.
JOHN ANNAND, Estate Overseer, Woodbine Cottage, Peebles.
A. T. GILLANDERS, F.E.S., Park Cottage, Alnwick, Northumberland.
ANDREW SLATER, Stobs Estate Office, Hawick; and
THE SECRETARY, *ex officio*.

HONORARY CONSULTING SCIENTISTS.

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

Consulting Chemist.—ALEXANDER LAUDER, B.Sc., F.C.S., 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., Royal Veterinary College, Clyde Street, Edinburgh.

Consulting Geologist.—JOHN SMITH FLETT, M.A., B.Sc., M.B., C.M., Geological Survey, 28 Jermyn Street, London, S.W.

Consulting Meteorologist.—ROBERT COCKBURN MOSSMAN, F.R.S.E., F.R.Met.Soc., 10 Blacket Place, Edinburgh.

PHOTOGRAPHIC ARTIST.

A. D. RICHARDSON, 8 Sciennes Gardens, Edinburgh.

LOCAL SECRETARIES.

Scotland.

Counties.	
Aberdeen,	JOHN CLARK, Forester, Haddo House, Aberdeen.
	JOHN MICHIE, Factor, Balmoral, Ballater.
Argyle,	WALTER ELLIOT, Manager, Ardtornish.
	JOHN D. SUTHERLAND, Estate Agent, Oban.
Ayr,	ANDREW D. PAGE, Overseer, Culzean, Maybole.
	A. B. ROBERTSON, Forester, The Dean, Kilmarnock.
Banff,	JOHN BRYDON, Forester, Rothes, Elgin.
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.
	JOHN HAYES, Dormont Grange, Lockerbie.
	JOHN NEWBIGGING, Nurseryman, Dumfries.
East Lothian,	W. S. CURR, Factor, Ninewar, Prestonkirk.
Fife,	WM. GILCHRIST, Timber Merchant, Ladybank.
	EDMUND SANG, Nurseryman, Kirkcaldy.
Forfar,	R. CAIRNS, The Gardens, Balruddery, near Dundee.
	JAMES CRABBE, Forester, Glamis.
	JAMES ROBERTSON, Forester, Panmure, Carnoustie.
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,	W. HARROWER, Forester, Tomnacroich, Garth, Aberfeldy.
	W. A. MACKENZIE, Factor, Faskally, Pitlochry.
	ALEX. PITCAITHLEY, Jeanie Bank, Old Scone, 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, . .	JOHN ALEXANDER, 46 Clarendon Road, Bedford.
	FRANCIS MITCHELL, Forester, Woburn.
Berks, . .	W. STORIE, Whitway House, Newbury.
Cheshire, .	WM. ELDER, Cholmondeley Park, near Malpas.
Devon, . .	JAMES BARRIE, Forester, Stevenstone Estate, Torrington.
	WM. STORIE, Forester, Gulworthy, Tavistock.
Durham, .	A. C. FORBES, Professor of Forestry, Armstrong College, Newcastle-on-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.
Northumberland,	JOHN DAVIDSON, *Secretary*, English Arboricultural Society, Haydon-Bridge-on-Tyne.
Notts, . .	W. MICHIE, Forester, Welbeck, Worksop.
	WILSON TOMLINSON, Forester, Clumber Park, Worksop.
Salop, . .	FRANK HULL, Forester, Lillieshall, Newport.
Suffolk, . .	ANDREW BOA, Agent, Great Thurlow.
	GEORGE HANNAH, The Folly, Ampton Park, Bury St Edmunds.
Surrey, . .	PHILIP PEEBLES, Estate Office, Albury, Guildford.
Warwick, .	A. D. CHRISTIE, The Gardens, Ragley Hall, Alcester.
York, . .	ADAM MAIN, Forester, Rose Cottage, Loftus.
	D. TAIT, Estate Bailiff, Owston Park, Doncaster.

Ireland.

Dublin, . .	JAMES WILSON, B.Sc., Royal College of Science, Dublin.
Galway, . .	THOMAS ROBERTSON, Forester and Bailiff, Woodlawn.
Kilkenny, .	ALEX. M'RAE, Forester, Castlecomer.
King's County,	ARCH. HENDERSON, Forester, Clonad Cottage, Tullamore.
Tipperary, .	DAVID G. CROSS, Forester, Kylisk, Nenagh.
Wicklow, .	ADAM JOHNSTONE, Forester, Coollattin, Shillelagh.

LIST OF MEMBERS, ETC.

Corrected to April 1905.

Royal Scottish Arboricultural Society.

INSTITUTED 16th FEBRUARY 1854.

PATRON—HIS MOST EXCELLENT MAJESTY THE KING.

PRESIDENT.

W. STEUART FOTHRINGHAM of Murthly, Perthshire.

1.—FORMER PRESIDENTS.

YEAR.

1854. JAMES BROWN, Deputy-Surveyor of the Royal Forest of Dean.
1855. Ditto, Wood Commissioner to the Earl of Seafield.
1856. Ditto, ditto.
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. ROBERT HUTCHISON of Carlowrie, F.R.S.E.
1865. Ditto, ditto.
1866. Ditto, ditto.
1867. Ditto, ditto.
1868. Ditto, ditto.
1869. Ditto, ditto.
1870. Ditto, ditto.
1871. Ditto, ditto.
1872. HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie.
1873. Ditto, ditto.
1874. JOHN HUTTON BALFOUR, M.D., M.A., F.R.SS. L. & E., Professor of Botany in the University of Edinburgh.
1875. Ditto, ditto.
1876. The Right Hon. W. P. ADAM of Blairadam, M.P.
1877. Ditto, ditto.
1878. Ditto, ditto.
1879. The Most Hon. THE MARQUESS OF LOTHIAN, K.T.
1880. Ditto, ditto.
1881. Ditto, ditto.
1882. ALEXANDER DICKSON, M.D., F.R.S.E., of Hartree, Regius Professor of Botany in the University of Edinburgh.

YEAR.

1883. HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie.
1884. Ditto, ditto.
1885. Ditto, ditto.
1886. The Right Hon. Sir HERBERT EUSTACE MAXWELL, Bart. of Monreith, M.P.
1887. Ditto, ditto.
1888. The Right Hon. THE MARQUESS OF LINLITHGOW, Hopetoun House, South Queensferry.
1889. Ditto, ditto.
1890. ISAAC BAYLEY BALFOUR, M.D., Sc.D., F.R.S., Professor of Botany in the University of Edinburgh.
1891. Ditto, ditto.
1892. Ditto, ditto.
1893. Ditto, ditto.
1894. R. C. MUNRO FERGUSON, M.P., of Raith and Novar.
1895. Ditto, ditto.
1896. Ditto, ditto.
1897. Ditto, ditto.
1898. Colonel F. BAILEY, R.E. (retired), F.R.S.E., Lecturer on Forestry, University of Edinburgh.
1899. The Right Hon. THE EARL OF MANSFIELD.
1900. Ditto, ditto.
1901. Ditto, ditto.
1902. Ditto, ditto.

2.—LIST OF MEMBERS.

Corrected to April 1905.

Date of Election.

HONORARY MEMBERS.

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.)
1873. BRANDIS, Sir Dietrich, K.C.I.E., Ph.D., *Ex*-Inspector General of Forests in India, Bonn, Germany.
1901. GAMBLE, J. Sykes, C.I.E., F.R.S., M.A., ex-Director of the Indian Forest School, Highfield, East Liss, Hants.
1905. HENRY, Auguste Edmond, Professor of Natural Science, etc., National Forest School, Nancy, France.
1886. HOOKER, Sir Joseph D., 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.)
1894. LOGAN, Sir Charles B., W.S., 23 Queen Street, Edinburgh.
1904. MACKENZIE, Donald F., F.S.I., Estate Office, Mortonhall, Edinburgh. (Also Life Member by Subscription, 1872.)

Date of Election.

1904. MANSFIELD, The Right Hon. the Earl of, Scone Palace, Perth. (Also Life Member by Subscription, 1896.)
1886. MICHAEL, General, C.S.I., Bangor Lodge, Ascot, Berkshire.
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, Dr William, Professor of Forestry in the Engineering College for India, Coopers Hill, Surrey.
1895. SCHWAPPACH, Dr Adam, Professor of Forestry, Eberswalde, Prussia.
1904. SOMERVILLE, Dr William, M.A., D.Sc., D.Œc., F.R.S.E., Board of Agriculture, 4 Whitehall Place, London, S.W. (Also Life Member by Subscription, 1889.)
1886. TAKEI, Morimasa, 58 Mikumicho, Ushima, Tokio, Japan.
1904. THOMSON, John Grant, Wood Manager, Grantown, Strathspey. (Also Life Member by Subscription, 1855.)

HONORARY ASSOCIATE MEMBERS.

Date of Election.

1903. BATTISCOMBE, Edward, Hinton Court, Hereford.
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 MEMBERS.

Date of Election.

1900. ADAIR, David Rattray, S.S.C., 19 Castle Street, 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.
1874. ADDINGTON, The Right Hon. Lord, Addington Manor, Winslow, Bucks.
1904. AGNEW, Sir Andrew, Bart., Lochnaw Castle, Stranraer.
1883. ALEXANDER, John, 46 Clarendon Road, Bedford.
1903. ALLAN, Robert, Factor, Halfway House, Polkemmet, Whitburn.
1883. ATHOLL, His Grace the Duke of, K.T., Blair Castle, Blair Atholl.
1896. BAIRD, J. G. A., M.P., of Adamton, 89 Eaton Square, London, S.W.
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.
1877. BALFOUR, Isaac Bayley, LL.D., Sc.D., M.D., F.L.S., Professor of Botany, Edinburgh.
1904. BARBOUR, George Freeland, of Bonskeid, Pitlochry.
1866. BARRIE, James, Forester, Stevenstone, Torrington, North Devon.

Date of Election.

1895. Barrie, James Alexander, Forester, Harlestone, Northampton
1889. Barron, John, Elvaston Nurseries, Borrowash, Derby.
1877. Barry, John W., of Fyling Hall, Fylingdales, Scarborough, Yorks.
1871. Baxter, Robert, Forester, Dalkeith Park, Dalkeith.
1903. Bazley, Gardner Sebastian, Hatherof Castle, Fairford, Gloucestershire.
1897. Begg, James, The Gardens, Lanrick Castle, Doune, Perthshire.
1871. Bell, William, of Gribdae, 293 Lordship Lane, London, S.E.
1897. Black, Alexander, The Gardens, Carton, Maynooth, Co. Kildare.
1877. Bolckow, C. F. H., of Brackenhoe, Marton Hall, Marton R.S.O., Yorks.
1895. Boord, W. Bertram, Land Agent, Bewerley, Pateley Bridge, Yorks.
1898. Borthwick, Albert W., D.Sc., Royal Botanic Garden, Edinburgh.
1902. Braid, William Wilson, Tossville, 12 Milton Road, Craigmillar Park, Edinburgh.
1900. Brown, Charles, Factor, Kerse, Falkirk.
1896. Brown, Rev. W. Wallace, Minister of Alness, Ross-shire.
1867. Bruce, Thomas Rae, Old Garroch, New Galloway.
1873. Brydon, John, Forester, Rothes, Elgin.
1879. Buccleuch, His Grace the Duke of, K.T., Dalkeith Palace, Dalkeith.
1879. Buchanan, Charles, Overseer, Penicuik Estate, Penicuik.

