







### TRANSACTIONS

OF THE

# ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

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

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

VOL. XXI.



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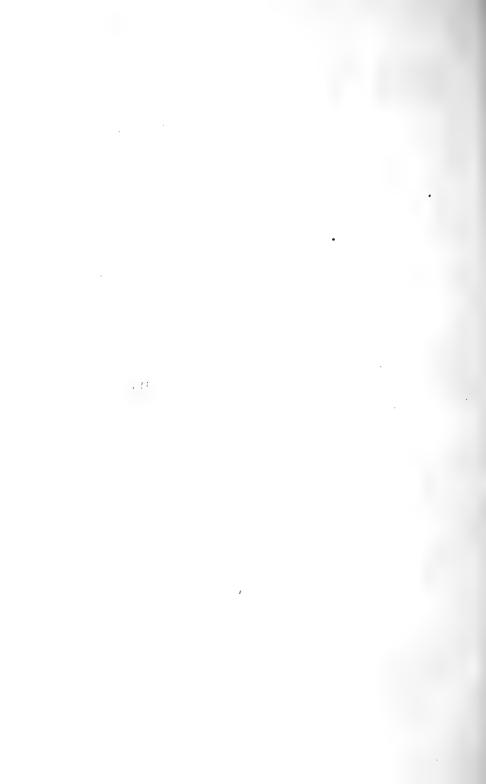
### CONTENTS.

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

I.	Heredity and Forestry. By William Somerville, M.A., D.Sc., D.Œc., Professor of Rural Economy, Oxford, .	PAGE
2.	The Mountain Pine (with Five Plates). By Sir John Stirling-Maxwell, Bart.,	10
3.	Soil: its Origin and Nature. By Professor James Geikie, LL.D., D.C.L., F.R.S. (continued from Vol. XX. p. 182). II.,	16
4.	The Inverliever State Forest. By R. C. Munro Ferguson, M.P.,	22
5.	State Afforestation in Scotland. By Lieut. Colonel F. Bailey,	27
6.	The Douglas Fir as a Commercial Timber-Tree (with Two Plates). By John D. Crozier,	31
7.	The Nursery Treatment of the Western or Californian Hemlock Spruce. By J. M. Murray,	41
8.	The Cultivation of Hardwoods. By J. Boyd,	44
9.	The Cultivation of Osiers. By Robert Sinclair,	50
10.	An Attack by Sawfly Larvæ (with Plate). By Fred.	52
II.	Forest Nurseries and Gardens-Some Suggestions. By	
	LieutColonel F. Bailey,	54
12.	The Afforestation Conference,	60
13.	A Forest Tramway (with Plate). By Fred. Moon,	71
14.	Continental Notes-France. By A. G. Hobart-Hampden, .	73
15.	Notes on the Forestry Exhibition at the Lincoln Show of the Royal Agricultural Society of England, held June 25th to 29th, 1907. By a Correspondent,	83
16.	Report on the Society's Forestry Exhibition held in the Highland and Agricultural Society's Showyard, Prestonfield, Edinburgh, 9th-12th July 1907. By a Correspondent,	90
		,,,

95	7. The Thirtieth Annual Excursion, August 1907 (with Plate),
102	Notes and Queries:—The Forestry Committee (1902) and Training in Forestry—First Steps at Inverliever—Note on Damage to a Young Coniferous Plantation by Water-Voles—An Irish Forestry Committee—Rural Employment in Ireland and Re-Afforestation—Publication of Indian Departmental Literature—The Albert or Hemlock Spruce at Loganbank—Appointments by the Department of Woods—Two Exceptional Trees—Plantations at Inverliever—Erratum,
112	Obituary:—Sir Dietrich Brandis, K.C.I.E., F.R.S.—M. Lucien Boppe, C.I.E.,
	Reviews:—Forest Mensuration. By H. S. Graves, M.A. New York, John Wiley & Sons; London, Chapman
117	and Hall, Ltd., 1906,  Schlich's Manual of Forestry. Vol. IV., "Forest Protection," 2nd ed., by W. R. Fisher. Bradbury, Agnew,
120	and Co., London,
120	English Arboricultural Society. Vol. I. No. 4,  Proceedings of the Royal Scottish Arboricultural Society 1907—continued.
	Syllabus of Competitions—1908.
121	8. Trees of Western America. By F. R. S. Balfour,
131	9. Soil: its Origin and Nature. By Professor James Geikie, LL.D., D.C.L., F.R.S. (concluded from p. 21),
135	o. A Scheme for Establishing a National Industry of Forestry.  By a Correspondent,
143	r. Root Disease in Scots Pine on Farm Lands (with Two Plates). By Bert. Ribbentrop, C.I.E.,
150	2. The Cultivation of Hardwoods. By J. Boyd (continued from p. 49),
159	3. Impressions of Forestry in the Schwarzwald (with Two Plates). By J. F. Annand,
176	4. Notes of Silvicultural Interest. By Thomas Hall,
180	5. Continental Notes—Germany. By Bert. Ribbentrop, C.I.E.,
***	6. The Selection and Training of Probationers for the Imperial Forest Service of India. By J. Nisbet, D. C., formerly
191	Conservator of Forests, Burma,

27. The Larch Shoot Moth (Argyresthia (Tinea) Iaevigatella) (with Plate). By R. Stewart MacDougall, M.A., D.Sc.,	195
28. Underplanting. By LieutColonel F. Bailey,	198
29. Experiments on the Relative Value of certain Timber Preservatives,	201
30. The Northern Branch of the Royal Scottish Arboricultural Society—Visit to the Lovat and Novar Estates,	205
31. The Aberdeen Branch—Excursion to Durris,	215
32. Forestry Section in the Scottish National Exhibition, Edinburgh, 1908, organised by the Royal Scottish Arboricultural Society, 1st May to 31st October,	217
Notes and Queries:—Arboriculture and Arable Land—The Ardgoil Estate—Afforestation of Surplus Lands—Forest Preservation in the United States—Afforestation of Reclaimed Lands—Basic Slag on Seed-Beds (with Plate)—Working-Plan for the Ardross Woods—Forestry at the West of Scotland Agricultural College—Forestry at the University of Edinburgh—Chair of Forestry at Cambridge—Forestry Appointment at Inverliever—Wood: its Botanical and Technical Aspect—The Cost of Fencing—Experimental Study of Larch Canker—The Forestry and Gardeners' Society of Argyll—Some recent Forestry Books,	222
Reviews and Notices of Books:—Forest Entomology. By A. T. Gillanders, F.E.S., Wood Manager to the Duke of Northumberland. xxii+422 pp., including Index. 351 Illustrations. Blackwood & Sons, Edinburgh, 1908. Price 15s.,	238
Trees and their Life-Histories. By Percy Groom. London: Cassell & Co. Price 25s. net. With 512 Illustrations,	239
Webster's Foresters' Pocket Diary (Sixth Edition) for 1908, for the use of Foresters, Estate Agents, Nurserymen. 2s. 6d. net. London: William Rider & Son, Ltd.,	240
Laws of the Society.	
Proceedings of the Royal Scottish Arboricultural Society, 1908, with Appendices.	
List of Members.	



# TRANSACTIONS

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

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



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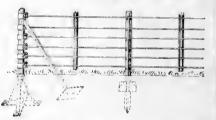


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#### SUBSCRIPTIONS FOR 1908.

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#### SYLLABUS.

The Syllabus of Subjects for Essays will be found at end of this Part.

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#### Membership.

THE Roll contains the names of 1200 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, 38, 10d, has since been raised by the Society and handed over to the University. Aided by an annual subsidy from the Board of Agriculture, which the Society was mainly instrumental in obtaining, a Course of Lectures at the University has been

delivered without interruption since 1889. It is recognised, however, that a School of Forestry is incomplete without a practical training-ground attached to it, which would be available, not only for purposes of instruction but also as a Station for Research and Experiment, and as a Model Forest, by which Landowners and Foresters throughout the country might benefit. The Society has accordingly drawn up a Scheme for the Establishment of a State Model or Demonstration Forest for Scotland which might serve the above-named objects. Copies of this Scheme were laid before the Departmental Committee on British Forestry, and in their Report the Committee have recommended the establishment of a Demonstration Area and the provision of other educational facilities in Scotland.

The Government has recently acquired the Estate of Inverliever in Argyllshire; and this, it is hoped, may prove to be the first step in a scheme of afforestation by the State of unwooded lands in Scotland. The Society has now submitted to the Government a Resolution urging the further provision of a more accessibly situated tract carrying a fair proportion of growing woods, which may fulfil the objects for which a State Demonstration Forest has so long been needed.

Meantime Mr Munro Ferguson, M.P., for a part of whose woods at Raith a Working-Plan has been prepared, and is now in operation, has very kindly agreed to allow Students to visit them.

#### Excursions.

During the past twenty-nine years, well-organised Excursions, numerously attended by Members of the Society, have been made annually to various parts of Scotland, England, and Ireland. 1895, a Tour extending over twelve days was made through the Forests of Northern Germany, in 1902 a Tour extending over seventeen days was made in Sweden, and during the summer of 1904 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, which extend to twenty volumes, are now published half-yearly in January and July, and are issued *gratis* to Members. A large number of the Prize Essays and other valuable Papers, and reports of the Annual Excursions, have appeared in them, and have thus become available to Students as well as to those actively engaged in the Profession of Forestry.

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

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

Consulting Meteorologist.—

\* \* \* \*

#### Local Branches.

The Society, at a recent Meeting, approved of the formation of Local Branches in suitable districts, and Local Branches have now been established in Aberdeen and Inverness for the convenience of Members who reside in the districts surrounding these centres. The President of the Aberdeen Branch is Alex. M. Gordon of Newton, and the Honorary Secretary and Treasurer is Robert Scott, Solicitor, 230 Union Street, Aberdeen. The President of the Inverness Branch is J. Grant Thomson, Wood Manager on the Seafield Estates, Grantown, and the Honorary Secretary and Treasurer is Alex. Fraser, Solicitor, Church Street, Inverness.

#### Local Secretaries.

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

#### Register of Estate Men.

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

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#### Scotland.

nties.

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## Royal Scottish Arboricultural Society.

#### FORM OF PROPOSAL FOR MEMBERSHIP.

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

	(Full Name,	
	Designation, Degrees, etc.,	and the second s
Candidate's	Address,	•
	Life, or Ordinary Member,	
	Signature,	
Proposer's	Signature	
	Address,	
Seconder's	Signature,	
	Address,	

#### 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:—

I.	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	

- 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:—

- Large Proprietors of land, and others,
   £10 10 0
   Small Proprietors, Factors, Nurserymen, and others,
   5 5 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.

I.	Heredity and Forestry. By William Somerville, M.A., D.Sc., D.Œc., Professor of Rural Economy, Oxford, .	PAGE.
2.	The Mountain Pine (with Five Plates). By Sir John Stirling-Maxwell, Bart.,	10
3.	Soil: its Origin and Nature. By Professor James Geikie, LL.D., D.C.L., F.R.S. (continued from Vol. XX. p. 182.) II.,	16
4.	The Inverliever State Forest. By R. C. Munro Ferguson, M.P.,	22
5.	State Afforestation in Scotland. By Lieut. Colonel F. Bailey,	27
6.	The Douglas Fir as a Commercial Timber-Tree (with Two Plates). By John D. Crozier,	31
7.	The Nursery Treatment of the Western or Californian Hemlock Spruce. By J. M. Murray,	41
8.	The Cultivation of Hardwoods. By J. Boyd,	44
9.	The Cultivation of Osiers. By Robert Sinclair,	50
10.	An Attack by Sawfly Larvæ (with Plate). By Fred. Moon,	52
II.	Forest Nurseries and Gardens—Some Suggestions. By LieutColonel F. Bailey,	54
12.	The Afforestation Conference,	бо
13.	A Forest Tramway (with Plate). By Fred. Moon, .	71
14.	Continental Notes-France. By A. G. Hobart-Hampden, .	73
15.	Notes on the Forestry Exhibition at the Lincoln Show of the Royal Agricultural Society of England, held June 25th to 20th, 1907. By A Correspondent,	83
		9

t on the Society's Forestry Exhibition held in the High- and Agricultural Society's Showyard, Prestonfield,	ield,	<ol> <li>Report on the Society's Forestry Exhibition held in the High land and Agricultural Society's Showyard, Prestonfield Edinburgh, 9th-12th July 1907. By A Correspondent,</li> </ol>
hirtieth Annual Excursion, August 1907 with Plate), 99	ate), 95	7. The Thirtieth Annual Excursion, August 1907 with Plate
ining in Forestry—First Steps at Inverliever—Note Damage to a Young Coniferous Plantation by Water-es—An Irish Forestry Committee—Rural Employment Ireland and Re-Afforestation—Publication of Indian artmental Literature—The Albert or Hemlock Spruce Loganbank—Appointments by the Department of ods—Two Exceptional Trees—Plantations at Inver-	Note ater- nent dian ruce : of	Notes and Queries:—The Forestry Committee (1902) an Training in Forestry—First Steps at Inverliever—Not on Damage to a Young Coniferous Plantation by Water Voles—An Irish Forestry Committee—Rural Employment in Ireland and Re-Afforestation—Publication of India Departmental Literature—The Albert or Hemlock Spruce at Loganbank—Appointments by the Department of Woods—Two Exceptional Trees—Plantations at Invertiever—Erratum,
	. 102	Obituary:—Sir Dietrich Brandis, K.C.I.E., F.R.S
	. 112	M. Lucien Boppe, C.I.E.,
ew York, John Wiley & Sons; London, Chapman		Reviews:—Forest Mensuration. By H. S. Graves, M.A. New York, John Wiley & Sons; London, Chapma and Hall, Ltd., 1906,
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	. 120	and Co., London,
	. I20	English Arboricultural Society. Vol. I. No. 4,
dings of the Royal Scottish Arboricultural Society	ciety	Proceedings of the Royal Scottish Arboricultural Societ

Syllabus of Competitions—1908.