1897. Campbell, James Arthur, Arduaine, Lochgilphead, Argyleshire.
1903. Capel, James Carnegy, 34 Roland Gardens, London, S.W.
1896. Carmichael, Sir Thos. D. Gibson, Bart. of Castlecraig, Malleny House, Balerno.
1882. Chowler, Christopher, Gamekeeper, Dalkeith Park, Dalkeith.
1883. Christie, William, Nurseryman, Fochabers.
1872. Clerk, Sir George D., Bart. of Penicuik, Midlothian.
1902. Clinton, The Right Hon. Lord, Fettercairn House, Fettercairn.
1898. Coats, Sir Thomas Glen, Bart., Ferguslie Park, Paisley.
1904. Coke, Hon. Richard, Holkham, Norfolk.
1879. *Colquhoun, Andrew, 75 Buchanan Street, Glasgow.*
1887. Cook, James, Land Steward, Arniston, Gorebridge, Midlothian.
1897. Coupar, Wm., Overseer, Balgowan, Perthshire.
1876. Cowan, Charles W., of Logan House, Valleyfield, Penicuik.
1892. Cowan, George, 1 Gillsland Road, Edinburgh.
1874. Cowper, R. W., Gortanore, Sittingbourne, Kent.
1904. Cox, Albert E., of Dungarthill, Dunkeld.
1904. Cox, William Henry, of Snaigow, Murthly.
1901. Craig, Sir James H. Gibson, Bart. of Riccarton, Currie.
1875. Craig, Wm., M.D., C.M., F.R.S.E., 71 Bruntsfield Place, Edinburgh.
1898. Crawford, Francis C., 19 Royal Terrace, Edinburgh.
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.
1901. Cunningham, Captain John, Leithen Lodge, Innerleithen.
1893. Curr, W. S., Factor, Ninewar, Prestonkirk.
1884. Currie, Sir Donald, K.C.M.G., M.P., of Garth Castle, Aberfeldy.

1867. Dalgleish, John G., of Ardnamurchan, Brankston Grange, Stirling.

Date of Election.

1876. DALGLEISH, Laurence, of Dalbeath, Rutland Square, Edinburgh.
1900. DALHOUSIE, The Right Hon. the Earl of, Brechin Castle, Forfarshire.
1892. DAVIDSON, William, Forester, Margam Park, Port Talbot, Wales.
1901. DEWAR, John A., M.P., Perth.
1898. DIGBY, The Right Hon. Baron, Minterne, Cerne, Dorsetshire.
1896. DOUGLAS, Alex., Abbey Gardens, Wykeham R.S.O., Yorks.
1872. DUNDAS, Sir Robert, Bart. of Arniston, Gorebridge, Midlothian.
1895. DUNDAS, Lieut.-Colonel Robert, Yr. of Arniston, Kirkhill, Gorebridge.
1902. DURHAM, Right Hon. the Earl of, Lambton Castle, Durham.
1876. EDWARDS, William Peacock, S.S.C., 21 Hill Street, Edinburgh.
1881. ELLIOT, Walter, Manager, Ardtornish, Morvern, Oban, Argyle.
1899. ELLISON, Francis B., Bragleenbeg, Kilninver, Oban.
1904. ELPHINSTONE, The Lord, Carberry Tower, Musselburgh.
1879. FALCONER, Dr John, St Ann's, Lasswade, Midlothian.
1894. FARQUHARSON, James, Forester, Ardgowan, Inverkip.
1900. FERGUSON, James Alex., Ardnith, Partickhill, Glasgow.
1888. FERGUSON, R. C. Munro, M.P., of Raith and Novar, Raith, Fife.
1901. FINDLAY, John Ritchie, of Aberlour, Aberlour House, Aberlour.
1902. FITZWILLIAM, Right Hon. the Earl of, Wentworth, Rotherham.
1896. FORBES, James, The Gardens, Overtown, Dumbartonshire.
1878. FORBES, Robert, Estate Office, Kennet, Alloa.
1873. *Forbes, William, Consulting Forester*, 190 *Garbraid Street, Maryhill, Glasgow.*
1869. FORGAN, James, Forester, Bonskeid, Pitlochry, Perthshire.
1897. FOTHRINGHAM, W. Steuart, of Murthly, Perthshire.
1866. FRANCE, Charles S., 7 Belmont Place, Aberdeen.
1901. FRASER, Alexander, Solicitor and Factor, 63 Church Street, Inverness.
1892. FRASER, George, Factor, Dalzell, Motherwell, Lanarkshire.
1892. FRASER, Simon, Land Agent, Hutton in the Forest, Penrith.
1893. GALLOWAY, Robert, S.S.C., *Secretary*, 19 Castle Street, Edinburgh.
1899. GARRIOCH, John E., Factor, Lovat Estates, Beauly.
1903. GASCOIGNE, Lieut.-Col. Richard French, D.S.O., Craignish Castle, Ardfern, Argyleshire.
1881. GILCHRIST, Wm., Kemback Saw-mills, Cupar.
1904. GILLESPIE, David, Advocate, of Mountquhanie, Cupar, Fife.
1900. GLADSTONE, Sir John R., Bart. of Fasque, Laurencekirk.
1901. GODMAN, Hubert, Land Agent, Ginsborough, Yorkshire.
1868. GOSSIP, James A., of Howden & Co., The Nurseries, Inverness.
1897. GOUGH, Reginald, Forester, Wykeham, York.
1904. GRAHAM, Anthony George Maxtone, of Cultoquhey, Crieff.
1884. GRAHAM, Wm., 6 Royal Crescent, W., Glasgow.
1874. GRANT, John, Overseer, Daldowie, Tollcross, Glasgow.
1880. GRANT, Sir George Macpherson, Bart., Ballindalloch Castle, Banffshire.
1900. HALDANE, William S., of Foswell, W.S., 55 Melville Street, Edinburgh.
1882. HAMILTON, Donald C., Forester, Knowsley, Prescot.
1899. HAMILTON, The Right Hon. Baron, of Dalzell, Dalzell House, Motherwell.

Date of Election.

1903. HARDIE, David, Factor, Errol Park, Errol.
1880. HARE, Colonel, Blairlogie, Stirling.
1896. HARLEY, Andrew M., Forester, 37 Hemdean Road, Caversham, Reading.
1880. HAVELOCK, W. B., The Nurseries, Brocklesby Park, Lincolnshire.
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, J. Smith, The Agricultural College, Aspatria.
1903. HILL, Robert Wylie, of Balthayock, Perthshire.
1902. HINCKES, Ralph Tichborne, J.P., D.L., Foxley, Hereford.
1902. HOOD, Thomas, jun., Land Agent, High Street, Coldstream.
1871. HOPE, H. W., of Luffness, Drem, Haddingtonshire.
1876. HORNE, John, Director, Forests and Gardens, Mauritius.
1876. HORSBURGH, John, Aberdour House, Aberdour, Fife.
1869. HUTH, Louis, of Possingworth, Hawkhurst, Sussex.
1884. *Inglis, Alex., Greenlaw Dean, Greenlaw, Berwickshire.*
1901. JOHNSTON, James, F.S.I., Factor, Alloway Cottage, Ayr.
1883. JOHNSTON, Robert, Forester, Bon Ryl Estate, Duns, Berwickshire.
1882. JONAS, Henry, Land Agent and Surveyor, 23 Pall Mall, London, S.W.
1901. KENNEDY, Frederick D. C.-Shaw-, Dyroch, Maybole.
1890. KENNEDY, James, Doonholm, Ayr.
1892. KERR, John, Farmer, Barney Mains, Haddington.
1903. KINNAIRD, The Hon. Douglas A., Master of Kinnaird, 10 St James Square, London.
1898. KINROSS, John, Architect, 2 Abercromby Place, Edinburgh.
1902. KIPPEN, William James, Advocate, B.A., LL.B., Westerton, Balloch, Dumbartonshire.
1890. LAIRD, David P., Nurseryman, Pinkhill, Murrayfield, Edinburgh.
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.
1896. LANSDOWNE, The Most Hon. the Marquess of, K.G., 54 Berkeley Square, London, S.W.
1876. LEICESTER, The Right Hon. the Earl of, Holkham Hall, Wells, Norfolk.
1868. LESLIE, Charles P., of Castle-Leslie, Glaslough, Ireland.
1893. LEVEN, George, Forester, Auchencruive, Ayr.
1881. LEYLAND, Christopher, Haggerston Castle, Beal, Northumberland.
1883. LONEY, Peter, Estate Agent, 6 Carlton Street, Edinburgh.
1881. LONSDALE, Claud, Rose Hill, Carlisle.
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.
1900. LOW, William, B.Sc., Tighnamuirn, Monifieth.

Date of Election.

1891. LUMSDEN, Hugh Gordon, of Clova, Lumsden, Aberdeenshire.
1875. LUTTRELL, George F., of Dunster Castle, Taunton, Somersetshire.
1900. LYELL, Sir Leonard, Bart. of Kinnordy, Kirriemuir.

1901. M'CALLUM, Thomas W., Retired Ground Officer, Dailly, Ayrshire.
1870. M'CORQUODALE, D. A., Bank of Scotland, Carnoustie, Forfarshire.
1900. MACDONALD, Harry L., of Dunach, Oban.
1894. MACDONALD, James, Forester, Kinnaird Castle, Brechin.
1895. MACDOUGALL, Professor Robert Stewart, M.A., D.Sc., Royal Veterinary College, Edinburgh.
1884. MACDUFF, Alex., of Bonhard, Perth.
1904. MACFIE, John William, of Dreghorn, Rowton Hall, Chester.
1901. M'GIBBON, Donald, Forester, Fothringham, Forfar.
1902. MACGREGOR, Alasdair Ronald, Edinchip, Lochearnhead.
1895. MACINTOSH, D. L., The Gardens, Stronvar, Lochearnhead.
1885. MACINTOSH, William, Fife Estates Office, Banff.
1879. M'INTOSH, Dr W. C., Professor of Natural History, University of St Andrews, 2 Abbotsford Crescent, St Andrews.
1893. MACKENZIE, James, Forester, Cullen House, Cullen.
1897. *M'Kerrow, Robert, Manager, Carton, Maynooth, Co. Kildare.*
1898. MACKINNON, A., The Gardens, Scone Palace, Perth.
1905. MACKINTOSH, W. E., Yr. of Kyllachy, 28 Royal Circus, Edinburgh.
1895. MACLACHLAN, John, of Maclachlan, 12 Abercromby Place, Edinburgh.
1879. M'LAREN, John, 12 Findhorn Place, Edinburgh.
1898. M'LAREN, John, Gardener, Ballencrieff, Drem, East Lothian.
1898. MACLEAN, Archibald Douglas, J.P., Harmony, Balerno.
1904. M'NAB, David Borrie, Solicitor, Clydesdale Bank, Bothwell.
1899. MACRAE-GILSTRAP, Major John, of Ballimore, Otter Ferry, Argyleshire.
1879. MACRITCHIE, David, C.A., 4 Archibald Place, Edinburgh.
1880. MALCOLM, Lieut.-Col. E. D., R.E., Achnamara, Lochgilphead.
1895. MANN, Charles, Merchant, Lumsden, Aberdeenshire.
1895. MARGERISON, Samuel, English Timber Merchant, Calverley, near Leeds.
1901. MARSHALL, Archd. M'Lean, 29 Queensgate Gardens, London, S.W.
1876. MARTIN, James, Forester, Knipton, Grantham, Lincolnshire.
1884. MASSIE, W. H., of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1894. MAUGHAN, John, Estate Agent, Jervaulx Abbey, Middleham R.S.O., Yorks.
1904. MAXWELL, Aymer, yr. of Monreith, Wigtownshire, Lieutenant, Grenadier Guards.
1893. MAXWELL, Sir John Stirling, Bart. of Pollok, Pollokshaws.
1879. MEIKLE, R. A., Ri Cruin, Lochgilphead, Argyleshire.
1880. MESHAM, Captain, Pontryffydd, Bodvari, Rhyl, Denbighshire.
1881. MICHIE, John, Factor, Balmoral, Ballater, Aberdeenshire.
1893. MIDDLEMASS, Archibald, Forester, Tulliallan, Kincardine-on-Forth.
1896. MILLER, Sir James Percy, Bart. of Manderston, D.S.O., Duns, Berwickshire.
1892. MILNE, J. K., Kevock Tower, Lasswade, Midlothian.
1897. MILNE-HOME, J. Hepburn, Caldra, Duns, Berwickshire.

Date of Election.

1882. MITCHELL, Francis, Forester, Woburn, Beds.
1902. MITCHELL, John, jun., Timber Merchant, Leith Walk Saw-mills, Leith.
1895. MONCREIFFE, Sir Robert D., Bart. of Moncreiffe, Perth.
1897. MORGAN, Alex., Timber Merchant, Crieff, Perthshire.
1899. MORGAN, Andrew, Assistant Factor, Glamis.
1898. MORGAN, Hugh, Timber Merchant, Crieff, Perthshire.
1895. MORGAN, Malcolm, Timber Merchant, Crieff, Perthshire.
1902. MUNRO, Hugh Thomas, Lindertis, Kirriemuir.
1898. MURRAY, Hon. Alan David, Scone Palace, Perth.
1896. MURRAY, William Hugh, W.S., 48 Castle Street, Edinburgh.