1907—continued.

#### TRANSACTIONS

OF THE

#### ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

#### I. Heredity and Forestry.1

By WILLIAM SOMERVILLE, M.A., D.Sc., D.Œc., Professor of Rural Economy, Oxford.

Perhaps the title of this short address does not quite clearly express the scope of the few remarks that I have to make, so I may at once explain that I do not intend to attempt to deal in detail with the transmission of the characters of a tree to its offspring, but merely to bring to your notice the results of some interesting, and, I think, suggestive experiments that have been conducted in Switzerland and Austria on behalf of the Departments of Forestry of the respective countries. I have had the opportunity of inspecting the Austrian work, which was initiated and is still being conducted by Dr Cieslar, and I have discussed in detail with Professor Engler the scheme and results of the Swiss work. I therefore speak, to some extent, from personal acquaintance with the results, and the fact that such acquaintance made a considerable impression on me has induced me to bring the matter before this Society, in the hope that it may stimulate your interest, and perhaps induce some of you to make experiments in the same direction.

Both in Austria and in Switzerland the spruce and larch (especially the former) have received most attention, in Austria some work has also been done with the Scots pine, while in Switzerland the silver fir and sycamore have also been experimented with. The silver fir, however, has not been found to give any information of value, while the results with the Scots pine are scarcely complete enough to make it necessary to discuss them on the present occasion. We will therefore confine our attention to the spruce, larch, and

Read before the Society at the General Meeting on 11th July, 1907.
VOL. XXI. PART I.

sycamore, three trees well known in this country, and widely distributed throughout Europe.

First of all, taking up the spruce, let us see what the Swiss results have to show.

Table I.

Swiss Experiments with Common Spruce Seed (Crop 1898)

sowed at Adlisberg (Zurich).

Seed produced at—	Seed Unsorted sown 1891		orted,							4-Year Old Plants.		ar Old 'nts.
Seed produced at—	tude.			Large	e Seed		lium ed.	Small	Seed.			
		Height.	Weight per 1000.	Height.	Height.	Weight per 100.						
	Ft.	Ins.	Oz.	In.	Oz.	Ins.	Oz.	Ins.	Oz.	Ins.	Ins.	Lbs.
Winterthur,	1800	5.3	25	4.5	29	3.8	25	3°4	26	11.8	18	15
'Adlisberg,	2200	4.0	20							9.5	14	10
Pilatus,	3300	3°7	16	4°1	34	3.2	19	3.3	16	8.7	14	10
Graubünden,	5100	2°I	13	2.5	13	2'1	11	1.2	9	5.9	10	6
Engadine,	5950	2.0	10	2°I	12	1.9	10	1.8	10	5.7	9	5

The general scheme of the experiments has consisted in procuring seed from trees of approximately equal age situated at different elevations. A careful study has been made of the size and colour of the cones, of the shape and dimensions of the trees and their foliage, and of the size and germinating capacity of the seed. The seed has been sown in two nurseries, the one (Adlisberg, near Zürich) at an altitude of some 2200 feet, and the other (Stanserhorn) at an altitude of some 6200 feet. The latter is situated at so high an elevation that any results obtained there can have but a modified interest for us, so I propose to confine our attention to the work at the lower elevation, which, though much above the limits of successful tree-growth in this country, presents conditions analogous to those found at a height, say, of about 500 feet in Scotland. I do not, however,

wish to suggest that the results obtained either in Switzerland or Austria can be immediately applied to our own conditions. My whole object in bringing the work to your notice is to stimulate interest, and to suggest that there is room for further research along similar lines, which, however, shall have strict regard to our peculiar insular conditions.

The examination of the seed showed that there was a gradual, though by no means regular, reduction in size according as it was obtained from low or high elevations, 1000 seeds usually weighing more than 6 grammes when obtained from an altitude under 3000 feet, and less than 6 grammes when the altitude was 3000 to 6000 feet. The percentage germination followed the same order, being about 70 to 80 for lower altitudes, 50 to 60 for higher altitudes. When the seed was kept over from year to year, the germinating capacity, of course, in every case declined; but the reduction in germinating power was much more marked in the case of high-grown seed than in the case of seed from low elevations. As a rule, seed from a high elevation did not germinate at all six years after being gathered, whereas seed from a low elevation would still germinate about 20 per cent.

When the seedlings had reached an age of two years, many were lifted and subjected to examination in various ways, when it was found, amongst other things, that the proportion of root to stem was greater in the case of plants from high-grown seed than where the seed had been procured at a low elevation. This character has doubtless been acquired by trees at a high altitude in order better to resist the violent gales to which they are subjected, and it is a character that has been transmitted through the seed.

But by far the most important result of these experiments is that which is concerned with the relationship between the rate of growth of the seedlings and the elevation at which the seed was gathered. Up to a certain altitude above sea-level trees grow as well as they do lower down; but as one gets higher a point is reached when the height-growth begins to be affected, and at the upper reaches of growth for any particular species, the trees are more or less stunted. Now, this reduction in the stature of trees is a character that is inherited; that is to say, it is transmitted to the progeny. It has already been mentioned that the seed of the spruce is smaller in size at high than at

low elevations; and that large seed produces large plants may be at once admitted. Table I. shows that when the seed was passed through sieves and sorted out into "large," "medium," and "small" grains, the resultant plants, when two years old, were always slightly tallest and heaviest when the largest seed had been used, and shortest and lightest when the smallest seed had been sown. But this does not explain why seed from a high elevation, when sown at a lower level, produces comparatively small plants; for the same result is got when seed has been sorted, and when the comparison is with grains of exactly equal size. The Table shows that in the case of unsorted seed, gathered at altitudes varying from 1800 to 5950 feet, and sown in 1899, the two-year-old seedlings averaged 5:3 inches in height, and weighed 25 oz. per 1000 when the seed came from mother-trees growing at the lower level, but only 2 inches and 10 oz. when the mother-trees had stood nearly 6000 feet above the sea. The Table also shows a gradual transition from the big to the little seedlings, according to the elevation of the seed-trees, but in inverse proportion, that is to say, the higher the elevation of the seed-trees the shorter and lighter the resulting plants. The character, it will be seen, is preserved by the seedlings when they are five years old—at that age the plants from Winterthur seed being 18 inches high, and 15 lbs. in weight per 100; whereas plants raised from Engadine seed were at that age only 9 inches high and 5 lbs. per 100 in weight.

The more important results of the Austrian experiments with

The more important results of the Austrian experiments with spruce are brought together in Tables II. and III. In the former of these Tables figures are shown dealing with seed from three different localities, and from three different altitudes in each locality. This seed was gathered in the autumn of 1890, and was sown in 1891 in a nursery in the Wienerwald, near Vienna, at an altitude of 1650 feet. When sufficiently large the plants were set out in the forest, and the measurements for 1905, shown in the Table, refer, of course, to the fifteen-year-old plants. Here, as in the Swiss experiments, seed from high elevations usually produced plants whose growth is slow, so that from seed gathered at Kärnten, at an altitude of 1700 feet, the plants were 53 inches high, whereas when the seed came from 5200 feet in the same district, the fifteen-year-old plants were only 30 inches high. Similarly for the seed from South Tyrol and the south of France, except that in the case of seed from the middle altitude in the

latter case the resultant plants were slightly taller than from the lower altitude. In the same Table the average growth-in-height for the year 1905 is also shown, that is to say, the average length of the last shoot. Fifteen years after sowing the seed the slower growth of plants from seed harvested at a high altitude is still as conspicuous as ever, and it seems probable that this characteristic will be maintained throughout the life of the tree. The poor growth, on the whole, during 1905 is accounted for by the extraordinary intensity of the drought of 1904, which was continued with but little modification throughout 1905.

Table II.

Austrian Experiments with Spruce (Crop 1890)
in the Wienerwald (1650 feet).

Origin of	Seed.		Altitude.	Height- Growth, 1905.	Height in 1905.	
Kärnten, .			Ft. 1700	Ins. 4°2	Ins. 53	
*			3400	2.9	40	
,,			5200	2.4	30	
South Tyrol,			3300	3.6	39	
,,			5500	2*4	28	
"			5800	1.6	21	
South France,			3000	2.6	30	
,,			4900	2.3	32	
,,			5100	2.0	24	
Central Sweden,			1000	1,3	12	

In the lowest line of the above Table (II.) figures are shown which relate to plants grown from Swedish seed, and it will be seen how very poorly such plants have grown in Central Austria.

Table III. also deals with Austrian experiments on spruce, the seed in this case being of the crop of 1894. This seed, from three altitudes in Silesia, has produced plants of exactly the same character as the others already discussed. The leading shoot in

1906 (the twelfth year from the seed) averaged 8.6 inches in length when the seed came from an altitude of 1700 feet, whereas it was only 2.3 inches long in the case of the plants raised from seed produced at an elevation of 3750 feet.

Table III.

Austrian Experiments with Spruce (Crop 1894)
in the Wienerwald.

C	Origin of	Se <b>e</b> d.			Altitude.	Height- Growth, 1906.	Height in 1906.
Silesia,					Ft. 1700	Ins. 8.6	Ins. 47
,,					2850 6.0		38
,,				• 1	3750 2.3		23
Central S	weden,			•	?	3*4	18
		Aus	trian	Ext	eriments w	ith Larch.	
			Origin	of Seed			Height, 8-Year Old Plants.
Silesia,			Origin				Height, 8-Year Old Plants. Ft. Ins. 6 8

In this Table, as in the last, the poor growth in Austria of Swedish spruce is strikingly emphasised.

So much for spruce. Now let us turn to the principal results obtained with larch.

The lower part of Table III. shows the height to which eightyear-old larches had attained when raised from seed produced respectively in Silesia and the Alps. Not only were the alpine larches shorter, but they were also less straight, and even at eight years of age they showed a tendency to produce buttress-like outgrowths or ribs. This lack of straightness, and the tendency to throw out buttresses, is thoroughly characteristic of the larch when grown in high alpine localities, and there can be no doubt, from the Austrian experiments, that these characters are also transmitted from the parent tree to its offspring. The Swiss Forest Department has also experimented with larch (crop 1900), and the main results are brought together in Table IV. In the first place, attention may be called to the general tendency for high-grown seed to produce short plants, though it must also be noted that this result was not observable until the parent trees had stood at an altitude of some 6000 feet.

TABLE IV.

Swiss Experiments with Larch Seed (Crop 1900)

in Nursery at Adlisberg (2200 feet).

				4-Year-Old Plants.				
Origin	Origin of Seed.			Altitude.	Height.	Leaves Appeared.	Stopped Growing.	
Bonaduz,*				Ft. 2350	Ins. 26	April 8	August 18	
Untervaz,*		٠		3700	27	,,	,, 6	
S. Maria,				5600	25`	April 3	,, 6	
Avers,*				6300	9	March 29	June 27	
Engadine,*				6900	15	,,	July 2	

<sup>\*</sup> Several trees.

Besides this character of high-grown seed, the Table also shows that the four-year-old larches varied to some extent as regards the date when they came into leaf, the plants from high-grown seed becoming green some days before the others. But much more striking was the period when growth ceased for the season, this occurring in the end of June or early in July for the plants raised from high-grown seed, but not till well into August in the case of the plants from low-grown seed. The growing season was thus a month to six weeks shorter in the former case than in the latter. Needless to say, these results have an important bearing on the liability of plants to be affected by late and early frosts, a form of injury to which the larch is specially subject.

Finally, a few of the results obtained with the sycamore in the Swiss experiments have been brought together in Table V. These plants were raised from seed sown in 1901, and when

three years old they showed the average heights stated in the Table. When seed was taken from trees situated at elevations ranging up to 3600 feet, the resulting plants showed but little difference in size, the advantage being rather in favour of the higher-grown seed. But in the case of seed produced above 5000 feet, the plants were distinctly shorter, agreeing in this respect with the results obtained with spruce and larch. When the dates of coming into leaf are examined, it is seen that plants from high-grown seed are somewhat later than the others, whereas they show a tendency to stop growing sooner, and they certainly shed their leaves earlier.

Table V.

Swiss Experiments with Sycamore (Crop 1900)
in Nursery at Adlisherg (2200 feet).

				3-Year-Old Plants				
Origin of Seed.			Altitude.	Height.	Leaves Appeared.	Stopped Growing.	Leaves Shed.	
Adlisberg, .		•	Ft. 2200	Ins. 25	May 5	July 31	Nov. 12	
Hasenrüten,.	٠		3150	26	,, 10	,, 15	,, 14	
Kalcherli, .			3500	27	,, 10	,, 3I	,, 14	
Wiesenberg,			3600	31	,, 10	,, 31_	, I4	
Platti,			5200	22	,, 16	, 15	,, ε	
Alp Drusen, .			5300	16	,, 16	,, 5	Oct. 13	

As previously stated, it would be most unsafe to apply these Austrian and Swiss results to the conditions prevailing in Scotland; but in the countries referred to there is no doubt that where plantations of spruce and larch are being formed at low or moderate altitudes, care should be taken to secure seed from similar localities. In the experimental plantations near Vienna, one finds that an area stocked with plants from low-grown seed is in close canopy with all ground-herbage suppressed, when on an adjoining area the young trees, raised from high-grown seed, are far from touching each other. It is perfectly evident that in the one case the profits of forestry will

be much larger than in the other, in fact, there may at the end of the rotation be all the difference between a satisfactory profit and a dead loss.

Although I have not troubled you with figures for plants raised at what, on the Continent, would be called a high altitude. I may mention that whereas seed from a low or moderate elevation is clearly indicated as the best for cultivation at such elevations, this class of seed produced plants that throve badly at high altitudes. For use at high altitudes, seed from similar altitudes must be obtained, and it seems to be not unlikely that in Scotland we might cultivate woods at greater heights than we do if we made a point of securing high-grown coniferous seed for the purpose. I am aware that Scots pines from home-grown seed are much more highly valued than so-called "German-Scotch," and I have not a doubt that the prejudice against foreign Scots pine plants is thoroughly well founded. But the home supplies of Scots pine seed are often insufficient to meet requirements, and, in any case, we want to have extensive experiments set a-going to see whether any foreign locality can furnish as good Scots pines as we grow at home. While we are probably sound in our belief with regard to Scots pine. I fear we know but little as to where we should turn for the best supplies of spruce and larch, and some other important trees. If larches that possess crooked and buttressed stems can produce plants having similar characters, the question naturally arises, can the tendency to disease be similarly transmitted? The tendency to injury from frost can certainly be transmitted, as we have just seen in the case of the Swiss experiments, and it is possible that some cases of want of success with this tree are due to the unsuitability of the source of supply of the seed. Similarly in the case of the spruce. How often do we see young spruces almost standing still in their growth, with foliage yellow, and branches covered with galls! These are exactly the symptoms that characterise some of the experimental plantations in Austria, and it may well be that our spruces also have sprung from seed ill-adapted to our peculiar conditions. Pending the production of reliable experimental results in this country, we cannot do better than take care to obtain our seed from well-grown healthy trees situated in the district where the woods are to be grown, or in a district of similar character.

#### 2. The Mountain Pine.

(With Five Plates.)

By Sir John Stirling-Maxwell, Bart.

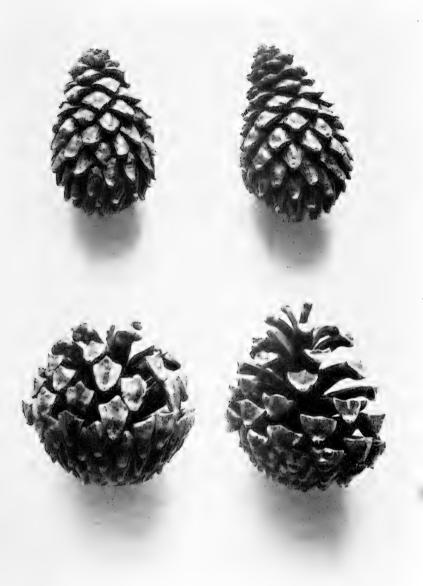
The Editor has asked me to contribute some notes on this species, which certainly deserves the attention of any forester who has to bring poor, high and exposed ground under forest.

The classification of the Mountain Pine is still incomplete, and presents difficulties into which these notes will not enter. The botanical nomenclature will also be avoided, as it is in a state of confusion, and presents more varieties than the tree itself.

From the forester's point of view there are three well-marked varieties of the Mountain Pine, which I will call Upright, Intermediate, and Dwarf. These are not mere sports, but constant varieties, hailing from different countries, coming true from seed, and, in fact, not less distinct than the Corsican, Austrian, and Pyrenean varieties of *Pinus Laricio*.

- 1. The Upright Mountain Pine, known in France as  $Pin \ \alpha$  Crochets from its hooked cone scales (Fig. 1), is a slender, erect-growing tree with a single stem, which, under favourable conditions, attains a height of 60 feet or more. It is the ruling species in large forests at elevations of 4000 to 7000 feet in the Pyrenees and in the French Alps near Briançon. It is also found in small colonies in the Engadine and on the moors of Southern Bohemia.  $^1$
- 2. The Intermediate form is a many-stemmed tree, which does not grow more than half the height of the Upright variety. Its shape is due to the rapid development of the side branches, which turn upwards and grow as fast as the leader. This is the variety commonly found in the mountains of Central Europe and on the Bavarian moors.
- 3. The Dwarf form is a creeping shrub not more than 6 feet high. Its branches tend to lie flat on the ground, only turning upwards at the extremities, and it has no leader. This variety forms vast thickets in the Carpathians, and on the Erz and Riesen mountains, which divide Bohemia from Saxony. It has no silvicultural interest, and need not concern us further.

<sup>&</sup>lt;sup>1</sup> P. E. Müller, Tidsskrift for Skovbrug, Copenhagen, 1887.



[Photo by Lady Mary Percy.]
Fig. 1.—Cones of Upright Mountain Pine, Pyrénées Orientales; Natural Size.



The Mountain Pine is one of the least exacting of trees, whether as regards soil, or aspect, or climate, and its requirements decrease with its stature. No doubt the humbler types. and their frugal character, are the outcome of the miserable homes to which the species has been for generations reduced. The present distribution of the three varieties, and perhaps also their origin, depends mainly on the encroachment of other species. Even in this, its noblest form, the Mountain Pine can thrive at altitudes where it has nothing to fear from the Scots pine or silver fir. But the hardy spruce is a more dangerous rival. Where it is present, the Mountain Pine is driven to higher ground. In such situations, too inclement for the Upright variety, the Mountain Pine is only found in the many-stemmed Intermediate form. Farther east, according to Müller,1 the Mountain Pine, even in this form, finds a serious rival in Pinus Cembra, and it is only the Dwarf variety that can scrape a living on the wind-swept tops to which Pinus Cembra does not mount. In the Alps the Upright variety is found only where the spruce is absent. The spruce appears to avoid the Brianconnais because it is too dry. Here, in the region above the Scots pine and silver fir, the Mountain Pine has no rival but the larch, with which it lives on friendly terms, germinating freely under the larch's light shade, and taking full advantage later of its broken canopy.

In the Pyrenees the conditions are still more favourable to the Mountain Pine. There the spruce is, for some unexplained reason, a scarce tree, found sparsely mixed with the silver fir, but never as a ruling species. The larch is altogether absent. The Mountain Pine consequently reigns supreme and almost alone in vast tracts of forest; for where it can thrive in its Upright form (and it is found in the Pyrenees in no other), it has nothing to fear from the encroachments of Pinus Cembra, the only other conifer of this high region. The Mountain Pine forests are found on the Spanish as well as the French side of the frontier. Their aspect is sombre, but very beautiful. Mile after mile they mount over ground rough with boulders, and still plentifully streaked with snow in the last days of May. The grey stems are so straight and cylindrical, and the crowns so narrow, that you seem to be in a larch forest which has exchanged its gay, deciduous foliage for this deep perennial verdure. The finest

<sup>&</sup>lt;sup>1</sup> P. E. Müller, Tidsskrift for Skovbrug, Copenhagen, 1887.

groves are the least accessible, which it has never paid to fell. They were hopelessly out of reach at the time of my pilgrimage. The forest officers said they knew specimens 100 feet high and g feet in circumference. If the reader wishes to verify these figures, he can only do so in July or August. In the lower Mountain Pine forests it is possible to work four months in the year. Here a system of Jardinage is practised, under which no trees reach the age of 100. Figs. 2 and 3 show a fine group in the Forêt Communal de Matemale, at a turn of the road between Mont Louis and Fourmiguères. These trees, judging by the stumps of some lately cut, are about 70 years old. They are 55 feet high, and average 3 feet in girth breast high. The largest measured 4 feet. The photographs, being taken from lower ground, do injustice to the stems, which are remarkably cylindrical. Fig. 4 is a group of Mountain Pines in the Forêt de la Matte, near Fourmiguères. Part of this forest is of Scots pine, and in places the two species are mixed. The reader may care to know how their growths compare here and in the French Alps, where the two species also meet. Up to 40 their growth in height is about equal. At Briançon it scarcely exceeds 40 feet for either species. But in that time the Scots pine, if it has escaped injury from snow, has invariably made more timber than its neighbour, measuring on an average 2 ft. 3 ins. in girth breast high, while the Mountain Pine only measures 1 ft.  $8\frac{1}{2}$  ins. On the buttresses of Mont Canigou, where the Mountain Pine is mixed with stunted silver fir, the growth is nearly double that above described. After the age of 40 there is usually a marked falling off in the height-growth of the Mountain Pine. Up to that age it is a singularly regular and slender tree (Figs. 6 and 7), never branching into gaps like the Scots pine. After 40 the stem swells, the crown gets rounder, and the branches hang down, but the tree seldom loses its narrow, columnar habit. A well-developed tree of 70 years carries branches notably short and light for its heavy cylindrical stem. At every stage the outline resembles that of the Corsican pine. The root-system of the Mountain Pine is shallower than that of the Scots pine, and at high altitudes the Scots pine can only keep pace with its more frugal cousin on the better soils. The condition of the two species, after a winter of heavy snow like that of 1906-1907, is in marked contrast. The Mountain Pine, among its crushed and splintered

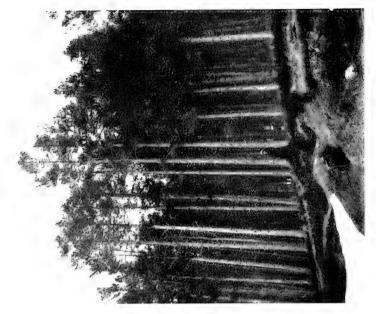
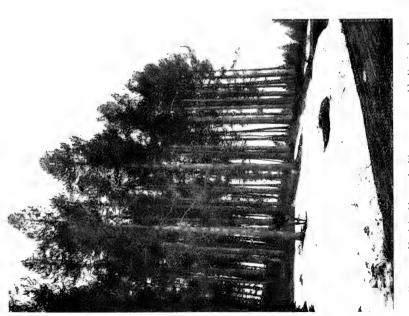
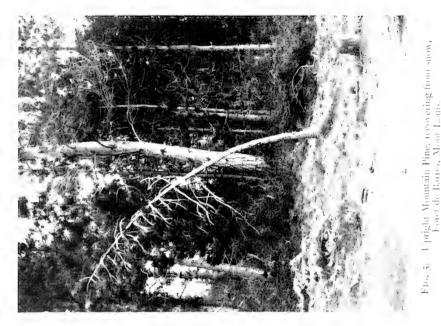


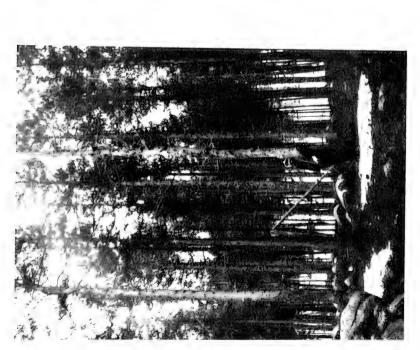
Fig. 3 —Upright Mountain Pine, 70 years old. Foret de Matemale, Pyrénées Orientales.



Fro. 2, —Upright Mountain Pine, 70 years old, Forét de Matemale, Pyrénées Orientales.

[To face page 12.





Fit: 4. Upright Mountain Pine, Foret de la Matte, Pyrénées Orientales.

neighbours, might sing with the Psalmist, "They are brought down and fallen: but we are risen, and stand upright." The recovery of the Mountain Pine from snow is one of the marvels of these woods. Even where trees of twenty years' growth have been bowed to the ground (as in Figs. 5 and 8), their wonderful toughness and elasticity enable them to stand up again in spring little the worse.

The Mountain Pine cleans its stem less readily than the Scots pine, being distinctly less impatient of shade. It also retains its needles longer, often eight and even nine years in the young state, as against four or five for the Scots pine. It is perhaps for this reason that new plantations of Mountain Pine make such slow progress for several years on poor soils. In one, for instance (Fig. 9), in the Clairée valley near Briançon, on a poor gravel almost destitute of vegetation, the Mountain Pine had taken fourteen years to reach the height of 6 feet. During that time hardly a vestige of humus can have been formed. During the last eight years the progress has been much more rapid, and the gravel is now hidden under 3 inches of dark humus-soil, which bears a plentiful crop of seedlings. In spite of its persistent foliage, the crown of the Upright Mountain Pine is never dense, because the growth of the side branches is slow, and consists, for the most part, of a simple extension of the main axis without side shoots. For the afforestation of poor soils, as in the Cevennes or Montagne Noir, or in plantations for the restraint of torrents in the higher valleys of the Alps and Pyrenees, the Mountain Pine has quite replaced the Scots pine in the estimation of French foresters. At Briançon, for instance, Scots pine is no longer grown in the nurseries. At Mont Louis the French government have a seed-drying establishment on a large scale, with store-rooms, and ovens and threshing machinery, which is mainly devoted to the seed of the Upright Mountain Pine. The same work is carried on at Briançon.