1899. NAIRN, Sir Michael B., Bart. of Rankeillour, Manufacturer, Kirkcaldy.
1903. NICOL, William Edward, D.L., J.P., of Ballogie, Aboyne.
1901. NICOLSON, Edward Badenach, Advocate, 4 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.Sc., Department of Agriculture, Cape Town.

1894. ORKNEY, William C., Surveyor's Office, Montrose Royal Asylum.
1899. ORR-EWING, Archibald Ernest, Ballikinrain Castle, Balfron.

1879. PATON, Hugh, Nurseryman, Kilmarnock, Ayrshire.
1898. PATON, Robert Johnston, Nurseryman, Kilmarnock.
1902. PATON, Tom W., Nurseryman, Kilmarnock.
1900. PERRINS, C. W. Dyson, of Ardross, Ardross Castle, Alness.
1897. PHILIP, Alexander, Solicitor, Brechin, Forfarshire.
1895. PHILIP, William Watt, Factor, Estate Office, Gigha, Argyleshire.
1878. PITCAITHLEY, Alexander, Forester, Jeanie Bank, Scone.
1896. PITMAN, Archibald Robert Craufurd, W.S., 48 Castle Street, Edinburgh.
1856. PORTSMOUTH, The Right Hon. the Earl of, Eggesford, North Devon.
1878. PUNCHARD, Frederick, Underley Estate Office, Kirkby Lonsdale, Westmoreland.

1876. RAE, William A., Factor, Murthly Castle, Perthshire.
1855. RAMSDEN, Sir John, Bart., Byram Hall, Ferrybridge, Normanton.
1873. RICHARDSON, Adam D., 8 Sciennes Gardens, Edinburgh.
1876. RITCHIE, William, Hope Lodge, Moffat.
1897. ROBERTSON, A. Barnett, Forester, The Dean, Kilmarnock, Ayrshire.
1879. ROBERTSON, Donald, Forester, Dunrobin, Golspie.
1866. ROBERTSON, Jas., Wood Manager, Panmure, Carnoustie, Forfarshire.
1890. ROBINSON, William, Gravetye Manor, East Grinstead, Sussex.
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.

1894. SANDERSON, Wm., Talbot House, Ferry Road, Leith.
1867. SCOTT, Daniel, Wood Manager, Darnaway, Forres.
1902. SCRIMGEOUR, James, Gardener, Manor House, Donaghadee.

Date of Election.

1890. SCRIMGEOUR, John, Overseer, Doune Lodge, Doune.
1896. SHAW-STEWART, Michael Hugh, M.P., of Carnock, Larbert, Stirlingshire.
1904. SHELLEY, Sir John Courtown Edward, Bart., Avington, Alresford, Hants.
1898. SHEPPARD, Rev. H. A. Graham-, of Rednock, Port of Menteith, Stirling.
1903. SHIEL, James, Overseer, Abbey St Bathans, Grant's House.
1893. SMITH, Charles G., Factor, Haddo House, Aberdeen.
1895. SMITH, Thomas, Overseer, The Nursery, Tring Park, Wiggington, Tring, Herts.
1877. SMITH, Thomas Valentine, of Ardtornish, Morvern, Argyleshire.
1896. SMITH, William G., Ph.D., Professor, Yorkshire College, Leeds.
1882. SMYTHE, David M., of Methven Castle, Perth.
1883. SPROT, Major Alexander, of Garnkirk, Chryston, Glasgow.
1899. STEWART, Duncan D., Factor, Rossie Estate, Inchture.
1892. STEWART, Sir Mark J. M'Taggart, Bart., M.P., of Southwick, Kirkcudbrightshire.
1904. STIRLING, Archibald, of Keir, Dunblane.
1880. SUTHERLAND, Evan C., Highland Club, Inverness.
1883. SUTHERLAND, His Grace the Duke of, K.G., Dunrobin Castle, Golspie.

1891. TENNANT, Edward P., 31 Lennox Gardens, London, S.W.
1877. TERRIS, James, Factor, Dullomuir, Blairadam, Kinross-shire.
1902. THOMSON, Peter Murray, S.S.C., 5 York Place, Edinburgh.
1901. THOMSON, Spencer Campbell, of Eilean Shona, 10 Eglinton Crescent, Edinburgh.
1871. TOMLINSON, Wilson, Forester, Clumber Park, Worksop, Notts.
1902. TROTTER, A. E. C., of Bush, Milton Bridge, Midlothian.
1883. TROTTER, Major-General Sir H., of Mortonhall, Edinburgh.
1903. TULLIBARDINE, The Most Hon. the Marquis of, D.S.O., Blair Castle, Blair Atholl.

1872. URQUHART, B. C., of Meldrum, Aberdeenshire.
1902. URQUHART, Farquhar, Nurseryman, Inverness.

1878. WALKER, Colonel I. Campbell, Newlands, Camberley, Surrey.
1897. WALLACE, John A. A., of Lochryan, Cairnryan, Stranraer.
1900. WARWICK, Charles, Land Steward, Clandeboye, Co. Down.
1893. WATSON, John T., 6 Bruntsfield Gardens, Edinburgh.
1891. WELSH, James, of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1871. WEMYSS, Randolph Gordon Erskine, of Wemyss and Torrie, Fife.
1898. WHITE, J. Martin, Balruddery, near Dundee.
1899. WHYTE, John D. B., Factor, Estate Office, Elveden, Suffolk.
1869. WILD, Albert Edward (Conservator of Forests, Darjeeling, India), c/o Henry S. King & Co., 65 Cornhill, London, E.C.
1898. WILSON, David, Timber Merchant, Troon, Ayrshire.
1889. WILSON, David, jun., of Carbeth, Killearn, Glasgow.
1904. WINK, John, Solicitor, High Street, Elgin.

1898. YOUNGER, Henry J., of Benmore and Kilmun, Greenock.
1899. YULE, Amy Frances, L.A., Tarradale House, Muir of Ord.

ORDINARY MEMBERS.

The Names printed in italics (in this and preceding list) are those of Members whose present Addresses are unknown. Any information regarding those Members will be gladly received by the Secretary.

Law V. Members in arrear shall not receive the *Transactions* while their Subscriptions remain unpaid. Any Member whose Annual Subscription to the Society remains unpaid for three years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till he shall have paid up his arrears.

Date of Election.

1895. Abbot, Thomas, Forester, Firknowe, Peebles.
1904. Abernethy, Thomas, Assistant Forester, Horton Hill, Banbury, Oxon.
1902. Acland, Sir Charles Thomas Dyke, Bart., M.A., D.L., etc., Killerton, Exeter.
1903. Ailsa, The Marquess of, Culzean Castle, Maybole.
1902. Ainslie, Thomas, Glenesk, Penicuik.
1902. Aitchison, William, Assistant Forester, Weirburn Cottage, Grant's House.
1905. Alexander, Henry, Head Forester, Grimstone Estate, Gilling East, York.
1903. Allan, James, Wood Merchant, Bieldside, Aberdeen.
1905. Allan, James, Forester, Lyde Green, Rotherwick, Winchfield, Hants.
1898. Allaway, William, 13 St Andrew Square, Edinburgh.
1905. Anderson, Duncan, Assistant Forester, Gilling East, York.
1901. Anderson, Robert, Bailiff, Phœnix Park, Dublin.
1900. Angus, Alexander, Gardener, Dalzell, Motherwell.
1887. Annand, John F., Overseer, Haystoun Estate, Woodbine Cottage, Peebles.
1899. Annandale, William, Land Steward, Kincaldrum, Forfar.
1903. Anstruther, Sir Ralph, Baronet, of Balcaskie, Pittenweem.
1903. Archibald, John Clark, Head Forester, Eden Hall, Langwathby R.S.O., Cumberland.
1903. Archibald, W. F. B., Forester, Whitehill, Bothwell.
1897. Armit, James, The Gardens, Heywood, Abbeyleix, Queen's Co.
1902. Armstrong, John, Saughton Vale, Murrayfield.
1898. Armstrong, Thos. J. A., Factor, Glenborrodale, Salen, Fort William.
1904. Arnott, William, Assistant Forester, Pollok Estate, Pollokshaws.
1860. Austin & M'Aslan, Nurserymen, 89 Mitchell Street, Glasgow.

1903. Baird, William Arthur, of Erskine, Glasgow.
1892. Ballingall, Niel, Sweet Bank, Markinch, Fife.
1898. Bannan, Andrew, Forester, Glenfarg Estate, Abernethy.
1897. Barclay, Robert Leatham, Banker, 54 Lombard Street, London, E.C.
1900. Barker, Arthur, Forester, Shanbally Castle, Cahir, Co. Tipperary.

Date of Election.

1903. Barnes, Nicholas F., Head Gardener, Eaton Hall, Chester.
1867. Barrie, David, Forester, Comlongan Castle, Annan, Dumfries.
1874. Barton, James, Forester, Hatfield House, Herts.
1904. Barton, James Robert, Factor, 61 Frederick Street, Edinburgh.
1899. *Beatson, David J., Crown Office, Parkend, near Lydney, Gloucestershire.*
1904. Beaumont, Robert, Assistant Forester, Heckfield, near Winchfield, Hants.
1883. Bell, Andrew, Forester, Forglen, Turiff, Aberdeenshire.
1901. Bell, Andrew, Forester, Bridgend, Montgreenan, Kilwinning.
1898. Bell, David, Seed Merchant, Coburg Street, Leith.
1900. Bell, Robert, Land Steward, Baronscourt, Newtown-Stewart, Ireland.
1898. Bell, R. Fitzroy, of Temple Hall, Coldingham.
1900. Bell, William, Forester, Balthayock, Perth.
1895. Bennet, J. B., C.E., A.M.I., 12 Hill Street, Edinburgh.
1905. Bennett, John, Forester, 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.
1903. Beveridge, Erskine, LL.D., of Brucefield, St Leonard's Hill, Dunfermline.
1903. Binning, The Lord, Mellerstain, Kelso.
1901. Bisset, John, Wood Merchant, Maryculter, Aberdeen.
1899. Bissett, Alexander, Forester, Tregothnan, Truro.
1903. Black, John, Agent for Esparto and Wood Pulp, 21 Fettes Row, Edinburgh.
1904. Black, John, Factor, Cortachy Castle, Kirriemuir.
1903. Blair, Thomas, Farmer, Hoprig Mains, Gladsmuir.
1904. Blunt, Major Walter, Castle Leod, Strathpeffer.
1872. Boa, Andrew, Estate Agent, Great Thurlow, Suffolk.
1892. Bond, Thomas, Forester, Lambton Park, Fence Houses, Durham.
1876. Booth, John, 39 Mozartstrasse Gross-Lichterfelde, Berlin.
1898. Borthwick, Francis J. G., W.S., 9 Hill Street, Edinburgh.
1887. Boulger, Professor, 11 Onslow Road, Richmond Hill, London, S.W.
1896. Bowles, William A., The Gardens, Adare Manor, Adare, Co. Limerick.
1883. Boyd, John, Forester, Wood Cottage, Kennishead, Thornliebank.
1897. Braid, J. B., Forester, Witley Court, Great Witley, Stourport.
1899. Braid, Thomas, Factor, Durris, Drumoak, Aberdeenshire.
1900. Broom, John, Wood Merchant, Bathgate.
1905. Brown, Alexander Shannon, Assistant Forester, 17 Henrietta Street, Kilmarnock.
1896. Brown, David, Manager, Wollaton Offices, Nottingham.
1901. Brown, David, Factor, Dunure, etc., Royal Bank, Maybole.
1904. Brown, George, Timber Merchant, Buckhaven Saw-mills, Buckhaven.
1905. Brown, George H., Assistant Forester, East Terrace, South Queensferry.
1900. Brown, Gilbert, Assistant Forester, Beaufort Cottage, Kiltarlity.
1878. Brown, J. A. Harvie-, of Quarter, Dunipace House, Larbert.
1904. *Brown, James, Forester, Burnside Cottage, Houston.*

Date of Election.