The Upright Mountain Pine yields a good timber, with red heart-wood, tough, resinous and durable. In the barrack buildings at Mont Louis, it survives in good condition from the seventeenth century. The specific gravity, as tested in Denmark, is higher than that of Scots pine, but lower than that of larch. The timber is highly esteemed for building. It is well adapted, on account of the abundance of resin, for the manufacture of charcoal, tar, and ligneous acid, but, not for the same

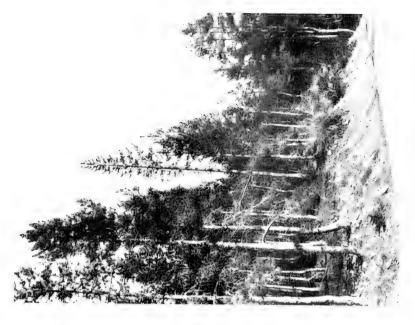
reason, of cellulose. In the Pyrenees the expense of transit is so great that the timber is disposed of locally so far as possible. The price is there slightly below that of Scots pine, as the local demand is for the wood more easily worked.

In Denmark the Mountain Pine, in its Intermediate form, has played an important part in the afforestation of the heaths and dunes of Jutland. It was introduced into Denmark from Eisenach in 1798. It did not come into prominence until the middle of the nineteenth century, when the wholesale destruction of the plantations of Scots and Austrian pine by Lophodermium Pinastri induced the Danish foresters to turn their attention to a species which had escaped that pest. The plantations of Mountain Pine now cover more than 15,000 acres. It is only since 1886 that the Upright variety has been planted on a large scale. It promises well, but is found rather more exacting as regards soil than the Intermediate form, and rather more subject to Lophodermium Pinastri. Specimens forty to forty-five years old prove that the tree maintains its erect habit in Denmark.<sup>1</sup>

On the Danish heaths the Mountain Pine displays a wonderful power of resistance to humic acid, and is found to improve heath soil for other species in a manner which is described by Danish writers as "remarkable and partly unexplainable." It does not appear certain that the Upright variety shares this valuable quality. If it does, it cannot fail to be of value in Scotland. Danish foresters assert that the Intermediate variety can make its good influence felt among spruce when it is in the low proportion of one to four. In the Pyrenees the Upright variety has the reputation of succeeding well on peat and in swampy places, but a plantation on soil of this character in the Forêt de Barrés, near Mont Louis, does not look particularly happy; it is, however, on an undrained snipe bog, such as the most sanguine Scot would shrink from planting.

It is a pity that the Upright variety of Mountain Pine is so little known in this country. It will be seen from the few illustrations given that it is absurd to dismiss this species as a mere bush, as most British writers do. No one would advocate its employment where more valuable kinds would thrive, but it appears to have the merit of living and making good timber where other kinds fail. An admirable description

<sup>&</sup>lt;sup>1</sup> Haandbog i Skovbrug, Hauch & Oppermann, Copenhagen, 1898-1902.





F16. 6.—Young growth of Upright Mountain Pine, Pyrénées Orientales.

[To face page 14.



Fig. 8.—Upright Mountain Pine, newly released from snow, Forêt de Barrés, Mont Louis.



F16. 9.—Plantation of Upright Mountain Pine, Vallée de Clairée, near Briangon.

of the Mountain Pine will be found in Sketches in Spain by Capt. S. E. Cook (Widdrington), 1834. Loudon follows it in his Arboretum. Numerous French writers, including Boppe, Matthieu, Demontzey, etc., give fairly adequate accounts of the tree, as well as Willkomm, and several Danish writers. The seed of the Intermediate variety can be obtained from Rafn of Copenhagen. For the seed of the Upright variety it is better to apply to the French Department des Eaux et Forêts. Application must be made through the British Embassy in Paris. Both seeds are cheap, and can be relied on to germinate well if treated in the same manner as Scots pine.

#### THE NOMENCLATURE OF THE MOUNTAIN PINE.

By MARION I. NEWBIGIN, D.Sc.

This subject is admittedly difficult, one great source of difficulty being that the growth-forms of the tree do not altogether correspond to the cone-forms, which are fairly well defined. A useful summary of the various classifications proposed is given in Lebensgeschichte d. Blütenpflanzen Mitteleuropas, by Kirchner, Loew and Schröter, with a suggested classification, on which the follow-

ing notes are based.

If we examine the cones only we find that *Pinus montana* may be split up into three well-defined subspecies—(1) uncinata, (2) pumilio, and (3) mughus. Upright and intermediate forms only occur in the first, which is therefore the only one which directly interests the forester. In this subspecies the cones are markedly unsymmetrical, have an excentric stalk, and are narrowed at the base. The scale-shields (apophyses) are better developed on the free side of the cone than on that turned to the stalk, and are raised so as to form a cap or pyramid. In this subspecies two varieties occur. In (1) P. montana uncinata var. rostrata the shield is strongly hooked, and the pyramid forming the hook is as high or higher than it is broad. The pyramid is well shown in the lower left-hand cone in the plate. This variety is especially western, occurring naturally in Spain, the Pyrenees, the western Alps and western Switzerland. It is typically upright, but under very unfavourable conditions sports into the dwarf form. Such dwarf sports will, however, apparently give seeds which reproduce the upright form. In (2) P. montana uncinata var. rotundata the hook is less well marked, the pyramid, if present, is not so high as it is broad, and may be represented only by a cap in the upper part of the shield. This variety is more widely spread than the other, occurring throughout the Alps except to the west. It is cultivated in Denmark and Germany, and occurs especially in the intermediate form, but is sometimes dwarf. The dwarf forms come true from seed. In brief, the true upright form is P. montana uncinata var. rostrata, the true intermediate *P. montana uncinata* var. rotundata, but both of these may also occur in the dwarf form. The dwarf forms of these two varieties are either (1) sports, or (2) constant races.

## 3. Soil: its Origin and Nature.

By Professor James Geikie, LL.D., D.C.L., F.R.S. (Continued from Vol. XX. p. 182.)

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Soils are usually classified by agriculturists as (a) Sedentary and (b) Transported. These terms, however, are true only of subsoils. All soils, properly so-called, may be said to be sedentary, inasmuch as they are formed out of the immediately underlying subsoils. To a geologist "soil" and "subsoil," no matter how intimately related, are nevertheless distinct things. Subsoil is an aggregate of disintegrated and decomposing rockmaterial, while soil consists of similar materials, with the addition of a varying amount of organic matter. True soil rarely exceeds one foot in thickness, and is usually thinner; but subsoil may vary in depth from a few inches up to hundreds of feet.

For this country a more suitable classification of soils would be (a) Bed-rock Soils and (b) Drift Soils. Under the former head would be included all soils overlying subsoils which are in process of being derived from the breaking-up and disintegration of the bed-rock. The latter term, on the other hand, would embrace all soils formed upon the surface of superficial formations of every kind. These "superficial formations" overlie and conceal the bed-rock, and are of very unequal thickness and varied origin—the soils yielded by them differing, it may be, entirely from the subsoils and soils which the concealed bed-rocks themselves would have supplied. A short description of a few typical examples of bed-rock soils and drift soils may suffice to illustrate the varying character of these two great groups.

#### (a) BED-ROCK SOILS.

The bed-rocks of this country differ greatly as regards their character and origin. Some consist of confused aggregates of crystalline ingredients, and are obviously of igneous origin, having cooled and consolidated from a molten condition. Such are the well-known rocks granite and basalt. Others resemble these in being crystalline, but differ from them in showing a certain arrangement of their ingredients in more or less regular lines or layers. Crystalline rocks having this leafy arrange-

ment are termed schists. Gneiss and mica-schist are common examples. Yet another great class of rocks are known as derivative rocks. These are so called because they have been derived from the breaking-up of pre-existing rocks, and the deposition of the materials in layers and beds. Characteristic rocks of this group are ordinary sandstones and argillaceous shales. To the same group belong the great marine limestones, which consist chiefly of the débris of corals, sea-lilies, shells, and other organisms.

1. IGNEOUS ROCKS.—The soils resulting from the disintegration and decomposition of igneous rocks show considerable variety. As typical examples we may cite granite and basalt.

Granite, as we have seen, is essentially an aggregate of three minerals—quartz, felspar, and mica or some other ferromagnesian species. While quartz is insoluble, the other constituents are in time decomposed by rain, and resolved into clay and certain alkalies and alkaline earths, which tend to be removed in solution as bicarbonates. When thoroughly decomposed, therefore, granite yields a clay-soil, containing a variable admixture of grit and sand (quartz). From this clay all the soluble ingredients-potash, magnesia, and lime-may be completely leached out. In general, however, larger and smaller fragments of the decomposing rock are disseminated more or less plentifully through the soil and subsoil, and from these fresh supplies of the alkalies and aikaline earths are continually set free.1 Other minerals besides those mentioned may be present in granite—the most notable being apatite, from the decomposition of which phosphoric acid is added to the soil. Under favourable conditions, therefore, granite yields a fertile clay-soil. In this country, however, the rock usually occurs at considerable elevations, where the climatic conditions and the form of the ground are against the retention in place of its decomposing débris. The disintegrated materials, unprotected by vegetation, fall a prey to wind, rain, and melting snow, and are carried more or less rapidly away. Steep declivities thus either remain bare or are curtained with sheets of loose boulders, blocks, and fragments of all shapes and sizes, while more gently

<sup>&</sup>lt;sup>1</sup> The common felspar of typical granite contains potash. The soil over this rock, therefore, may be expected to contain a good supply of that substance. Not infrequently the mineral hornblende is more or less plentifully present, from the decomposition of which lime is derived.

inclined surfaces may be clothed with rough grit and gravel, consisting largely of insoluble quartz. Over the low grounds clay is sometimes spread to some extent; but from this the soluble alkalies and alkaline earths may have been largely removed.

Basalt is a dark-coloured rock which, as a rule, is readily disintegrated and decomposed. It contains a considerably smaller percentage of silica than granite, and a much larger proportion of basic ingredients. The essential constituents are felspar and augite—usually accompanied by olivine and ironoxides, and not infrequently by apatite, but no quartz is present. From the decomposition of these minerals various soluble and insoluble compounds are produced. The former are represented chiefly by carbonates of lime, potash, and magnesia, while the latter appear as clay and fine sand, commingled with which are iron-oxides. The resulting soil is a dark loam, which often shows traces of phosphoric acid, derived from the decomposition of the apatite. Basalt-rocks are fairly common in the lowlands of Scotland, entering often largely into the formation of hillranges, and frequently occurring as more or less isolated knolls and straggling hillocks, or forming wider stretches of lumpy and hummocky ground.

Granite and basalt may be taken as representative of igneous rocks in general—the former yielding, under favourable conditions, clay-soils, while from the latter, soils of a loamy character tend to be produced. There are many other igneous rocks, however, a few approximating to granite in chemical composition; others being more nearly related to basalt. Rocks of this intermediate character necessarily yield soils-some of which are clay-like, while others are loamy. Generally they are more or less fertile.

2. Schists.—The rocks included under this head are of very variable nature, and are often termed "metamorphic," because they are believed to have undergone certain great changes which have obscured or even sometimes entirely concealed their original character. The most typical kinds are markedly crystalline; but others may show only slight indications of crystalline texture.

Gneiss is one of the more crystalline varieties, and resembles granite in composition, consisting, like it, of quartz, felspar, and one or more ferro-magnesian silicates. It therefore tends to yield a clay-soil with the usual admixture of grit. According,

as conditions of climate and surface-slope are favourable or the reverse, the soil may be good or practically barren. In this country the rock is largely confined to the Highlands, and therefore it is only here and there that its disintegrated and decomposing materials are allowed to remain for any time in situ.

Mica-schist.—This rock is also largely restricted to our mountain districts. Typical mica-schist, consisting of quartz and mica only, weathers slowly, and the thin soils derived from it are generally of poor quality. But not infrequently many accessory ingredients are more or less plentifully present in mica-schist—such as felspar, garnet, apatite, and sometimes calcite. When the gradients are favourable, the soils derived from such mica-schists may be as good as or even better than those yielded by granite and gneiss. They are often rather loams than clays, and under favourable conditions have proved to be fairly fertile.

Now and again we encounter schistose rocks which have essentially the same composition as some of our dark-coloured basic igneous rocks, and the resulting soils in such cases are dark loams of good quality. Unfortunately, the rocks referred to (amphibolites) are somewhat sparingly developed in Scotland, occupy no large areas, and often occur at relatively high elevations—being confined to our Highland areas.

The only other metamorphic rocks that need be referred to are clay-slate and quartzite—both of which occupy considerable areas in the Highlands. The former consists essentially of silicate of alumina, and its disintegrated materials, therefore, usually form a cold, wet, sterile clay. Occasionally, however, owing to the presence of felspathic and micaceous ingredients, the soil is of a less forbidding quality. As quartzite consists essentially of quartz, its disintegrated débris forms at the best only a thin, meagre, sandy soil.

3. Derivative Rocks.—In this division many varieties of rock are placed. Some, however, are but sparingly developed, and need not be here considered. Excluding these, we may say that the great majority consist either of arenaceous, argillaceous, or calcareous materials.

Arenaceous Rocks.—The most characteristic of these rocks are the sandstones, of which there are many varieties. The great majority are quartzose, that is to say, they are made up chiefly of

20

grains of quartz, and hence the soils derived from them tend to be light, and are often not sufficiently retentive. Many sandstones, however, contain larger or smaller proportions of argillaceous matter diffused through them, and may then yield loamy soils of good quality. Now and again we meet with sandstones which have been derived more or less immediately from the breaking-up of such rocks as granite, gneiss, etc. Such sandstones often contain much decomposing felspar, and various more or less altered ferro-magnesian minerals, particularly mica from which soluble alkalies and alkaline earths are obtained. Few sandstones, indeed, do not contain scales of mica, which are often so plentiful as to give the rock quite a fissile structure. However abundant such minerals may be in a sandstone, they are not often conspicuous in the overlying subsoil, while they are wholly wanting in the vegetable soil. It is obvious, in short, that they become decomposed, and in the process yield compounds available for plant-food. Many sandstones owe their induration to some cementing material which binds the grains together. This material may be calcareous, ferruginous, or argillaceous. When such rocks are weathered, therefore, the nature of the cementing material necessarily affects the character of the soil. There are certain very old arenaceous rocks, which contain so large a proportion of argillaceous material that the soils formed upon them are often rather clays than loams. The rocks referred to are termed greywacké by geologists. They are relatively hard, greyish-blue or greenish as a rule, and are known to the country folk as whinstones. The Lammermuirs, the Lowthers, and other hill-ranges in the south of Scotland are built up very largely of these rocks. Although the soils derived from greywackés are not infrequently too retentive, yet here and there, when they can be well drained, they are cultivated with success. It may be added that greywackés not infrequently contain considerable porportions of felspathic material, the decomposition of which naturally enriches the soil.

Sandstones may occur either in thick massive beds or in thinner strata, and the individual beds are very frequently separated by intervening layers of argillaceous shale. Hence when a series of sandstones and shales crop out at the surface, the soils derived from both sets of beds eventually become commingled. This, of course, is due to that movement of soilmaterials which is always in progress. Thus in regions where

sandstones and shales occur in rapid succession, the overlying soil is usually of a loamy character.

Argillaceous Rocks.—The rocks of this class are as variable in character as those just described. Naturally the soils given by them are clay-like. Many of the rocks in question consist almost exclusively of silicate of alumina and quartz in the finest state of division—all soluble ingredients being practically wanting. Such rocks, it need hardly be said, crumble down into cold, wet, retentive, infertile clays. Some clay-rocks, on the other hand, contain much sand, so that the soil resulting from their disintegration is of a transition or loamy character. Again, certain clay-rocks are largely charged with calcareous matter, and would be then termed marls—some of which yield excellent soils.

While argillaceous rocks sometimes occupy wide regions—the prevalent soils of which are consequently of a heavy, clay-like nature, yet more frequently the rocks in question are interbedded with sandstones. When such is the case, the resulting soils, as we have seen, are often strong loams, forming some of the most fertile land met with in this country. Good examples are furnished by the famous "red soils" of East Lothian, Wales, and Cornwall, all of which overlie Old Red Sandstone strata. Somewhat similar soils are yielded by the "Keuper Marl" of Cheshire and the Midlands of England.

Calcareous Rocks.—Limestones invariably contain insoluble impurities, such as sand and clay—they do not consist exclusively of calcium carbonate. Thus the soils derived from limestone are either loams or clays. They are usually reddish, yellowish, or brown in colour, and vary in character from stiff retentive clays to calcareous loams. Good examples of these soils are seen in the chalk districts of England. Limestones all the world over yield somewhat similar coloured soils—the colour being due to the presence of iron-oxides. As limestones are usually traversed by numerous joints or fissures which have been widened by the action of acidulated water, much of the red earth (i.e., the insoluble portion of the rock) is washed by rain, or, as the case may be, by melting snow, into these open fissures. Limestone regions, therefore, especially when relatively high, are apt to show a bare rocky surface, the hollows of which may be sparingly sprinkled with a thin clay-like or loamy soil.

[Note.—This article will be concluded in our next issue.]

### 4. The Inverliever State Forest.

By R. C. MUNRO FERGUSON, M.P.

The Royal Scottish Arboricultural Society has every reason to be gratified with the acquisition of Inverliever. We have put pressure upon successive Governments for a long while past in order to obtain two definite objects of supreme importance,—

- (1) Provision for the training of foresters;
- (2) Acceptance by the State of liability for the afforestation of suitable lands.

Our requirements for the training of foresters were detailed by Mr Hanbury's Departmental Committee, whose very moderate recommendations remain neglected. Yet it is facilities for instruction and for experimental work, as laid down by that Committee, that are our chief requirement. All this has yet to be obtained, and we cannot insist on it too strongly, in view of the fact that the Secretary for Scotland has, unfortunately and unaccountably, refused to extend to Scotland a most useful inquiry, which is now being conducted into technical rural training in England-a decision which prevents this essential but neglected branch of our educational system from being submitted to independent and competent investigators.

The evidence and report published by the Forestry Committee of 1902 laid much stress upon the immense scope that exists for State afforestation, especially in Scotland. And it is satisfactory to note that, in spite of the general apathy of Ministers and their officials, our Society's action is receiving support both from the Office of Woods and Forests, whose administration, thanks to Mr Stafford Howard, is now more enlightened, and from the Labour Party in search of work for the unemployed, as well as from a considerable mass of independent public opinion. It is interesting to observe that those who believe in land nationalisation as a general principle, and those who do not, have alike discovered that for this one object, if for no other, they can heartily co-operate. The policy of State afforestation has behind it the most opposite schools of politicians, thinkers, and practical men; and it is this happy union of opinion, in favour of a sound and inevitable policy, that has at length induced the Government to make a start with one of the items of our programme, namely, the State afforestation of the Highlands as a commercial enterprise. That is what Inverliever represents, and nothing more. It is but the first step on a long road which will eventually lead to the acquisition of several millions of acres for State forests. It is a step that should be firmly planted, and for the next year or two there is little to be done save to press on with the preliminary organisation necessary to establish a regular Forest Plan for these 12,000 acres. In connection with this undertaking, it would be well to have a small Scottish Advisory Council whom the expert in charge of the planting and planning could consult about initiatory proceedings. As soon as Inverliever is fairly under way—and no time should be lost—we shall have to persuade the State to extend its possessions and to develop larger and larger areas of suitable country.

What we have to do now, as the Government refuses to allow the question of landward technical instruction to be opened in Scotland, is to take the matter into our own hands, and unceasingly to insist upon the purchase of the demonstration area which is so absolutely essential to any scheme of silvicultural training. We need 10,000 to 15,000 acres, with at least a couple of thousand acres of woodland upon it. Some large estate might be acquired with a view to keeping only what is needed, or else two or three small estates, forming a group in the same locality, might furnish between them the necessary specimens of mature and growing timber, together with bare land for experimental planting and observation forests; or, better still, one estate might be acquired in the Highlands for instruction in the growth and utilisation of coniferous timber, and another in the Lowlands for the same operations in hardwood: the Highlands having almost unrivalled advantages for the first product, and there being great scope in the Lowlands for raising many most valuable hardwoods. Inverliever, being almost bare, is useless for purposes of instruction, invaluable though it is as being a new departure in sound social and economic State policy. A demonstration forest—soon to become the sphere of a properly equipped forest school-is what we must now concentrate our energies on securing with the least possible delay. It could be laid out at little expense under a competent expert, and were land acquired at the rates current of late years, there should be little, if any, loss on the transaction. Eventually, of course, money would

21

be required for the equipment of the forest school, from which there would be, if no direct return, an incalculable public advantage, because, without it, neither the State nor the private owner has any chance of succeeding. These are points which need little discussion here, for upon them we have all been for long agreed.

Another consideration which must now be dealt with is the establishment of a Scottish Board of Forestry. Such a body. or else a Commission under the Board of Agriculture, is needed at once to schedule land suited to silviculture, more especially in the Highlands. This area should be defined and marked off, not only with a view to drafting a comprehensive scheme of State afforestation, but—and this would be its first duty to safeguard the public interest in all land suited to silviculture. Stress was laid on this point so far back as the appointment of the Deer Forests Commission by Sir George Trevelyan, of which I refused the Chairmanship, because the Secretary for Scotland could not be induced to extend the scope of the inquiry to include afforestation, which I regarded as the most important subject that could come under review. Things have moved on a little since then, but even at this moment the Small Landholders Bill renders an immediate investigation more urgent than ever, since sporting lands and grazings, once subdivided, and farms having fixity of tenure, would, so far as these may be suited to afforestation, be definitely lost to our prospective forest area. The great mistake made in Ireland at the time of the Land Purchase Acts, in excluding from their scope all reservations for forests, should not be repeated here. A great opportunity was then lost for the creation of national forests in Ireland. A Departmental Committee on Irish Forestry is now proceeding to consider—

- (1) The present provision for State aid to forestry in Ireland;
- (2) The means whereby, in connection with the operation of the Land Purchase Acts, existing woods may be preserved, and land suitable for forestry acquired for public purposes; and
- (3) The financial and other provisions required for a comprehensive scheme of afforestation in Ireland.

But it is to be feared that under present conditions there is little scope for afforestation in Ireland. Important, however, as silviculture might have been to the prosperity of

Ireland, it must always have been a minor consideration there as compared with its importance to Scotland, and what was a regrettable oversight in the case of Ireland would be a fatal error in any scheme for the solution of the Scottish land question; for with us afforestation is the crux of the whole problem, in that it is by far the surest way to increase the landward population. A policy to provide work ultimately for two or three hundred thousand men surely comes before one for creating a few score, or even a few hundred, of small farms. At anyrate, the alternative should be placed before the country, for if the whole of the Highlands was divided into small farms, it would add very little, if at all, to its existing population. Plant the Highlands, and the number of its people would double. Captain Sinclair provided that one of the three agricultural commissioners under his Bill should be a person skilled in forestry, but the Bill characteristically made no provision whatever whereby this skilled person could turn his knowledge to practical use. He was unprovided with staff, location, or funds; he was to be a mere name and cipher. Nothing could have come of this insertion of words in a project of law.

The proposed land Court had the widest powers to assume control of land at its own valuation for "experiment" in small farms; it was expressly debarred from purchase, which is sufficient evidence that the Government had never given the least practical consideration to forestry. For whatever the effects of divided ownership in agricultural occupation, it has not yet been advocated either as a panacea for the ills of silviculture or as a possible form of tenure for State forests. The effect of the Bill, were it to pass, which, fortunately, is not probable, would be to exclude all lands now allocated as outruns from any future scheme of State afforestation. Such moorland would carry no more population whether it were under the stock of a large or small farmer, but under timber it would support thirty or forty times the number of men it can now employ. To schedule land suited to silviculture is an essential preliminary to any real social and economic land policy in Scotland, and therefore we should press this consideration upon the country with all the force at our command. Unless that be done, and done quickly, there is grave risk that some haphazard reversion to eighteenth-century

methods of cultivation will involve prospective forestry, no less than our existing agriculture, in a common ruin. Owners and occupiers who are making good use of their land should, under a national scheme of forestry, remain undisturbed so far as is consistent with the public interest. But it may be roughly assumed that all heather land and rough pasture not needed for the well-being of existing small holdings, and rented under, say, 3s. an acre, which, under timber, is likely to vield twice as much, or more, should be scheduled for afforestation. Were a Board of Forestry entrusted with control, it could take over Inverliever, and undertake any future extensions on the same lines. It could select and carry out a demonstration forest. It could organise a forest school, and, taking over technical forestry education from the Education Department, which is not the proper department to administer it, it could supervise or assist in developing a complete system of forestry training, from the primary school to the university. This Board should be entrusted with the duty of safeguarding the public interest in lands suited to, but unutilised for timber growing; with the purchase of land and the organisation of State forests; with the establishment of demonstration or observation State forests and affiliated technical establishments, forest gardens and plots; while it should be consulted by the Education Department as to the curriculum in all schools in forest districts.

The Board should consist, at its inception, of a forest expert, aided by assessors to advise in the purchase or scheduling of land, and by a strong Advisory Council, for which the R.S.A.S. could present a fair choice of candidates. Later on the Board would develop, but at first the whole cost need not exceed two or three thousand a year.

As regards our Society—its branches have already achieved a notable success at Inverness and Aberdeen. It would be well if another branch or two could be formed. British lecturers in forestry are now an important group, from whom we expect much. A joint summer excursion for the English, Scottish, and Irish Societies, attended by them, with full opportunities for conference, would stimulate concerted action.

#### 5. State Afforestation in Scotland.1

By Lieut.-Colonel F. BAILEY.

The recent purchase by the Government of the estate of Inverliever, in Argyllshire, which, it may be hoped, is the first step in a scheme of State afforestation in the Highlands of Scotland, is a measure of great national importance.