1899. Brown, John, C.A., 10 Royal Exchange, Edinburgh.
1899. Brown, John, Forester and Ground Officer, Craighall, Rattray, Perthshire.
1893. Brown, Robert, Forester, Boiden, Luss.
1895. Brown, Walter R., Forester, Park Cottage, Heckfield, near Winchfield, Hants.
1900. Brown, William, Assistant Forester, c/o Mrs Robertson, Woodlawn, Co. Galway.
1901. Bruce, David, Forester, Ingmire Hall, Sedbergh, Yorks.
1895. Bruce, Peter, Manager, Achnacloich, Culnadalloch, by Connel.
1904. Brunton, John, Foreman Forester, Woodville Cottage, Birr.
1897. Brydon, John, Seed Merchant and Nurseryman, Darlington, Co. Durham.
1873. Buchan, Alexander, A.M., F.R.S.E., LL.D., Secretary of the Scottish Meteorological Society, 2 Dean Terrace, Edinburgh.
1899. Burn-Murdoch, John, of Gartincaber, Doune.
1904. Butler, Robert, Forester, Lealholm, Grosmont R.S.O., Yorks.

1902. Cadell, Henry Moubray, of Grange and Banton, B.Sc., F.R.S.E., F.A.S., J.P., etc., Grange, Bo'ness.
1896. Cairns, Richard, The Gardens, Balruddery, near Dundee.
1903. Cairns, Thomas, Assistant Forester, 10 Newton Street, Mansfield.
1905. Callander, Gavin, Wood Merchant, Newton Stewart, Wigtownshire.
1901. Cameron, Alex., Land Steward, Caledon Demesne, Caledon, Tyrone.
1900. Cameron, Dr James, The Fountain, Loanhead.
1902. Cameron, Ewan, of Rutherford, West Linton.
1899. Cameron, John J., Clydesdale Iron Works, Possilpark, Glasgow.
1904. Cameron, Robert, Assistant Forester, Lynedoch, Almondbank, Perth.
1895. Campbell, Alexander, Land Steward, Rosemill Cottage, Strathmartin, by Dundee.
1899. Campbell, Alexander, Hilton Cottage, Stanley, Perthshire.
1902. Campbell, Buchanan, W.S., 7 Lansdowne Crescent, Edinburgh.
1904. Campbell, David S., Assistant Forester, Scone.
1904. Campbell, Duncan, Assistant Forester, Scone, Perth.
1896. Campbell, James Alex., M.P., of Stracathro, Brechin.
1900. Campbell, James S., Assistant Forester, Ginsboro Hall, Ginsboro, Yorks.
1894. Campbell, John, Timber Merchant, Inverness.
1902. Campbell, Lieut.-Col. J. C. L., Royal Engineers, of Achaladar, Blairgowrie.
1901. Campbell, Peter Purdie, Factor, Estate Office, Mertoun, St Boswells.
1903. Campbell, Sir Alexander, Bart., Kilbryde Castle, Dunblane.
1903. Canch, Thomas Richard, B.Sc., P.A.S.I., Portland Estate Office, Kilmarnock.
1903. Carruthers, Major Francis John, of Dormont, Lockerbie.
1898. Carson, David Simpson, C.A., 209 West George Street, Glasgow.
1904. Cathcart, Sir Reginald Gordon, Bart., Cluny Castle, Aberdeenshire.
1904. Cavers, A. R. S., Estate Office, Benmore, Kilmun.

Date of Election.

1900. CAVERS, Walter, Timber Merchant, 12 East Brighton Crescent Portobello.
1904. CHADWICK, Robert, Findhorn House, Forres.
1897. CHALMERS, James, Overseer, Gask, Auchterarder, Perthshire.
1898. CHALMERS, James, Forester, Ayton House, Abernethy.
1904. CHALMERS, Robert W., Assistant Forester, Pollok Estate, Pollokshaws.
1892. CHAPMAN, Andrew, Factor, Dinwoodie Lodge, Lockerbie, Dumfriesshire.
1892. CHAPMAN, Mungo, Torbrix Nurseries, St Ninians, Stirling.
1897. CHISHOLM, Colin, Forester, Lundin and Montrave Estates, Hattonlaw, Lundin Links.
1884. CHRISTIE, Alex. D., The Gardens, Ragley, Alcester, Warwickshire.
1890. CLARK, Charles, Forester, Cawdor Castle, Nairn.
1902. CLARK, Francis Ion, Estate Office, Haddo House, Aberdeen.
1891. CLARK, John, Forester, Haddo House, Aberdeen.
1892. CLARK, John, jun., Forester, Bawdsey, Woodbridge, Suffolk.
1892. CLARK, William, 66 Queen Street, Edinburgh.
1902. CLARK, William, Assistant Factor, Raith, Kirkcaldy.
1901. CLAYTON, Thomas Lill, Under Forester, Manby Lodge, Broughton Brigg.
1902. CLOUGH, C. H., Olderoft, Stanwix, Carlisle.
1904. COBB, Herbert Mansfield, Land Agent, Higham, Rochester, Kent.
1896. COCKBURN, Alex. K., Assistant Forester, 51 High Street, Peebles.
1900. COLLIE, Alexander, Knowsley, Prescot, Lancashire.
1893. *Collins, Frederick, Forester, 2 Garland Road, Ware, Herts.*
1905. COMRIE, William Lewis, Factor, Cally Estates Office, Gatehouse.
1895. CONNOR, George A., Factor, Craigielaw, Longniddry.
1904. COUPAR, Charles, Assistant Forester, Lynedoch, Almondbank, Perth.
1903. COUTTS, Albert, Assistant Forester, Royal Botanic Garden, Edinburgh.
1858. COWAN, James, Forester, Bridgend, Islay, Argyleshire.
1899. COWAN, Robert, Chisholm Estates Office, Erchless, Strathglass.
1901. COWAN, Robert Craig, Craigiebield, Penicuik.
1900. CRABBE, Alfred, Forester, Craigo, Montrose (c/o Mrs Muirden, The Gardens).
1875. CRABBE, David, Forester, Byreburnfoot, Canonbie, Dumfriesshire.
1867. CRABBE, James, Forester, Glamis Castle, Forfarshire.
1904. CRAIG, Alexander, Assistant Forester, Glamis.
1893. CRAIG, John, Loxington, Saltcoats.
1903. CRANSTOUN, Charles Joseph Edmondstoune, of Corehouse, Lanark.
1899. CRERAR, David, Land Steward, Methven Castle, Perth.
1898. CRICHTON, William, Manager, Castle Ward, Downpatrick.
1903. CROLL, John, of D. & W. Croll, Nurseryman, Dundee.
1898. CROMBIE, James, Forester, c/o Mrs Goulder, Fawley, near Henley-on-Thames.
1900. CUMMING, John H., The Gardens, Grantully Castle, Aberfeldy.
1904. CUNINGHAME, Captain Sir Thomas Montgomery, Bart., D.S.O., of Corsehill and Kirktonholm, Kirkbryde, Maybole.
1898. CUNNINGHAM, George, Advocate, 21 Royal Circus, Edinburgh.

Date of Election.

1904. DAINE, Herbert Simpson, M.R.A.S.E., F.H.A.S., Woodfall Hall Farm, Huyton, Liverpool.
1901. DALRYMPLE, Hon. Hew H., Lochinch, Castle Kennedy, Wigtownshire.
1904. DALRYMPLE, Sir Charles, Bart., M.P., of Newhailes, Musselburgh.
1901. *Dalziel, Henry, Assistant Forester, Royal Botanic Garden, Edinburgh.* (*Central Africa.*)
1884. DALZIEL, James, Forester, Culzean Castle, Maybole, Ayrshire.
1905. DAVID, Albert E., Assistant Forester, Bowood, Calne, Wilts.
1905. DAVID, William J., Assistant Forester, Heckfield, Winchfield, Hants.
1904. DAVIDSON, James, 12 South Charlotte Street, Edinburgh.
1865. DAVIDSON, John, Agent, Greenwich Hospital Estates, Haydon Bridge-on-Tyne.
1892. DAVIDSON, John, Forester, Dalzell, Motherwell, Lanarkshire.
1901. DAVIE, George, Overseer, Glencurse, Perth.
1904. DAVIE, Thomas, Assistant Forester, Lynedoch, Almondbank, Perth.
1904. DENHOLM, John, Timber Merchant, Bo'ness.
1902. DEWAR, H. P., Forester, Beaufort Castle, Beauly.
1904. DEWAR, Robert, Assistant Forester, Pollok Estate, Pollokshaws.
1905. DEWAR, William, Assistant Forester, Fauldsley, Halliburton, Coupar Angus.
1904. DICK, William, Timber Merchant, Hamilton.
1895. DINGWALL, Alexander, Glendoig Villa, Perth.
1904. DODDS, Thomas, Cashier, Pollok Estate Office, 216 West George Street, Glasgow.
1903. DON, Alex., Namitomba Estate, Zomba, British Central Africa.
1901. DONALD, James Alexander, Assistant Forester, Cluny Square, Cardenden, Fife.
1893. DONALDSON, James, Timber Merchant, Tayport, Fife.
1897. DORMAN, Arthur John, of Grey Towers, Newby, Nunthorpe R.S.O., Yorks.
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., Assistant Forester, Margam, Port Talbot, Wales.
1903. DOW, Alexander, Forester, Bretby Park, Burton-on-Trent.
1892. *Dow, R., Forester, Douglas Castle, Douglas, Lanarkshire.*
1898. DOW, Thomas, Assistant Forester, Weekley, near Kettering.
1904. DRUMMIE, Alexander, Assistant Forester, Alnwick, Northumberland.
1900. DRUMMOND, Dudley W., Commissioner, Cawdor Estate Office, Ferryside, South Wales.
1904. DRUMMOND, William, Assistant Forester, Scone, Perth.
1862. DRUMMOND & SONS, William, Nurserymen, Stirling.
1903. DUFF, Mrs M. M. Wharton-, Orton, Morayshire.
1904. DUNCAN, Alexander, Assistant Forester, Lynedoch, Almondbank, Perth.
1905. DUNSTAN, M. I. R., Principal of South-Eastern Agricultural College, Wye, Kent.
1873. DURWARD, Robert, Manager, Blelack, Dinnet, Aberdeenshire.

Date of Election.

1900. DUTHIE, James A., Manager, Ben. Reid & Co., Ltd., Nurserymen, Aberdeen.

1898. EADSON, Thomas G., Assistant Forester, Whaley, Mansfield.
1885. EDDINGTON, Francis, Overseer, Monk Coniston Park, Lancashire.
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, Wood Cottage, Newlands Park, Chalfont St Giles, Bucks.
1893. ELDER, William, Forester, Cholmondeley Park, Malpas, Cheshire.
1898. ELDER, Wm., Engineer, Berwick-on-Tweed.
1903. ELGAR, Walter Robinson, Land Agent, Hill House, Sittingbourne.
1902. ELLICE, Captain Edward Charles, M.P., Invergarry.
1901. ELWES, Henry John, F.R.S., of Colesborne, Cheltenham.
1901. ERSKINE, Richard Brittain, Oaklands, Trinity, Edinburgh.
1898. EWAN, Peter, Assistant Forester, Brownshill, Colstoun, Haddington.
1873. EWING, David, Forester, Strichen House, Aberdeen.
1904. EWING, Guy, Land Agent, Cole Allen, Edenbridge.
1903. EYRE, Alfred Hamilton, Forester, Stanway, Winchcombe R.S.O., Gloucestershire.

1898. FARQUHARSON, Dr Robert, of Finzean, M.P., Aboyne, Aberdeenshire.
1901. FARQUHARSON, Sir John, K.C.B., Corrachree, Tarland, Aberdeenshire.
1899. FAWCETT, Thos. G., Land Agent, Yarm-on-Tees.
1900. FEAKS, Matthew, Mourne Park, Newry.
1904. *Fenwick, Andrew, Assistant Forester, Lynedoch, Almondbank, Perth.*
1903. FENWICK, William, Factor, Rockdale, Kinfauns, Perth.
1899. FERGUSON, J. E. Johnson, M.P., of Springkell, Ecclefechan.
1903. FERGUSSON, John Blackburn, Barrister-at-Law, J.P., LL.B. Camb., Balgarth, Ayr.
1880. FERGUSSON, Sir James Ranken, Bart., Spitalhaugh, West Linton.
1893. FINLAYSON, Alexander, Hardengreen, Eskbank.
1893. FINLAYSON, Malcolm, Solicitor, Crieff, Perthshire.
1869. FISHER, William, Estate Agent, Wentworth Castle, Barnsley, Yorkshire.
1899. FISHER, W. R., Assistant Professor of Forestry, Coopers Hill, Surrey.
1899. FLEMING, John, Timber Merchant, Albert Saw-mills, Aberdeen.
1904. FLEMING, William, Fruit Grower, etc., 18 Murano Place, Edinburgh.
1897. FLETT, John Smith, M.A., M.B., B.Sc., Geological Survey, 28 Jermyn Street, London, S.W.
1890. FORBES, Professor Arthur C., Armstrong College, Newcastle-on-Tyne.
1898. FORBES, James, Factor, Blair Castle, Blair Atholl.
1904. FORBES, Robert Guthrie, Agent, Hursley Park, Winchester, Hants.
1904. FORBES, Robert Guthrie, jun., Forester, Hursley Park, Winchester, Hants.
1891. FOREMAN, Frederick, Nurseryman, Eskbank, Dalkeith.
1892. FORGAN, James, Sunnybraes, Largo, Fife.
1889. FORSTER, William A., Forester, Belgrave Lodge, Pulford, Wrexham.

Date of Election.

1904. FORTUNE, Thomas, Florist and Seed Merchant, 17 Queensferry Street, Edinburgh.
1904. FOSTER, Henry, Assistant Forester, Castle Menzies, Aberfeldy.
1898. FOSTER, James, jun., Kennet Village, Alloa.
1900. FRASER, Alexander, Factor, Lundin and Montrave Estates Office, Leven.
1902. FRASER, George M., Land Agent, 13 Drumsheugh Gardens, Edinburgh.
1898. FRASER, James, Assistant Forester, Cahir Park, Cahir, Co. Tipperary.
1899. FRASER, James, Home Steward, Tregothnan, Truro.
1895. FRASER, J. C., Nurseryman, Comely Bank, Edinburgh.
1905. FRASER, John, Forester, 121 Latimer Road, Eastbourne, Sussex.
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.
1896. FRATER, John, Foreman Forester, Ardross Mains, Alness, Ross-shire.
1902. FRATER, John, Head Forester, Ardross Castle, Alness, Ross-shire.
1899. FYSHE, Peter, Newtonlees, Dunbar.

1874. GALLOWAY, George, Estate Offices, Woodhouses, Whitchurch, Salop.
1904. GALLOWAY, George, Quarrymaster, Roseangle, Wellbank, by Dundee.
1896. GAMMELL, Sydney James, of Drumtochty, Drumtochty Castle, Fordoun.
1898. GAULD, William, Forester, Crushmore Lodge, Drumcliffe, Co. Sligo.
1902. GAVIN, George, Factor, Falkland Estate, Falkland.
1900. GELLATLY, John, Forester, Newhall, by Penicuik.
1897. GELLATLY, Thomas, Forester, Hallyburton, Coupar Angus.
1897. GEMMILL, Wm., Farmer, Greendykes, Macmerry, East Lothian.
1903. GIBSON, William, Forester, Springbank Cottage, Monkton, Ayrshire.
1905. GILBERT, Alexander, Assistant Forester, Dalgety House, Donibristle, Aberdour.
1897. GILLANDERS, A. T., F.E.S., Forester, Park Cottage, Alnwick, Northumberland.
1894. GILLESPIE, James, Forester, Blairmore, Braco.
1894. GILMOUR, Major Robert Gordon, of Craigmillar, The Inch, Midlothian.
1880. *Glen, David A., Forester, Bedgebury Park, Goudhurst, Kent.*
1903. GOLD, William, Forester, Dellavaird, Auchenblae.
1903. GOODAIR, James Stewart, Assistant Forester, Drumtochty, Fordoun.
1904. GORDON, Frank, Assistant Forester, Dean Road, Kilmarnock.
1900. GORDON, Thomas, County Buildings, Edinburgh.
1897. GOW, Peter, Land Steward, Laggan, Ballantrae, Ayrshire.
1897. GOW, Peter Douglas, Farmer, Bonaly, Colinton, Midlothian.
1902. GRAHAM, Andrew, M.D., Currie.
1887. GRANT, Alexander, Forester, Rothie-Norman, Aberdeenshire.
1867. GRANT, Donald, Forester, Drumin, Ballindalloch, Banffshire.
1904. GRANT, Ewan S., Assistant Forester, Royal Botanic Garden, Edinburgh.
1893. GRANT, John B., Forester, Downan House, Glenlivet.
1893. GRANT, Peter, Land Steward, Kilmeade Farm, Athy, Co. Kildare.
1903. GRAY, Hon. Morton G. Stuart, of Kinfauns, Perth.
1901. GRAY, Major William Anstruther-, of Kilmany, Cupar-Fife.

Date of Election.

1902. GRAY, Robert, Timber Merchant, Fraserburgh.
1902. GRAY, Walter Oliver, Foreman Woodman, North Lodge, Minto.
1904. GRAY, Wm., Farmer, Braehead, Cramond Brig.
1902. GREIG, Hugh Gorrie, Coltness Estate Office, Wishaw.
1904. GRENFELL, Arthur Pascoe, Cossington, Bridgwater.
1898. GREY, Sir Edward, Bart., M.P., of Falloden, Chathill, Northumberland.
1903. GRIFFITHS, Sir Richard Waldie, of Hendersyde Park, Kelso.
1905. GURNEY, Eustace, Spraixton Hall, Norwich.

1879. HADDINGTON, The Right Hon. the Earl of, K.T., Tyninghame, Prestonkirk.
1880. HADDON, Walter, Solicitor, Royal Bank, Hawick.
1905. HALL, Thomas, Forester, Moore Abbey, Monasterevan, Co. Kildare.
1904. HALLEY, John Y. (of Garvie & Syme), Ironmonger, etc., Perth.
1897. HALLIDAY, Geo., Timber Merchant, Rothesay, Bute.
1901. HALLIDAY, John, Timber Merchant, etc., Rothesay.
1899. HAMILTON, James, The Gardens, Manderston, Duns.
1897. HAMILTON-OGILVY, H. T. M., of Beil, Prestonkirk, East Lothian.
1904. HANCOCK, Charles, M.A., Barrister-at-Law, Firlands, Grayshott, Hants.
1892. HANNAH, George, Overseer, The Folly, Ampton Park, Bury St Edmunds, Suffolk.
1903. HANNAH, Thomas, Assistant Forester, Raith, Kirkcaldy.
1905. HANSON, Clarence Oldham, Deputy Conservator, Indian Forest Department, Staunton, Coleford, Gloucestershire.
1903. HARDY, Marcel Edgard, Assistant for Botany, University College, Dundee.
1897. HARROWER, William, Forester, Garth, Aberfeldy, Perthshire.
1897. HART, John, Factor, Mains of Cowie, Stonehaven, Kincardineshire.
1894. HARVEY, James, The Gardens, Mortonhall, Liberton.
1897. HAY, Alexander, of Ben. Reid & Co., Nurserymen, Aberdeen.
1905. HAY, Henry Ferguson, Assistant Forester, c/o Mr C. Stuart, Willockstone, Troon, Ayrshire.
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, 8 Rennie Street, Kilmarnock.
1896. HAY, Wm. P., Merchant, Rosebank, Loanhead, Midlothian.
1889. HAYES, John, Overseer, Dormont, Lockerbie, Dumfriesshire.
1869. HAYMAN, John, Glentarff, Ringford, Kirkcudbrightshire.
1904. HAYWARD, Henry, Land Agent, St Margarets, Dover, Kent.
1897. HEGGIE, James George, Factor, The Burn, Inch of Arnhall, Edzell.
1866. HENDERSON, Arch., Clonad Cottage, Tullamore, King's County.
1871. HENDERSON, John, Overseer, Vogrie, Gorebridge.
1901. HENDERSON, Peter, Factor, Ballindalloch.
1893. HENDERSON, R., 4 High Street, Penicuik, Midlothian.
1893. HENDERSON, William, Forester, Clonad Cottage, Tullamore, King's County.

Date of Election.

1898. HENDRY, James, 5 Thistle Street, Edinburgh.
1900. HEWITSON, William, Assistant Forester, Knockderry Farm, Cove, Dumbartonshire.
1895. HILL, Claude, of Messrs John Hill & Sons, Spot Acre Nurseries, Stone, Staffordshire.
1904. HILL, George, Assistant Forester, Fothringham, Forfar.
1895. HOARE, Sir Henry Hugh Arthur, Bart. of Stourhead, Bath.
1903. HODSON, Richard Edmund, Land Agent, Coolfadda House, Bandon, Co. Cork.
1866. HOGARTH, James, Forester, Culhorn, Stranraer, Wigtownshire.
1905. HOGG, Richard, Estate Overseer, Glenapp, Ballantrae, Ayrshire.
1897. HOGG, Thos., The Gardens, Woodside, Paisley.
1874. HOME, Edward, Assistant Forester, Whiterig, Ayton, Berwickshire.
1902. HOWE, John Arnold, Assistant Forester, Kingswood, Murthly.
1905. HUDSON, W. F. A., M.A., Lecturer on Forestry, Agricultural College, Glasgow.
1876. HULL, Frank, Forester, Lilleshall, Newport, Salop.
1900. HUNTER, David, of Ahlbottn & Co., 5 Nelson Street, Edinburgh.
1905. HUTTON, George Kerse, Assistant Forester, Castle Kennedy, Wigtownshire.

1905. IMRIE, Charles, Assistant Forester, Dean Road, Kilmarnock.
1901. IMRIE, James, Assistant Forester, Knowsley, Prescot, Lancashire.
1901. IMRIE, William, Timber Merchant, Oakwood, Ayr.
1904. INGLIS, David, Accountant, National Bank, Allanmore Park Crescent, Kirkcaldy.
1897. INGLIS, George Erskine, Estate Agent, Campbeltown, Argyleshire.
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, Assistant Forester, Cothall Cottage, Altyre, Forres.
1904. IRVINE, Cosmo Gifford, Assistant Forester, 29 Roseneath Terrace, Edinburgh.
1901. IRVINE, John, Assistant Forester, Colesborne, Cheltenham, Gloucestershire.

1893. JACK, George, S.S.C., Dalkeith, Midlothian.
1902. JACK, Thomas, Farmer, Hermiston, Currie.
1898. JACKSON, James, The Gardens, Methven Castle, Perth.
1895. JAMIESON, Andrew, Overseer, Carnbroe, Bellshill.
1898. JAMIESON, James, Forester, Ffairfach Nurseries, Golden Grove Estate, Llandilo, South Wales.
1896. JARDINE, Sir R. W. B., Bart. of Castlemilk, Lockerbie, Dumfriesshire.
1904. JOANNIDES, Pericles, Student of Forestry, 81 Gilmore Place, Edinburgh.
1901. JOHNSTON, Andrew Reid, Assistant Forester, c/o Mrs Vickers, Pilsley, Bakewell.
1900. JOHNSTON, David, Manager, Charlestown Limeworks, Fife.
1899. JOHNSTON, Edward, Forester, Dalquharran, Dailly, Ayrshire.

Date of Election.

1878. JOHNSTONE, Adam, Forester, Coollattin, Shillelagh, County Wicklow.
1900. JOHNSTONE, William, Head Forester, Beil, Prestonkirk.
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.