In course of time this State forest, which, when fully developed, will cover an area of some 12,000 acres, will afford a much-needed object-lesson to private landowners in the growing of timber on business lines, with profit as the sole object of management; and a practical illustration will shortly there be given of the manner in which, according to expert opinion based on the results obtained in neighbouring countries, the formation of timber-crops raised with that object should be undertaken, and in which the young crops should be managed during the early stages of their growth.

It is true that full proof of the success attainable under the system followed on the Government estate cannot be afforded until a generation of trees has been raised thereon. And in the absence of such proof, or at least of practical demonstration of the methods which, applied uninterruptedly through all stages of a crop's progress, yield satisfactory results elsewhere, no real advance in the general development and extension of our own woodlands can be hoped for. Nor is this surprising; for proprietors can hardly be expected to embark their capital in schemes of planting which extend beyond the limits of their present aims, and which may indeed in some cases run counter to the exacting requirements of sport and amenity, until they have become convinced that such schemes offer a sufficiently good prospect of financial success.

But a number of landowners have now, by accompanying excursions of the Forestry Societies or otherwise, personally studied on both French and German soil the results achieved by the practice of systematic forestry in those countries; and some at least among them are doubtless sufficiently convinced of the potentialities of forestry at home to render them willing to make a start, if an example of such work were available here for more prolonged study by themselves and their employees; and

<sup>&</sup>lt;sup>1</sup> Reprinted from the Scotsman of 8th November.

particularly so if they could be shown how to deal with a portion at least of their existing woods (which have, for the most part, been raised with objects other than that of profit), so as to secure the best results now obtainable from them.

Demonstration in the latter, and very important, branch of the business cannot be given at Inverliever, because the crops growing there are too small in extent, and are not sufficiently varied in nature and condition. For this and the other purposes that have been so often set forth, it is necessary to provide accessibly-situated Demonstration Forests, which should include considerable areas of growing woods, of species and ages as varied as possible. The State alone is competent to own and control forests maintained for these objects, as on privately owned estates there is no security for that continuity of aim and action which is essential to the evolution of a crop of high-class timber-trees of ages running from 80 to 130 years. Two Demonstration Forests are required; one in the Lowlands, where "hardwoods" would form the principal crop, and another in the Highlands, where the stock would be mainly conifers.

The acquisition by the Government of these two areas, in addition to Inverliever and its hoped-for extensions, could not fail to give a powerful impulse to the development of forestry on private estates in this country. And as work of a very interesting nature could at once be undertaken in the existing crops, the Demonstration Forests would also provide the means of imparting practical instruction to students of the science from our University and other classes. Relatively brief visits by them to Continental forests, for study of the results there obtained, might shortly be substituted for the longer periods occupied in practical work abroad, which, until our State-raised crops become fully developed, will, unfortunately, be necessary for the instruction of the students in our advanced classes.

The State forests will be worked on a purely commercial basis, as an investment made for profit; and the management will be conducted with full knowledge of the methods of treatment which have succeeded in other and neighbouring countries. An accurate record will, from the very beginning, be kept of all work done, as well as of all expenditure incurred, and of all yield in material and money. This record, which, as a matter of course, will be available to those interested in it, will without doubt prove to the landowner that his woods may be made by

no means the least profitable part of his estate, and will, it may be hoped, render him willing to spend such available sums as may be required for their gradual development. It is true that in doing this the individual owner of to-day is, in most cases, sowing what he will not reap. But most proprietors are probably able to do something, at least on a moderate scale, towards the improvement of their family estates; and the stocking, annually without intermission during the period of possession by each successive owner, of even a small area of constant amount, would be a step in that direction, which might be taken without the imposition of an insupportable burden.

The ground and the species should be selected under competent professional advice; and the work should be carried on year after year until a forest composed of a series of similarly constituted crops, of regularly graduated ages, and standing on equal areas, has been formed. It would be a great advantage if the future forest could lie in one continuous block, though this is not an absolute necessity. The reason is that large blocks of forest are much to be preferred to smaller ones, because, in their case, the trees affording mutual shelter, develop better; the length of fencing and its cost per acre vary inversely with the extent of the area enclosed; fewer roads are needed; work is more concentrated, and is consequently cheaper, and more easily and completely supervised. If, for example, a proprietor had decided that he could annually plant out an area of 10 acres. and if 80 years were required to bring the crop to its most profitable dimensions, the total area of the future forest would be 800 acres; and so for every additional 10 acres which could be undertaken annually. It would, as a matter of course, be essential that the proprietor should make such a record of his scheme as would enable his successors to go on with it.

When once the suggested forest has been fully constituted, the owner, who will restock the ground as it is cleared, certainly continues to sow what he will not reap; but, on the other hand, he reaps what he did not sow, for year by year he will cut a full-grown crop, which had been planted by one or other of his predecessors, and in the case of crops which are to stand long enough to yield large timber, thinnings which can at least pay all annual outlay, will become silviculturally desirable, long before the felling age has been reached. Many proprietors appear to shrink from undertaking afforestation, because they

think it necessarily involves extensive operations with the immediate outlay of an amount of capital that they are not prepared to lay down. But if, having convinced themselves of the financial soundness of afforestation work, which they cannot do otherwise than through an example set before them by the State, they were to act as above suggested, an important extension of the industry would shortly become apparent.

No doubt a portion of the State Demonstration Forests would be set apart for experimental and educational work having more than a merely local interest, which the Government officers would conduct for the benefit of the country generally. In this section of the estate the object of management would differ entirely from that governing work in the main forest, in that it would not be expected to yield a money profit; and its records would consequently be separately kept.

The Royal Scottish Arboricultural Society has, for many years past, persistently urged the provision of a State Demonstration Forest, and it may be hoped that the important step now taken by the Government will shortly be followed by the acquisition of additional areas, more accessibly situated, and otherwise more suitable than Inverliever, for the educational and other purposes above indicated.

A point which will early become interesting is the effect that the starting of planting on a considerable scale in the Argyllshire Highlands will have in connection with the rural labour question. As sufficient local labour is not likely to be available, an opportunity will at once be afforded of putting to the test the suggestions recently made by Dr Schlich and others, for giving forest work to a portion of the army of the unemployed. But it is certain that the forest will require a large number of permanent workers, while the inauguration of systematic forestry is invariably followed by the development of various wood-using industries, which through it secure an unfailing supply of the necessary raw material; and it may confidently be expected that before the lapse of many years, a considerable resident population will have established itself within and around the new forest. of the forest in this direction is likely to be more important and far-reaching than in that of providing casual work for the unemployed.

# 6. The Douglas Fir as a Commercial Timber-Tree.

(With Two Plates.)

By John D. Crozier.

It is now eighty years since the Douglas fir was first introduced into Britain, and although during the first forty years or so of its existence in the country it was not generally recognised as an economic species, the latter half of that period witnessed a remarkable forward movement in the estimation of planters regarding the suitability of the tree for cultivation for profit.

At the date of its introduction, no doubt, the timber of the larch had come to be appraised at its true value, and planters could hardly be expected to launch out on large experiments with a new and comparatively unknown tree. Still the planting of Douglas fir went steadily on; and when, in later years, the larch showed unmistakable signs of deterioration, and the question of a more reliable substitute forced itself on the attention of those connected with woodlands, the Douglas fir was thought by many to be the only tree capable of filling the breach. Certainly no other tree, native or imported, possessed in so remarkable a degree the characteristics necessary to place it at the head of our list of coniferous timber-trees. Possessed of a robust constitution, a first class quality of timber, and a power of adaptation to soils and situations possessed by few other trees, the good opinion formed of the tree by early planters is not likely to be belied by the results of later experience.

A native of western North America, where many of our most promising exotics are found indigenous, and where also much of the lower flora is identical with that of Britain, showing the similarity of the climate of the two countries, it is found over an area of about fifty thousand square miles, and is perhaps the most widely distributed of all the American trees. It is found in the higher reaches of the Fraser river and the Cascade Mountains, in latitude 55°. From thence it extends along the coast and Rocky Mountain ranges to a point in Mexico, just within the northern Tropic. At its northern limit the climate is moist and the rainfall heavy; while at its southern extremity the climate is dry and arid, and the sunshine almost perpetual.

It is supposed to reach its highest state of development in the State of Oregon and Western Washington, and in the moist regions around Puget Sound, where specimens of 300 feet in height and 27 feet in circumference have been recorded. On the eastern (or Atlantic) slope of the Rocky Mountains, where the rainfall is light and the drying easterly winds especially severe, the tree, naturally, does not attain to those gigantic Under the most favourable conditions in the dimensions. foothills and valleys, its size limit is stated at 150 feet in height and 9 feet to 12 feet in girth. It reaches its greatest altitude in Colorado, where it clothes the mountain sides to a height of 11,000 feet, but at that extreme elevation it has been dwarfed by exposure to a mere bush of 3 or 4 feet in height. It will therefore be seen that in its native habitat the Douglas fir is subjected to extremes of heat and cold, moisture and drought, elevation and scorching winds, such as in Britain it would be impossible to find a parallel to; and when we further take into consideration the magnitude of the area over which it is found indigenous, the comparison shows all the more strongly the extraordinary accommodative nature of the tree.

The experience gained of the tree in Britain proves its partiality to the hills and valleys rather than to the open plains or plateaux, and no doubt when planted in the former positions its tendency towards great height-growth will be most fully taken advantage of. It is not too exacting as to depth or quality of soil, provided the subsoil is deep and porous and the drainage efficient, but an undrained soil is fatal.

The genus, which consists of only one species, is represented by several geographically well-defined forms or varieties, but for the purposes of this paper it will be necessary to deal with two of these only, the "green" or "Oregon," and the "glaucous," which, by common consent, we speak of as the Colorado variety. That these two varieties have not been sufficiently differentiated from a commercial point of view is a fact only too well known, and has been the cause of much disappointment. They are, however, easily distinguished, both by the form of the trees and the colour of their foliage, and by the

<sup>&</sup>lt;sup>1</sup> In reference to this point, Prof. Balfour, Hon. Botanist, writes: "Some of these are regarded by modern writers as of specific rank. Mayr, for instance, recognises four species in the genus."—Hon. Ed.





DOUGLAS FIR (Colorado Variety).

DOUGLAS FIR (Oregon Variety).

NORWAY SPRUCE.

Specimens from seven years old plantation—from date of planting. The Colorado Variety and the Norway Spruce were five years old when planted, and the Oregon Variety three years old. Their respective heights are now: Colorado Variety, 8 ft. 10 ins.; Oregon Variety, 15 ft. 6 ins.; Norway Spruce, 10 ft. 11 ins.

difference in their cones, as may be seen from the accompanying photograph. (Fig. 3 Plate VII.)

On the estate of Durris, Kincardineshire, the Deeside property of Henry Robert Baird, Esq., the Douglas fir was first planted about seventy-two years ago, and since that date it has been reared and planted out on a more extensive scale than on any other estate in Britain. The original tree has now reached a height of 114 feet, girths 12 feet 6 inches at 5 feet above ground-level, and contains over 300 cubic feet of timber. It is, of course, of the green or Oregon variety.

The Colorado tree was not introduced until about thirty to thirty-five years later, but about that date considerable numbers were planted in admixture with Scots pine and spruce in various parts of the estate. It has not, however, proved a success as a timber-tree, being considerably slower in growth than either of the species with which it had been mixed, and in many cases it has been quite suppressed before reaching its thirtieth year. These results are being verified by later experiments, but its suppression seems destined to take place at an even earlier age. As a commercial tree, it is of no account in our climate, but it is capable of withstanding severe exposure, transplants well, and is quite frost-hardy. Its principal uses will probably be found in the formation of shelter-belts, and for planting in those positions where it is not desirable to see trees of large stature.

In the Douglas fir of Oregon, however, we have a tree of a totally different character, and one which, after an extended trial, has proved its suitability for all practical purposes. On the estate already mentioned, occupying the northern slope of the eastern extremities of the Grampian Hills, the plantations rise from 100 feet to 900 feet elevation, but these are backed up, towards the western part of the estate, by a still higher range of hills, which in a measure tends to break the severity of the gales which blow from that direction. The soil alternates from a light loam overlying gravel, in the valley of the Dee, to a gritty boulder clay, in parts mixed with peat, at the higher elevations, and overlies gneiss, the principal geological formation of the locality. The Douglas fir has been tested on all classes of soil, and at elevations varying from the lowest up to the highest point, and in no case has it failed to make satisfactory headway. At an altitude of 850 feet, it may be seen,

34

accompanied by *Picea sitchensis* only, racing away from larch, spruce, and Scots pine. While averse to moisture in the soil, a considerable amount of humidity in the atmosphere is certainly beneficial to the tree. The average annual rainfall on the low ground amounts to 35 inches, and the aspect being northerly, the air is cool and moist; but a very considerable increase in the amount of rainfall above stated would, I feel convinced, give a correspondingly good result on the growth of the tree. On good forest soil it is no infrequent occurrence to see trees in the pole stage making growths of 4 feet and upwards in the course of a single season. This rapid growth, however, is not maintained for long; but under favourable conditions an average annual growth of about 2 feet would seem to be well within the possibilities of the tree up to its sixtieth year.