1904. KAY, William, Grain Merchant, Lasswade.
1904. KEIR, Alexander, Assistant Forester, Lynedoch, Almondbank, Perth.
1896. KEIR, David, Forester, Ladywell, Dunkeld.
1904. KENNEDY, Colonel Watson, Wiveton, Hancley, Norfolk.
1899. KENNEDY, Thomas, Assistant Forester, Lambton Park Fence Houses, Durham.
1901. KENT, William, Forester, Crossford, Dunfermline.
1896. KETTLES, Robert, Assistant Forester, Craigend, Perth.
1894. KIDD, Wm., Forester, Harewood, Leeds.
1879. KINCAIRNEY, The Hon. Lord, 6 Heriot Row, Edinburgh.
1900. KING, David, Nurseryman, Osborne Nurseries, Murrayfield.
1901. KINLOCH, Sir John G. S., of Kinloch, Meigle.
1905. KINROSS, D. A., Farmer, Hillend, Clackmannan.
1898. KYLLACHY, The Hon. Lord, of Kyllachy, 6 Randolph Crescent, Edinburgh.

1899. LAIDLER, George, Assistant Factor, Ivy Cottage, Brodick.
1898. LAIRD, James W., Nurseryman, Monifieth.
1899. LAMOND, Alexander, Forester, Freeland, Forgandenny.
1899. LAMOND, William, Assistant Forester, Beechhill Nursery, Murrayfield.
1901. LAUDER, William, Assistant Gardener, Baronscourt, Ireland.
1897. LAURISTON, John, Assistant Forester, 13 Weekley, Kettering, Northamptonshire.
1900. LAWRIE, James, The Gardens, Murthly Castle, Perthshire.
1903. *Lawson, Alexander R., c/o Mrs Summers, Glenerd Cottage, Port Errol.*
1902. LEARMONT, John, Nurseryman, Larchfield Nurseries, Dumfries.
1905. LEATHEM, Adam, Assistant Forester, 104 Green Street, Newton, Ayr.
1904. LEES, D., of Pitscottie, Cupar, Fife.
1905. LEES, Ernest A. G., Assistant Factor, Durris Estate, by Aberdeen.
1874. LEIGH, William, of Woodchester Park, Stonehouse, Gloucestershire.
1880. LEISHMAN, John, Manager, Cavers Estate, Hawick, Roxburghshire.
1898. LEYS, Wm. B., Forester, Colstoun Old Mill, Gifford, East Lothian.
1903. LIDDALL, William John Norbray, Advocate, 26 Great King Street, Edinburgh.
1879. LINDSAY, Robert, Kaimes Lodge, Murrayfield, Midlothian.
1880. LINLITHGOW, The Most Hon. the Marquis of, Hopetoun House, South Queensferry.
1897. LOCK, Hampton C., Assistant Forester, Middleton, Tamworth.
1898. LOW, James, Temple, Gorebridge, Midlothian.
1898. LOW, James, Forester, Innes Estate, Elgin.

Date of Election.

1900. LUMSDEN, Robert, jun., 316 Morningside Road, Edinburgh.

1902. MACARTHUR, William, Assistant Forester, Queen Street, Waddesdon, Aylesbury, Buckinghamshire.
1892. MACBEAN, Simon, Land Steward, Erskine, Bishopton.
1896. M'BEATH, David, Forester, Abbey Village, Withnell, Lancashire.
1894. M'CALLUM, Edward, Overseer, Kerse Estate, Falkirk.
1903. M'CALLUM, Hugh, Forester, Fota Island, Queenstown.
1898. M'CALLUM, James, Forester, St Ann's Cottage, Lockerbie.
1904. M'CLELLAN, Frank C., Royal Agricultural College, Cirencester.
1893. M'COUBRIE, M. S., Land Steward, Tullamore, King's County, Ireland.
1899. M'DIARMID, Hugh, Assistant Forester, Dalmeny Park, Edinburgh.
1900. MACDIARMID, Hugh, Factor, Island House, Tiree, Oban.
1904. MACDONALD, Alexander, Factor, Meggernie, Aberfeldy.
1904. M'DONALD, Archibald M'Intyre, M.A., Advocate in Aberdeen, 46 King Street, Aberdeen.
1902. MACDONALD, Daniel, 35 Park Road, Trinity, Edinburgh.
1902. M'DONALD, Donald M'Intosh, Assistant Forester, Peel Cottage, Dispensary Street, Alnwick.
1893. MACDONALD, George U., Forester, Raith, Kirkcaldy.
1897. M'DONALD, James, Forester, Powerscourt, Enniskerry, Co. Wicklow.
1903. MACDONALD, James Farquharson, S.S.C. and N.P., Kilmuir, Linlithgow.
1895. MACDONALD, John, Forester, Skibo, Dornoch.
1901. MACDONALD, Mrs Eleanor E., The Manse, Swinton.
1897. M'DONALD, William, Forester, Worsley, near Manchester.
1904. M'DONALD, William Yeats, of Auquharney, Hatton, Aberdeenshire.
1894. M'DOUGALL, Alex., Forester, Tuncombe Park, Helmsley R.S.O., Yorks.
1902. MACDOUGALL, John, 16 St Andrew Square, Edinburgh.
1904. M'EWAN, James, Assistant Forester, Logiealmond, Methven.
1904. M'EWAN, Wm., Assistant Forester, Kingswood, Murthly.
1901. MACEWEN, Alexander, Overseer, Castle Lachlan, Strachur, Inveraray.
1898. MACFADYEN, Donald, Assistant Forester, Drumlanrig, Thornhill.
1901. M'GARVA, Gilbert Ramsay, Factor, Estate Office, Innes, Elgin.
1901. M'GHIE, John, Overseer, Kelburne Estate, Fairlie.
1904. M'GIBBON, R., Forester, Wentworth, Rotherham.
1890. M'GREGOR, Alex., The Schoolhouse, Penicuik, Midlothian.
1902. M'GREGOR, Alexander, Assistant Forester, Sunnyside Nurseries, Kilwinning, Ayrshire.
1896. M'GREGOR, Angus, Forester, Craigton, Butterstone, Dunkeld.
1899. M'GREGOR, Archibald, Forester, Airthrey Castle, Bridge of Allan.
1901. M'GREGOR, Robert, Forester, Rossie Priory, Trottick, Inchture.
1904. M'HAFFIE, John A., Saw-Mill Manager, 19 Horace Street, St Helens, Lancashire.
1899. M'HARDY, Alexander, The Castle, Inverness.
1905. M'HARDY, James, Assistant Forester, Benmore, Kilmun.
1904. M'HARDY, William, Forester, Chancefield, Falkland, Fife.
1901. MACHATTIE, John W., City Gardener, City Chambers, Edinburgh.
1894. M'ILWRAITH, Wm., Forester, Egton, Grosmont R.S.O., Yorks.

Date of Election.

1905. M'Intosh, Alexander, Assistant Forester, Benmore, Kilmun.
1904. M'Intosh, Robert, Forester, Cullentra Cottage, Rathdrum, Co. Wicklow.
1901. Macintosh, William, Forester, New Chapel, Boncath R.S.O., South Wales.
1898. M'Intyre, Malcolm, The Gardens, The Glen, Innerleithen, Peebles-shire.
1898. Mackay, Æneas J. G., LL.D., Advocate, 2 Albyn Place, Edinburgh.
1892. M'Kay, Allan, c/o Park & Co., Ltd., Timber Merchants, Fraserburgh.
1865. Mackay, John, Lauderdale Estate Office, Wyndhead, Lauder.
1899. M'Kay, John, Assistant Forester, Golspie Saw-mills, Golspie.
1887. Mackay, Peter, Forester, Taymouth Castle, Aberfeldy.
1900. M'Kechnie, Angus, Assistant Forester, c/o Mrs Hope, Bailifgate, Alnwick.
1891. Mackendrick, James, Forester, Pallas, Loughrea, Co. Galway.
1867. Mackenzie, Alex., Warriston Nursery, Inverleith Row, Edinburgh.
1901. Mackenzie, Charles, Assistant Factor, Mortonhall, Liberton.
1901. M'Kenzie, Daniel, Forester, Wynyard Estate, Stockton-on-Tees.
1899. M'Kenzie, James, Wood Merchant, Inverness.
1897. Mackenzie, John, Forester, Arbigland, Kirkbean, Dumfries.
1904. Mackenzie, Sir Alexander Muir, Bart. of Delvine, Murthly.
1900. Mackenzie, Sir Kenneth John, Bart. of Gairloch, 10 Moray Place, Edinburgh.
1892. Mackenzie, W. A., Factor, Faskally, Pitlochry.
1896. Mackenzie, Wm., Forester, Novar, Evanton, Ross-shire.
1901. Mackenzie, William H., Dean Road, Kilmarnock.
1905. M'Kerchar, John, Commercial Traveller and Seedsman, 35 Giesbach Road, Upper Holloway, London, N.
1883. MacKinnon, George, The Gardens, Melville Castle, Lasswade.
1902. MacKinnon, John, Gardener, Terregles, Dumfries.
1892. MacKinnon, William, Nurseryman, 75 Shandwick Place, Edinburgh.
1878. Mackintosh, The, of Mackintosh, Moy Hall, Inverness.
1904. Maclaggan, George C. R., Forester, Dupplin, Perth.
1903. Maclaggan, John G., Forester, Glenalmond, Perthshire.
1879. M'Laren, Charles, Land Steward, Cally Lodge, Dunkeld.
1901. M'Laren, Donald, Overseer, Sundrum, by Ayr.
1902. Maclean, Peter, Forester, Invergarry.
1898. M'Lennan, John, The Gardens, Castle Boro, Enniscorthy, Co. Wexford
1901. M'Leod, Peter, Nurseryman, Perth.
1905. M'Millan, Duncan, Assistant Forester, Benmore Estate, Kilmun.
1903. M'Millan, Duncan H., Assistant Forester, Pollok, Pollokshaws.
1895. Macmillan, John D., Steward, The Farm, Ganston Manor, Abbeyleix, Queen's Co.
1903. M'Naughton, George, Assistant Forester, Dunning Park, Dunning, Perth.
1903. M'Naughton, John, Forester, Auchterarder House, Perth.
1902. Macnicol, D., Land Agent, F.S.I., Derwas, Abergele.
1902. M'Omish, John, Nurseryman, Crieff.
1902. *M'Pherson, Alexander, Assistant Forester, Royal Botanic Garden, Edinburgh.* (*Central Africa.*)

Date of Election.

1901. Macpherson, Duncan, Assistant Forester, Scone, Stormontfield, Perth.

1900. Macpherson, John, Forester, Wynyard Park, Wolverton, Stockton-on-Tees.

1896. M'Queen, John, Proprietor of the *Scottish Border Record*, Galashiels.

1890. M'Rae, Alexander, Forester, Castlecomer, Ireland.

1900. M'Rae, Henry, Assistant Forester, Coedrighan Park, near Cardiff, South Wales.

1895. M'Tavish, John, Assistant Forester, The Poles, Dornoch.

1905. M'Vinnie, Samuel, Forester, Wallhouse, Torphichen, Bathgate.

1884. Main, Adam, Forester, Loftus R.S.O., Yorkshire.

1894. Malloch, William, 50 South Street, Perth.

1903. Malthouse, George Thomas, F.R.H.S., Harper-Adams Agricultural College, Newport, Salop.

1896. Mar and Kellie, The Right Hon. the Earl of, Alloa House, Alloa.

1902. Marshall, George, Broadwater, Godalming, Surrey.

1901. Marshall, Harley, of Dunduff, Dunfermline.

1898. Marshall, John, Wood Merchant, Killiecrankie, Perthshire.

1899. Marshall, John, Timber Merchant, etc., Maybole.

1893. Marshall, J. Z., Timber Merchant, 2 Dean Terrace, Bo'ness.

1893. Mather, R. V., of Laing & Mather, Nurserymen, Kelso.

1901. Matthews, Robert, Land Steward, Duncrub Park, Dunning.

1896. Maxtone, John, Forester, Duff House, Banff.

1891. Maxwell, James, Forester and Overseer, Ruglen, Maybole.

1886. Maxwell, The Right Hon. Sir Herbert E., Bart. of Monreith, M.P., Port William, Wigtownshire.

1904. Meade, Richard Y. E., B.A., Land Agent, Estate Office, Dunchurch, Rugby.

1896. Meiklejohn, John I. R., Factor, Novar, Evanton, Ross-shire.

1901. Meldrum, David, Nurseryman and Seed Collector, Arbroath Road, Forfar.

1899. Melville, David, The Gardens, Dunrobin Castle, Golspie.

1901. Menzies, James, Assistant Forester, The Mill, Castlecomer, Co. Kilkenny.

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, The Gardens, Blythswood, Renfrewshire.

1895. Michie, James, Forester, The Nurseries, Orwell Park, near Ipswich.

1893. Michie, William, Forester, Welbeck, Worksop, Notts.

1904. Mickel, F. Ord, Wood Merchant, Upper Bonnington, Linlithgow.

1905. Millar, John, Timber Merchant, Greenhaugh Saw-mills, Govan.

1904. Miller, Andrew, Saw-miller, Lynedoch, Almondbank, Perth.

1904. Miller, Charles Alexander, Wood Merchant, Craighulan, Pitlochry.

1882. Milne, Alex., of James Dickson & Sons, 46 Hanover Street, Edinburgh.

1899. Milne, Alexander, Factor, Urie Estate Office, Stonehaven.

1902. Milne, Alexander, Assistant Forester, Albury, Surrey.

Date of Election.

1903. MILNE, Colonel George, of Logie, Aberdeenshire.
1904. MILNE, Frederick, Assistant Forester, Scone, Perth.
1895. MILNE, James, Land Steward, Carstairs House, Carstairs.
1899. MILNE, Ritchie, Assistant, Annandale Estate Office, Hillside, Lockerbie.
1900. MILNE, Robert Anderson, Solicitor, Peebles.
1898. MILNE, Robert P., Spittal Mains, Berwick-on-Tweed.
1891. MILNE, R. W., Forester, 26 Etterby Street, Stanwix, Carlisle.
1890. MILNE, William, Farmer, Foulden, Berwick-on-Tweed.
1902. MILNE, William, Forester, Huntly Hill, Stracathro, Brechin.
1901. MILNE-HOME, David William, of Wedderburn, Caldra, Duns.
1894. MILSOM, Isaac, Gardener and Steward, Claydon Park, Winslow, Bucks.
1904. MITCHELL, Alexander, Assistant Forester, Braidwood, Gorebridge.
1898. MITCHELL, David, Forester, Drumtochty, Fordoun.
1869. MITCHELL, James, Factor, Ardallie, Fossoway.
1904. MITCHELL, James, Organising Secretary for Technical Education to Fife County Council, County Buildings, Cupar, Fife.
1904. MITCHELL, John Irvine, M.A., Teacher, Edinburgh.
1897. MITCHELL, Wm., Forester, Lough Cutra, Gort, Co. Galway.
1901. MITCHELL, William Geddes, Estate Agent, Doneraile, Co. Cork.
1903. MOERAN, Archibald E., Land Agent, etc., Palmerston House, Portumna, Co. Galway.
1903. MOFFAT, James, Land Steward, Muirfad, Pilnure, Galloway.
1902. MOFFAT, John, Forester, Blackwood, Lesmahagow.
1901. MOFFAT, William, Overseer, Possil, Maryhill, Glasgow.
1897. MOON, Frederick, Forester, Garden Cottage, Mount Trenchard, Foynes, Co. Limerick.
1902. MORGAN, David, Douglasleigh, Carnoustie.
1895. MORRISON, Hew, LL.D., Librarian, Edinburgh Public Library.
1903. MORRISON, William, Manufacturer, 80 Park Road, Glasgow.
1902. MORTON, Alexander, of Gowanbank, Darvel.
1905. MORTON, Andrew, Assistant Forester, Wynyard Park, Stockton-on-Tees.
1896. MOSSMAN, Robert C., F.R.S.E., F.R.Met.Soc., 10 Blacket Place, Edinburgh.
1904. MOWAT, George, Forester, Cotgrave, Nottingham.
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, Assistant Forester, Holkham Hall, Norfolk.
1902. MUNRO, George A., S.S.C., 6 Rutland Square, Edinburgh.
1903. MURDOCH, Robert, Overseer, Bertha, by Perth.
1892. MURRAY, Alexander, Forester, Murthly, Perthshire.
1902. MURRAY, Bailie John, J.P., 11 Strathearn Road, Edinburgh.
1904. MURRAY, Charles A., of Taymount, Stanley.
1901. MURRAY, David, Gardener, Culzean Gardens, Maybole.
1902. MURRAY, Donald, Assistant Forester, Altyre, Forres.
1900. MURRAY, George J. B., Assistant Forester, Holylee, Walkerburn.

Date of Election.

1900. MURRAY, John C., F.S.I., Factor and Commissioner, Haggs Castle, Glasgow.
1904. MURRAY, John M., Assistant Forester, King's Wood, Murthly.
1900. MURRAY, William, of Murraythwaite, Ecclefechan, Dumfriesshire.

1904. NAIRN, Robert, Forester, Rowallan, Kilmarnock.
1894. NEIL, Archibald, Forester, Warkton, Kettering, Northamptonshire.
1893. NELSON, Robert, Assistant Forester, Kinmount Estate, Cummertrees, Dumfriesshire.
1885. NEWBIGGING, John, Nurseryman, Dumfries.
1895. NEWTON, George, 28 Charlotte Square, Edinburgh.
1893. NICOL, James, Forester, Aird's Mill, Muirkirk, Ayrshire.
1895. NICOL, James, Forester, Croxteth, Liverpool.
1901. NICOLL, William Peter, Assistant Forester, Kippo, Kingsbarns, Fife.
1898. NISBETT, J. L. More, The Drum, Liberton, Midlothian.
1899. NOBLE, Charles, Forester, Donibristle, Aberdour.
1904. NOBLE, Hugh, Assistant Forester, Cothall, Altyre, Forres.

1900. OLIPHANT, Joseph, Assistant Forester, Chapelhill, Methven.
1902. OSWALD, Richard Alexander, of Auchencruive, Ayr.

1875. PAGE, Andrew Duncan, Land Steward, Culzean, Maybole, Ayrshire.
1893. PAGE, Walter, Farmer, Myregornie, Kirkcaldy, Fife.
1902. PAGET, Leopold Cecil, Land Agent, Harewood, Leeds.
1900. PATERSON, George, Timber Merchant, 8 Albyn Terrace, Aberdeen.
1902. PATERSON, Peter, Commission Agent, 12 Maygate Street, Dunfermline.
1898. PATTERSON, Thomas L., Hardengreen, Dalkeith.
1904. PAUL, John M., Gardener, Dalmeny Park.
1897. PEARSON, James, Forester, Sessay, Thirsk, Yorks.
1899. PEARSON, James, Assistant Factor, Colinsburgh, Fife.
1869. PEEBLES, Andrew, Estate Office, Albury, Guildford, Surrey.
1897. *Peebles, James, Assistant Forester, The Park, Somerley, near Ringwood, Hants.*
1897. PEEBLES, Philip, Estate Office, Syon House, Brentford.
1904. PETERS, William, Assistant Forester, Gateside, Markinch, Fifeshire.
1896. PHILP, Henry, jun., Timber Merchant, Campbell Street, Dunfermline.
1896. PHILP, John, Timber Merchant, Campbell Street, Dunfermline.
1904. PIGOT, James Louis, (late) Indian Forest Service, Somerley Road, Greystone, Co. Wicklow.
1903. PIRRIE, John, Sawmaker, Giles Street, Leith.
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.
1901. PORTAL, Maurice, Sandhoe, Hexham.
1899. PORTEOUS, Colonel James, of Turfhills, Kinross.
1899. PORTEOUS, George, Merchant, Poltonhall, Lasswade.

Date of Election.

1896. PRENTICE, George, Strathore, Kirkcaldy, Fife.
1899. PRICE, Aaron W., Forester, Bolstone, Ross-on-Wye.
1898. PRICE, W. M., Factor, Minto, Hawick.

1903. RAE, Robert T., Land Steward, Sunlaws, Roxburgh.
1901. RAFFAN, Alexander, Foreman Forester, Fairburn, Ross-shire.
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.
1904. RALSTON, Gavin W., M.A., Advocate, 6 Abercromby Place, Edinburgh.
1870. RATTRAY, Thos., Forester, Westonbirt House, Tetbury, Gloucestershire.
1905. REID, Alexander T., Assistant Forester, Benmore Estate, Kilmun.
1901. REID, Hugh, Forester, Ashton Court, Long Ashton, near Bristol.
1894. REID, James S., Forester, Balbirnie, Markinch, Fife.
1900. REID, John, Estate Overseer, The Mains, Lochgelly.
1903. REID, Robert Matelé, St Colme House, Aberdour, Fife.
1901. RENNIE, Joseph, 24 Reidhaven Street, Janston, Buckie.
1902. RIDER, William H., Editor *Timber Trades Journal*, 164 Aldersgate Street, London.
1892. RITCHIE, Alexander, Overseer, Harvieston and Castle Campbell Estates, Dollar.
1898. RITCHIE, Wm., Assistant Forester, Moss-side Cottage, Lynedoch, Perth.
1900. ROBB, John, Road Surveyor, County Buildings, Edinburgh.
1904. ROBERTSON, Alexander, Assistant Forester, Meikledams, Durris.
1897. ROBERTSON, Andrew N., Forester, Glenferness, Dunphail.
1899. ROBERTSON, Charles, Assistant Forester, Fulford, Raith, Kirkcaldy.
1896. ROBERTSON, Duncan, Forester, Strathord, Stanley, Perthshire.
1896. ROBERTSON, George, Forester, Ponsbourne Park Estate, near Hertford.
1894. ROBERTSON, George D., Assistant Forester, Carolside, Earlston.
1896. *Robertson, James, Assistant Forester, Dalzell, Motherwell.*
1900. ROBERTSON, James, Assistant Forester, Dalcrue, Lynedoch, Almondbank.
1904. ROBERTSON, James, Assistant Forester, Stormontfield, Scone.
1904. ROBERTSON, James, Forester, Ardmulchan, Navan, Co. Meath.
1896. ROBERTSON, John, Forester, Altyre, Forres.
1902. ROBERTSON, John, Assistant Forester, Royal Botanic Garden, Edinburgh.
1902. ROBERTSON, John, 136 George Street, Edinburgh.
1902. ROBERTSON, R. A., M.A., B.Sc., Lecturer on Botany, University, St Andrews.
1895. ROBERTSON, Thomas, Forester and Bailiff, Woodlawn, Co. Galway.
1883. ROBERTSON, William, Assistant Forester, Ringwood, Birnam, Perth.
1902. ROBINSON, Stewart, Lynhales, Kingston, Herefordshire.
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.
1898. Rodimer, Charles S., Brenyar Avenue, Ardnadam, Sandbank, Greenock.
1893. Romanes, James, C.A., Harewood Glen, Selkirk.
1898. Ross, Charles D. M., Factor, Abercairney, Crieff.
1887. Ross, John, Forester, Hopetoun, South Queensferry, Linlithgowshire.
1899. Rough, Edward D., Manure Merchant, Broxburn.
1903. Rule, John, Forester, Huntly.
1893. Rutherford, James A., Land Agent, Highclere Park, Newbury, Berks.
1870. Rutherford, John, Forester, Linthaugh, Jedburgh, Roxburghshire.
1904. Rutherfurd, Henry, Barrister-at-Law, Fairisington, Roxburgh.
1901. Ryan, Thomas, The Gardens, Castlewellan, Co. Down.