In North America the timber is known as Oregon and Columbian pine, and exported under those names. According to the author of The Forests of Canada, it is used for almost every purpose, from wharf- and ship-building down to the manufacture of household furniture, and, owing to its great durability when air is excluded, it is especially valuable for pile work in the building of bridges. The average cut per acre is calculated at 50,000 cubic feet, and as all trees above 5 feet diameter and below 2 feet are not included in the cut, it would be interesting to know the limit of production. Whether under cultivation in this country it will ever approach either the volume or the value attained in its native habitat, is a question frequently asked, but which it would be idle to speculate upon. In the first place, the requirements of our home trade do not demand a heavy class of timber, and secondly, no one would consider a rotation based on the period required to bring those trees to their matured state within the limits of practical forestry. Any comparison, however, between the quality of the home-grown and foreign Douglas fir must, in the meantime, be greatly to the disadvantage of the former, as while the oldest trees in Britain are still in an immature state, the imported timber usually is the product of several centuries growth.

In appearance the timber of home growth resembles larch, but in a young state it is not possessed of the density and toughness of fibre of that timber. For standing in contact

with soil, and for such purposes as gate-making, fencing, etc., where the ability to stand tear and wear is a desideratum, it is inferior to larch, but there are many other purposes for which it is infinitely superior, and for the supply of which a much greater volume of timber is required. For constructive purposes of all kinds it is especially suited, and, owing to the beauty of its grain and the ease with which it can be worked, it is valuable for the finished work of interiors. The timber stains well, and, when varnished, takes on and retains a beautiful gloss. Outlying and badly grown trees, when sawn up, are liable to warp, but this defect is not apparent when dealing with trees of clean straight growth, and with home timber more freedom may be used in regard to nailing. In a younger state the timber has been tried and found useful as curingbarrel staves and heading, and for box wood, for which, in this locality, there is an unlimited demand.

What the most profitable length of rotation may be is a question which will have to be determined by trade demands, but to provide timber of a class, fitted for house construction, any period short of one hundred years need not, I feel convinced, be contemplated, and on deep rich soils probably other ten or twenty years will require to be added to that period. No doubt trees of sufficient size to produce beams and scantlings of any size desired may be grown in fifty to sixty years, but it would be nonsensical to speak of timber of that age as matured, and, judging by the vigorous state of the oldest trees in the country, the prospects are that a long rotation may yield better financial returns than a short one.

For simple high-forest, pure cropping will be found in every way the most practical system. In mixed plantations an even height cannot possibly be maintained, owing to the dominating character of the Douglas fir, and the canopy, which in its case is always necessary to check the growth of the persistent side branches, cannot be kept intact. Formerly the high price of seeds and plants was a sufficient bar to pure planting on an extensive scale, but now that seedling Douglas fir may be purchased at prices not greatly in excess of those ruling for other coniferous forest trees, pure planting is quite defensible on economic grounds, and at any rate, any saving effected in the planting, by mixing with other trees, will be more than lost sight of in the cost of pruning, which at a subsequent date will

become necessary. Another advantage gained in pure plantations is, that the danger of loss or deflection of the leading shoot by winds, frequently noticeable in mixed plantations on exposed sites, is nowhere apparent when dealing with the tree planted and cultivated on common-sense principles.

It would be matter for surprise, indeed, were any result other than that of disappointment to follow the directions frequently laid down for the planting of the Douglas fir in a mixture of other trees; but should a mixed plantation for any reason be decided upon, and the Douglas fir still be regarded as the permanent crop, a distance of more than 6 feet apart should not be contemplated, and the interspaces should be filled up to 3 feet over all with Norway spruce, which seems about the only tree suitable for the purpose.

In that case, 1210 Douglas firs would be required per acre as standard trees, and with the matrix composed of 3630 Norway spruce, the cost of planting, where the plants had been purchased of a size sufficiently large to enable them to be put directly out to the forest, would be considerably lessened.

As no area of pure Douglas fir in this country has yet reached maturity, statements purporting to show the volume and value of pure crops must be regarded as somewhat hypothetical. There can be no doubt, however, that yield tables dealing with the ordinary coniferous forest trees help us but little in arriving at a true estimate of its productive capacity. As a result of measurements taken in various parts of the estate, and under varying conditions, I found that the increase over spruce in cubical contents was never less than 50 per cent., frequently 75 per cent., and in some cases as high as 120 per cent.—the higher percentage showing at the higher altitudes. As regards Scots pine, the increase was more pronounced, varying from 150 per cent. to 200 per cent. Those figures represent the mean of a number of measurements taken in each plantation, and the trees selected were as nearly as possible an average of their kinds.

The Douglas fir plantation at Taymount is perhaps the oldest pure wood of the species in this country, and it has at different periods been dealt with by forestry experts. In 1888, the plantation then being only 28 years of age, Dr Schlich estimated the volume at 2956 cubic feet per acre, quarter-girth measurement. In the winter of 1899 and spring of 1900

Dr Nisbet shows in Our Woods and Forests, page 208, that the plantation had increased to 4850 cubic feet per acre; while in 1903, or after only three years' growth, Dr Somerville in the Transactions, Vol. XVII. page 273, calculates the contents per acre to have reached the enormous total of 7977 cubic feet. Either Dr Somerville's estimate would appear too high or Dr Nisbet's too low, as, judging by the rate of increment between the years 1888 and 1900, the three years between 1900 and 1903 could hardly have been responsible for an addition of 3127 cubic feet per acre.

As a pit-wood tree the Douglas fir is well adapted, and is deserving of consideration wherever crops cultivated for that purpose are found to pay. Crowded together in pure plantation, by the time they have reached their thirtieth year they will be found capable of yielding an amount of pit-wood almost incredible to those who have not seen the tree so grown. For this purpose the planting should be done at not more than 3 feet apart, as otherwise a gross basal growth and a too branching stem will certainly follow.

While not a suitable tree for mixing with other species of even age, the Douglas fir may with great advantage be introduced as an under-crop in older oak and larch plantations. In this respect it has no rival amongst conifers, taking into consideration the value and volume of the timber it is capable of producing under the shade of other trees. As the result of experiments conducted on this estate, now of thirty years standing, its superiority over spruce and silver fir has been abundantly proved. Where both of those species have failed, either as the result of attack by aphis or too dense shading, the Douglas fir has grown into useful timber. In comparison with beech as the shade-bearer, the latter probably is preferable, owing to the greater amount of organic matter it is capable of depositing on the ground, but as beech timber is of comparatively little value, better financial results may be anticipated from the planting of the former. Excellent examples of the beneficial results obtained by underplanting larch with both beech and Douglas fir may here be seen, but no apparent advantage has been gained by the use of the former over the latter. The soil in both cases has been greatly improved, and the overhead larches have increased in volume over the parts not so treated to an almost incredible extent.

Underplanting larch woods with Douglas fir should not preferably be delayed beyond the thirtieth year, as the danger of too long delay may be experienced in the unlooked for decay of the larches before the Douglas firs have reached a marketable size. All the suppressed and weakly stems should have been previously removed, and from 500 to 600 standards will be sufficient to leave per acre. The size of the Douglas plants to be used in the operation must be determined by local conditions, but if no danger is to be apprehended from ground game, 2- or 3-year-old seedlings may be used and planted by the dibbling-iron, a cheap and efficient process.

April we find by experience to be the most favourable month for planting, and for general use 2-year seedlings 1-year transplanted give the best results. These may be planted either by pitting or notching, but the latter method, in our moist climate, and when carefully done, is quite satisfactory. The distance at which they are put in is usually from 3 to  $3\frac{1}{2}$  feet. In ground covered with a rank growth of bracken, pits are opened at 4 feet apart, and a larger class of plant used. With a little attention for the first two years after planting, the Douglas firs rapidly assert themselves, and in a few years are capable of suppressing the rankest growth.

When thinning operations become necessary they must be conducted with a light hand, the aim being always to keep the ground as heavily stocked as possible, without endangering the health of the plantation, until it has reached its maximum of height-growth, in order to promote branch-shedding and to guard against damage by gales.

As regards the reproductive capacity of the Douglas fir, it leaves little to be desired. Indeed, its early reproductive features were regarded by some as a sure sign of early decay, but this belief has now been dissipated.

Trees of about 15 years of age, if occupying an open, sunny position, may be depended upon to produce a supply of good seed, but from 30 to 50 years may be regarded as the most fertile period. As an illustration of this fertility, I had the produce of an outlying specimen tree 40 years of age counted, and found that the total number of cones amounted to over 15,000. The tree was branched to the ground, and even the lowest tier was thickly covered with cones. There is no rule by which a good seed-harvest may be foretold. The bloom, which

shows itself somewhat precociously in our climate, is frequently nipped by late frosts, otherwise every second or third year might be depended upon for a supply. Like the larch, there is a red and a white flowered variety, but whether there is an accompanying variation in the quality of the timber. I have not been able to The white variety may be distinguished by the lighter colour of its leaves and its more spreading habit. As a timber-tree it is inferior to the red variety, but it is also less common. The cones ripen in the beginning of October, and they should then be collected without delay, as in presence of drying winds the scales open and the seed is shed. After storage in a dry loft during the winter, the cones, if the quantity is not too large, may be exposed to sun-heat, and the seeds extracted in that way. In the beginning of May the seeds should be sown out in well-prepared beds 3 or 31 feet in width, 1 lb. of seed being allowed to every 8 or 10 lineal yards. Much depends, however, on the quality of the seed, and in purchasing, a guarantee as to the germinative capacity and the source from which it has originated should be demanded. It has been the practice of some seed firms in the eastern States of America to supply seeds of the Colorado variety when the other had not been specially mentioned, and this, not from dishonest motives, but because the glaucous variety is in those parts regarded as of the two much the hardier and more reliable tree. Where the collection of the seed is under control, much may be accomplished in the improvement of the type of the tree commercially. The tendency to sport as regards shape of bole, branch formation, and shade of colour, is a specially noticeable feature of the tree. Two trees may be seen growing closely together in the plantation, the one possessed of a mast-like stem and practically devoid of branches, while the other, whose branches may shoot out at an upward angle, is still clothed to the ground, and as a timbertree presents a most forbidding appearance. Obviously the seeds of such trees as the latter type should not be collected, but may be left as fit food for the squirrels, which are specially fond of them. That seedlings inherit to a certain extent the characteristics of the parent is an admitted fact, and, as a result of this knowledge, no one would willingly select trees with a badly developed stem, or which possessed other undesirable features. as the standard or mother-tree for natural reproduction. If this careful selection, then, is necessary in the one case it is no less

40

so in the other, and especially as regards the Douglas fir in its present unfixed type. While the horticulturist has by persistent endeavour, from his point of view, improved the standard of almost every plant under his charge, comparatively little has been done in an endeavour to improve the type of our timbertrees, or even to preserve their best features.

To attack by insects and fungi the tree is not immune, although less subject than our native and longer introduced trees. In the nursery, Botrytis Douglasii is responsible for the killing back of a few young shoots, and Phoma Douglasii at a later stage occasionally attacks the stems of the tree, but the real damage to be guarded against is that caused by Agaricus melleus and Trametes radiciperda, which attack the trees after being planted out in the forest. On old clearings, or when underplanted in old hardwood plantations, they are likely to be most destructive. Another fungus, Aecidium coruscans, which I believe has not previously been observed in this country, or mentioned in scientific literature as attacking the Douglas fir, I found in a few young plants in the nursery some time ago. It is a species of rust-fungus, and is stated by Hartig to be common on the spruce in Sweden and Finland. (See Fig. 2 Plate VII.)

As regards insect pests, the pine weevil, *Hylobius abietis*, seems to be the only cause of damage to the tree, but with proper precautions injury from this source can be easily avoided. *Megastigmus spermotrophus*, a species of the *Cynipidæ* or Gall wasps, is occasionally destructive to the seeds, but its lifehistory is still under investigation, and it is to be hoped that some means of overcoming its attack may be devised.

The practical experience gained of the Douglas fir in this country points it out as one of the most valuable timber-trees ever introduced, and when its suitability for commercial purposes has been fully realised, there can be no doubt it will be one of the most largely planted of all our timber-trees.

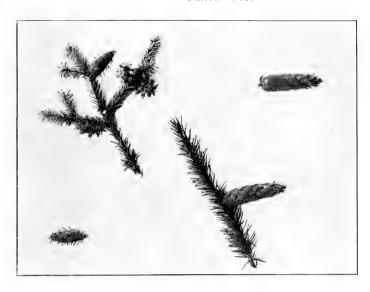


FIG. 3. CONES OF THE COLORADO AND OREGON VARIETIES OF THE DOUGLAS FIR.

The cone of the former (see upper part of figure) is smaller and more evenly conical, and has its bracts more exserted and reflexed.

Fig. 2. ABCIDIUM CORUSCANS ON DOUGLAS FIR (DRIED SPECIMEN).

The leaves and branches below point of attack have developed normally, while above the leaves are short and fleshy, and bear aecidia on all their four sides.

# 7. The Nursery Treatment of the Western or Californian Hemlock Spruce.

By J. M. MURRAY.

The Western Hemlock Spruce (*Tsuga mertensiana*, Carr) has hitherto been looked upon only as one of our finest ornamental species, but, judging from its habit and rate of growth, it may also come into consideration as being likely to form a valuable forest-tree in Britain.