1894. Samson, David T., Seafield Estates Office, Grantown, Strathspey.
1904. Sanderson, James, of Symington, Stow.
1875. Sang, Edmund, of E. Sang & Sons, Nurserymen, Kirkcaldy.
1904. Sangster, Alexander, Student of Forestry and Agriculture, The Mall, Montrose.
1903. Schott, Dr Peter Carl, Nursery and Seed Establishments, Knittelsheim, Palatinate, Germany.
1870. Scott, Adam, Forester, Southwick Park, Fareham, Hants.
1892. Scott, David, Overseer, Dumfries House, Cumnock, Ayrshire.
1901. Scott, Frank, Assistant Forester, Blackmoor, West Liss, Hants.
1881. Scott, James, Forester, Wollaton Hall, Nottingham.
1903. Scott, John, Forester, Hartrigge, Jedburgh.
1890. Scott, John D., Land Steward, Estate Office, Brushford, Dulverton, Somerset.
1902. Scott, Malcolm William, Registrar, etc., Currie.
1903. Shand, Alexander, Assistant Forester, Methlick, Aberdeenshire.
1897. Sharpe, Thomas, Forester, Monreith, Port William, Wigtownshire.
1893. Shaw, Andrew, Victoria Saw-mills, Perth.
1904. Shaw, John, Overseer, The Glen Cottage, Cardross.
1903. Simon, Thomas, jun., Assistant Forester, Montrave, Leven.
1887. Simpson, Anthony, Dropmore, Maidenhead, Bucks.
1902. Simpson, George, Timber Merchant, Kirkcaldy.
1894. Simpson, James, Nurseryman, Dundee.
1898. *Sinclair, William, Forester, Donibristle, Aberdour, Fife.*
1900. Singer, John G., Forester, Newe Estates, Strathdon, Aberdeenshire.
1868. Slater, Andrew, Stobs Estate Office, Stewartfield, Hawick.
1899. Sleigh, Charles W., M.A., Factor, Blackwood Estate Office, Lesmahagow.
1903. Small, Robert, Forester, Birch Hedges, Letham, East Lothian.
1902. Smart, John, Merchant, 18 Leith Street, Edinburgh.
1901. Smith, Allan, Land Steward, Dunira, Comrie.
1904. Smith, D. D., Nurseryman and Seed Merchant, St Catherine's Street, Cupar, Fife.
1904. Smith, F. H. Osmond, High Street, East Grinstead.
1873. Smith, G. B., Wire Fence Manufacturer, Craighall Ironworks, Glasgow.
1901. Smith, James, Forester, 1 Oxmantown Mall, Birr, King's County.

Date of Election.

1895. SMITH, John, Cabinetmaker, Peebles.
1901. *Smith, John C., Assistant Forester, Moss-side, Lynedoch, Almondbank, Perth.*
1901. SMITH, Matthew, Manager for Dyer & Co., Peebles.
1901. SMITH, Sydney, Factor, Drummuir Estates Office, Keith.
1901. SMITH, Thomas, Factor, The Castle, Maybole.
1896. SMITH, William, Forester, Camperdown, Dundee.
1899. SMITH, William, Overseer, Fairnalee, Selkirk.
1904. SOUTAR, William, Forester, Lower Lodge, Titsey Limpsfield, Surrey.
1904. SPARKE, Norman Lush, Assistant, Albury Estate Office, Guildford.
1898. SPENCE, William, Assistant Forester, Clunie Square, Kirkcaldy.
1899. SPIERS, Adam, Timber Merchant, Warriston Saw-mills, Edinburgh.
1903. SPRUNT, David, Assistant Forester, Muthill, Perthshire.
1899. STALKER, Wm. J., Nurseryman, Nairn.
1903. STEPHEN, Alfred, Assistant Forester, Drumtochty, Fordoun.
1904. STEVEN, William, Builder, Muirpark, Dalkeith.
1902. STEVENSON, Allan, Architect, 14 Cathcart Street, Ayr.
1899. STEWART, Alex., Forester, Shadwell Court, Thetford.
1901. STEWART, Alistair D., Castlehill, Inchture.
1897. STEWART, Charles, Forester, Castle Menzies, Aberfeldy.
1898. STEWART, James, Clerk of Works, Sandbeck Park, Tickhill, Rotherham.
1901. STEWART, James, Forester, Letham and Fearn Estates, Letham Grange Arbroath.
1903. STEWART, John, Assistant Forester, Cavens, Kirkbean, Dumfries.
1901. STEWART, John M., Forester, Benmore, Kilmun, Greenock.
1902. STEWART, Rev. Daniel Caldwell, The Manse, Currie.
1876. STEWART, Robert, Forester, Stonefield, Tarbert, Lochfyne, N.B.
1899. STEWART, William, Land Steward, Dalhousie Castle, Dalkeith.
1904. STOBO, Robert W., Assistant Forester, Heckfield, Winchfield, Hants.
1897. STODDART, James, Builder, Bonnyrigg, Midlothian.
1902. STONE, Alfred William, Clerk of Works, Ashton Court Estate, Bower, Ashton, Bristol.
1893. STORIE, William, Forester, Gulworthy, Tavistock, Devon.
1893. STORIE, W., Whitway House, Newbury, Berks.
1899. STUART, J. Windsor, Factor, Bute Estate Office, Rothesay.
1902. STUNT, Walter Charles, Lorenden, Ospringe, Kent.
1892. SUTHERLAND, John D., Solicitor and Estate Agent, Oban, Argyle.
1903. SWAN, Andrew R., Farmer, Craiglockhart Farm, Slateford.

1901. TAINSH, John, Estates Office, Ochtertyre, Crieff.
1869. TAIT, David, Overseer, Owston Park, Doncaster, Yorkshire.
1892. TAIT, James, Builder, Penicuik, Midlothian.
1900. TAIT, James, jun., Woodsbank, Penicuik.
1898. TAIT, William, Assistant Seedsman, 75 Shandwick Place, Edinburgh.
1895. TAIT, Wm. A., 13 Brandon Terrace, Edinburgh.
1900. TAYLOR, Alexander, Overseer, Kildrummy, Mossat, Aberdeenshire.
1903. TAYLOR, James Pringle, W.S., Dunsmure, Corstorphine.
1902. TAYLOR, John, Forester, Glentulchan, Glenalmond, Perthshire.
1904. TAYLOR, Robert, Assistant Forester, Scone, Perth.

Date of Election.

1905. Taylor, Robert, Forester, Broomhall Estate, Charlestown, Fife.
1897. Taylor, William, Forester, Sandside, Kirkcudbright.
1905. Telfer, John, Assistant Forester, Heckfield, Winchfield, Hants.
1895. Terras, Alexander, Forester, Dalgetty Castle, Turriff.
1904. Thompson, Dugald, Forester, Drimsynie, Lochgoilhead.
1893. Thomson, David W., Nurseryman, 113 George Street, Edinburgh.
1903. Thomson, John Burnside, Estate Manager, Calderwood Castle, High Blantyre.
1903. Thomson, Robert, Assistant Forester, Park Hill, Ampthill, Bedfordshire.
1904. Threipland, Captain W. Murray, Fingask Castle, Perthshire.
1901. Tivendale, William D., Head Forester to Duke of Portland, Burnhouse, Galston.
1904. Todd, John, Estate Clerk, Ingleby, Derby.
1900. *Tully, James B., Assistant Forester, Hope Vlei Estate, Bloemfontein, O.R. Colony.*
1900. Turnbull, Andrew, Assistant Forester, Picktree, Chester-le-Street, Co. Durham.
1903. Turnbull, John, Assistant Forester, Dumfries House, Cumnock.
1901. Turner, Joseph Harling, Agent for Duke of Portland, Cessnock Castle, Galston.
1898. Tweedie, Alexander, Forester, Faskally, Pitlochry.
1900. Tweedie, John M., Forester, Foulden, Berwick.

1883. Underwood, Henry E., Fornham, St Martin, Bury St Edmunds, Suffolk.
1903. Unwin, Arthur Harold, D.Œc., Town House, Haslemere, Surrey.
1903. Usher, Thomas, Factor, Courthill, Hawick.

1903. Veitch, John, Factor, Fasnacloich.

1903. Walker, Captain George Lawrie, of Crawfordton, Thornhill.
1894. Walker, Henry H., Factor, Monreith, Port William, Wigtownshire.
1870. Wall, G. Y., Land Agent, Grange House, Darlington, Durham.
1903. Wallace, Andrew, Assistant Forester, Montrave, Leven.
1893. Wallace, David P., Forester, The Saw-mills, Filleigh, Molton, S. Devon.
1893. Wallace, Robert B.P., Timber Merchant, 12 Danube Street, Edinburgh.
1899. Wandesforde, R. H. Prior, of Castlecomer, Co. Kilkenny.
1901. Wason, Eugene, M.P., of Blair, Dailly, Ayrshire.
1903. Watson, Hugh, Forester, Sunnyside Cottages, Maybole.
1901. Watson, James, Manager, Moy Hall, Inverness-shire.
1893. Watson, John, Timber Merchant, Annandale Street, Edinburgh.
1872. Watt, James, J.P., of Little & Ballantyne, Nurserymen, Carlisle.
1893. Watt, James W., Knowefield Nurseries, Carlisle.
1889. Watters, Dennis, Forester, Wester Elchies, Carron, Strathspey.
1904. Weal, James A., Timber Merchant, Boundary Place, Liverpool.
1902. Webster, Thomas, Overseer, Burdie House, Loanhead.
1903. Welsh, Charles, Assistant Forester, Drumtochty, Fordoun.

Date of Election.

1904. WENTWORTH-FITZWILLIAM, George Charles, of Milton, Peterborough.
1902. WHELLENS, Henry, Assistant Forester, Raith, Kirkcaldy.
1905. WHITE, Andrew, Forester, Portmore, Eddleston.
1895. WHITE, William, Farmer, Gortonlee, Lasswade.
1884. WHITTON, James, Superintendent of Parks, 249 George Street, Glasgow.
1901. WHYTOCK, James, The Palace Gardens, Dalkeith.
1895. WIGHT, Alexander, Overseer, Thurston, Innerwick.
1895. WIGHTON, John, Forester, Estate Bailiff, Alderwasley, Matlock, Bath.
1883. WILKIE, Charles, Assistant Forester, Lennoxlove, Haddington.
1891. WILKIE, G., Architect, Hayfield, Peebles.
1904. WILKINSON, Henry Bevis, Assistant Factor, The Grange, Kirkcudbright.
1902. WILKINSON, John, Factor, The Grange, Kirkcudbright.
1903. WILLIAMSON, James, Factor, Mid-Hartfield Lodge, Paisley.
1895. WILLIAMSON, John, Bank Agent, Loanhead, Midlothian.
1903. WILLS, George, Manager, Crichton Royal Institution Farm, Dumfries.
1896. WILSON, James, M.A., B.Sc., Royal College of Science, Stephens Green East, Dublin.
1904. WILSON, James Jackson, C.E., etc., Pollok Estate Office, 216 West George Street, Glasgow.
1900. WILSON, James, jun., Nurseryman, St Andrews.
1904. WILSON, James Watt, Seedsman and Nurseryman, Perth.
1902. WILSON, John, M.P., Airdrie House, Airdrie.
1901. WILSON, John Currie, Factor, Tulliallan Estate Office, Kincardine-on-Forth.
1897. WILSON, John H., D.Sc., F.R.S.E., St Andrews.
1903. WILSON, Thomas, Head Gardener, Glamis Castle, Glamis.
1901. WILSON, William G., Overseer, Dalquharran, Dailly.
1899. WILSON, William, Timber Merchant, Auchenleck, Ayrshire.
1893. WISEMAN, Edward, Nurseryman, Elgin.
1895. WISEMAN, William, Nurseryman, Forres.
1904. WOOD, James, Forester, Marr Doncaster, Yorkshire.
1894. WOOD, William, The Gardens, Newton Don, Kelso, Berwickshire.
1904. WORSFOLD, Edward Mowll, Land Agent, Christ Church Villas, Priory Road, Dover.
1904. WOTHERSPOON, George, Factor, Cromartie Estate Office, Kildary, Ross-shire.
1905. WRIGHT, Mrs Elizabeth W., of Westby House, Forfar.
1904. WRIGHT, Robert Patrick, F.H.A.S., F.R.S.E., Principal of West of Scotland Agricultural College, Blythswood Square, Glasgow.
1904. WYBRANTS, David William, Tighnduin, Monifieth.
1868. WYLLIE, George, Ballogie, Aboyne, Aberdeenshire.

1897. YEATS, Alexander, Land Steward, Dunnottar Estate, Stonehaven.
1904. YOOL, Thomas, Factor, Menzies Estates Office, Aberfeldy.
1904. YORKE, Maurice Francis, Land Agent's Assistant, 35 New Walk, Leicester.
1905. YOUNG, John, Hedger, West Lodge, Corehouse, Lanark.
1875. YOUNG, William, Forester, Morriston Cottage, Earlston, Berwickshire.

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