The only objection that can be fairly urged against the general and liberal use of this tree for planting, is the exorbitant price asked by nurserymen for the plants. This price is no doubt determined to a great extent by the scarcity and dearness of seed. Along with this, there is the difficulty experienced in rearing the plants. But the scarcity of seed is not likely to be long continued, since we have now in this country trees which bear seed freely. As a proof of the fertility of these seeds when in a favourable situation, thousands of natural-grown seedlings may be seen springing up. Also, judging by experience, it is reasonable to believe that plants produced from home-grown seed will be better adapted to our climate than those of foreign origin.

While employed on an estate in Perthshire, I had considerable experience in rearing the Western Hemlock spruce, more popularly known to arboriculturists as *Abies albertiana*, the Albert spruce.

On this estate many thousands were reared from home-collected seeds, and I will now endeavour to explain the chief points to be attended to in raising the plants.

It is during the earlier stages of growth that the greatest care must be taken, since then the plants are, as compared with other forest-trees, somewhat tender.

The cones become ripe in October, and the seed may be easily extracted, but a few hours in a kiln will be of great assistance in bursting the cones.

The germinating power of the seed is equal to that of the Douglas fir. The seeds should be sown about the end of April, and as they are very small, care must be taken not to sow too thickly. The covering on the seeds must not be too heavy, barely a quarter of an inch being sufficient.

Most of the plants were reared in an open border, but some were also reared in propagating-boxes in a cold frame.

With the fostering influence of a better soil, the finest plants were certainly raised in the latter manner, but with more expense than the former. Where only a few thousands are wanted, and the necessary attention can be given, I should certainly recommend the raising of the plants for a time in boxes under glass. Germination takes place in about twenty-one days after sowing. Protection must be then given against small birds, such as finches, which seem to be very partial to the newly germinated seedlings.

Very great care must also be taken at this stage as regards watering and shading; in fact, on this to a great extent the welfare of the crop depends. For several weeks the young plants should not be exposed to the direct rays of the sun.

To prevent this, the plants should be shaded with a light covering of tiffany. This may be supported on a light framework, about 12 inches above the plants. A convenient method is to run two wires through the tiffany and fix them to the framework, thus making it convenient to slip the material off and on. This shading should be kept off at night and on dull, sunless days, and only put on during bright sunshine.

The next point in regard to which great care must be taken, is in watering. Overhead watering must always be avoided as much as possible. In the case of plants in boxes, it is much better to immerse the box in a trough of water about once a fortnight. Where overhead watering has to be done, it should be done during the afternoon, and never at night. When watering is done at night, damping off is more liable to occur.

Plants reared in the open should be protected against frost during the first winter at least. In the first year their tops do not always get sufficiently matured to withstand frost, and also at this age the plants are apt to be thrown out by alternate frost and thaw.

A method of protection which I have seen used was to place rough boarding on the framework previously erected for the tiffany. This also affords a protection against snow, and the covering can be taken off on fine days. The plants reared in boxes may be protected in the same way.

It is better to defer transplanting until the plants are two years

old, as by this means they can be protected, if necessary, during two successive winters.

The full cost of rearing under this method (i.e., in an open border) does not exceed 5s. per thousand for two-year seedlings, and the after treatment required is similar to that used for the larch, Scots pine, or spruce. This being so, it may be reasonably expected that the price of full-grown plants of Tsuga mertensiana, grown from home-collected seed, should not much exceed the price of larch, etc.

The Western Hemlock spruce requires a situation moderately sheltered, but will grow on any friable soil free from stagnant water. It also seems to delight in a little side-shade.

When young, the tree has a very striking and graceful appearance. The leading shoot and the extreme points of the lateral branches are always pendulous, and the tree resembles somewhat in habit *Cedrus deodara*. Its growth, however, is much more rapid than in that species, for it attains a height of over 85 feet in 46 years, with a trunk fully 7 feet in circumference at 5 feet from the ground.

The durability of the timber of British growth has not yet been ascertained, but that which I have seen cut up, although of young growth, appeared to be hard, tough and close-grained. To all appearance the wood seems to be as useful and durable as either the Scots pine or the common spruce, and it is not so readily affected by heart-rot as the last-named. Except. however, in very favourable situations, I would not recommend its use as the ruling species in a plantation. As a dependent species in a mixture with other conifers there are few sites or soils on which it will not thrive. In rate of growth, so far as I have seen, it exceeds that of the common spruce. Although the plants are somewhat tender during the first two or three years' growth, after that age they are quite hardy. On account of this, it is best to defer planting till they are about four years old, when they will be from 24 to 30 inches high. The time for planting should also be considered, and the greatest success is got by late spring planting.

It is hoped that the foregoing notes may be of some assistance to those interested in the rearing of this species.

#### 8. The Cultivation of Hardwoods.

By J. BOYD.

In submitting the following remarks regarding the cultivation of hardwoods, I do so with diffidence, yet with the conviction, which has grown on me, that very many of our hardwood plantations have suffered permanently through the very common practice of mixing the broad-leaved trees with conifers. It has been my lot to have had something to do with such woods during all my experience in forestry, and the result of that experience, and of observations elsewhere, is that, rightly or wrongly, I have arrived at the conclusion that, generally speaking, the practice is wrong, and that, unless under exceptional circumstances or special conditions, hardwoods should be grown by themselves, and conifers likewise.

Plantations, created under the system referred to, have usually a certain number of hardwoods planted out by single trees in lines, at distances apart varying from about 6 to 15 or 16 feet, there being generally a mixture of four or five kinds of hardwood trees, and the intervening spaces being filled in with another mixture of three, or probably four, kinds of conifers. All the trees are more or less of an even age. The result is, not a mixed wood, but a very complex mixture of trees, which is very difficult to manage. Of course, the conifers are only supposed to be retained on the ground for a short period, as nurses, to draw up the others into clean, straight stems, and this, in itself, entails a considerable amount of extra attention and expense in the management, if the woods are ever to have a chance of attaining the end for which they have been formed. Even with the best possible attention it is a very difficult task, and sometimes an impossible one, to keep the woods as dense as they ought to be, and, at the same time, to preserve the hardwoods. Not infrequently, indeed, does it happen that a large proportion of the nurses have to be removed so early—to prevent the permanent trees from being overtopped - that the canopy is destroyed, with the result that instead of the hardwoods being drawn up into clean straight stems, the very opposite takes place. The extra space given, through the removal of the nurses, encourages an increased lateral growth at the expense of the desired growth in height; and so much is this the case, that in middle life the ground may become stocked with trees having short stems, large crowns, affording an unsatisfactory canopy, and with an undergrowth of all manner of herbage, all of which conditions are—as is well known—opposed to good results. In the end, when the final crop is removed, the return will be very far short of what the locality was capable of producing had the ground been properly stocked and the crop properly managed, or even had the ground been properly stocked and the crop left to nature. Further, in all probability, the soil will have seriously deteriorated, and have been rendered unfit for restocking with anything but trees of an inferior class. If this is the result obtained by the system with an expensive management, it is surely proof that there is something very far wrong with it. It may be argued, however, that the fault is not in the system, but in the management; and that, if the crop had been left to itself, the result would have been more satisfactory. Undoubtedly there can be no better test applied, than to allow nature a free hand, because any piece of ground if properly stocked, and left to nature until middle life, will give successful results if properly handled thereafter. In the case of such complex mixtures as are under discussion, there may be instances where nature has guided the development to a satisfactory result; but, with such a foundation to work upon, she is handicapped; and, although she can do much in the way of rectifying man's errors, there are many cases where her efforts prove ineffectual. Where such mixtures are left to nature, it will occasionally happen that the final crop is a hardwood one; but it is much more likely that in early life the conifers will gain the ascendency over the hardwoods, and, in the final crop, there will be a preponderance of the nurses on the ground. The reason of this is that the majority of the hardwoods will have been overtopped in the first fifteen or twenty years, the only exceptions being those individual trees whichon good situations—have become quickly established, and have been able to hold their own with the quick-growing conifers. Thus it is that the best nature can do gives but poor results. Instead of a hardwood crop, we have a crop of conifers with a few of the hardwoods dotted through it, a crop which, financially, may be quite as much a success as one which had received careful attention in order to preserve the hardwoods; but which is by no means a success in the true sense, because the ground

was stocked with the object of having a crop of hardwoods, and that end has not been attained; and further, as the result is practically a crop of conifers, it was shere waste of money to plant so many of the more expensive hardwoods. The financial result, it has been admitted, may be equal to that of the hardwood crop already discussed, but then that is far short of what ought to be obtained from the soil; and, moreover, the favourable return is due not to the quality but rather to the quantity of timber produced by conifers on such a soil, the timber being almost invariably soft and inferior, and, in the case of Scots pine, unless in very old trees, being deficient in redwood. It is indeed no unusual thing to fell Scots pine trees which have grown in such localities for 90 or 100 years, and have attained a diameter of from 15 to 18 inches, and to find that they have no more than from 6 to 8 inches of heartwood. No doubt they have not reached maturity at that age, but then they would take nearly as long as oak would to reach that stage; and even then the quality of the timber would be inferior to that grown on a more suitable

As regards revenue, the return from such a crop of Scots pine would not stand comparison with that obtained from a full crop of oak. Therefore if the soil is capable of growing a crop of the latter, or other valuable hardwood, it is a mistake to have it stocked with the former, except where unusual circumstances justify the growing of conifers for some express purpose, such as for pit-wood; but then, of course, there ought to be no intermixture of hardwoods.

soil.

Some reference has already been made to nature's work in rectifying man's mistakes; and it has been implied that the tendency of her work, when undisturbed, is to allow either the hardwoods or the conifers to gain the ascendency. This indicates that it is unnatural to have them growing in company; and therefore, according to the laws of nature, they should be grown apart—each class on soil and situation suited to its proper development. It would look a most unnatural and stupid proceeding to plant oak, beech, and other hardwoods amongst Scots pine on a poor, bare moorland or hill-side; and why should Scots pine and other conifers be planted amongst oak, beech, and other hardwoods on a soil and situation which is well adapted to the proper growth and cultivation of these latter. In the case of natural forests, hardwoods and conifers may be found

overlapping to some extent, but in a general way the one class is quite distinct from the other, and it would surely be more reasonable to follow nature, than to work at cross purposes with her. Indeed, almost everything seems to be in favour of the former course: the management is simpler, the fertility of the soil is better preserved, and the financial results are more satisfactory. The chief difficulty would lie in the formation of the woods, and especially so where there is a variable soil, which is not uncommon in many localities. In such cases, a considerable amount of care and skill would be required to ensure the whole ground being stocked with trees suited to the various soils. If this were not secured, the growing of hardwoods by themselves might prove to be no more satisfactory than the mixture system. In this, as in all things, the forester, if he wishes success, must study nature and be guided by her. Indeed, at all times he should follow in the steps of nature, and assist her where necessary, but on no account should he attempt to drive her into paths of his own making.

Before concluding, it is worth while looking at some of the causes that have brought about the adoption of the system of planting hardwoods and conifers in mixtures, how these causes have taken effect, and how best they may be counteracted in the future, if already they have not been counteracted to some extent at least. If the want of means for acquiring a proper knowledge of the elementary principles of silviculture be considered one of the causes, then it may be said that this difficulty has already been removed, for the means available at the present time are so ample, that there is no reason for anyone being in ignorance of these principles, and any man who remains ignorant of them has only himself to blame; because, within the last twenty years, many thoroughly sound, practical, and scientific books have been put into circulation, and other facilities are now within the reach of all.

The very great success of the larch, on its introduction into this country, combined with its high quality as a valuable timber-producing tree, resulted in a craze for planting larch anywhere and everywhere; this probably was the chief cause for the initiation of the mixture system. Experience of the ravages of the larch disease may be said to have counteracted this practice, to some extent, as it is now well known, and generally admitted,

that it is a mistake to plant larch except where the general conditions suit its growth; and foresters who still plant it indiscriminately are exceptional.

The difference between the cost of planting any given area with hardwoods alone, and that of planting it with a mixture, has had a great influence in promoting the system under discussion. It is a cause which still exists and will be much more difficult to overcome, because of the difference between the cost, per unit, of seedlings of the common conifers and of those of the most valuable hardwoods. This difference must always be very considerable, and is therefore likely to remain a factor in favour of mixing hardwoods with the cheaper kinds; but discretion ought to prevent this circumstance from having too great an influence. The difference in cost has, of course, been greatly increased through the depredations of ground game, which necessitate the practice of using large hardwood transplants, where, but for the existence of these pests, smaller ones would have served the purpose better, at probably less than half the cost. Not only have these enemies of forestry affected the cost of regeneration in this way, but they have, in many instances, practically wiped out the hardwoods from stretches of young plantations, and left large areas with nothing but conifers. This also has had a very considerable influence on stimulating the system of mixtures; the mixtures being planted with the idea that there is a remote chance of having a hardwood crop, but with the certainty that, if this is destroyed, there will still be a crop of some kind on the ground. It is therefore satisfactory to know that the real destructiveness of ground game, and especially of rabbits, is beginning to be realised by many landowners, and that they are being reduced to reasonable numbers, or, better still, exterminated. The removal of this cause may thus be said to be within sight, and it is hoped that the day is not far distant when 2-years hardwood seedlings, or 3-years once transplanted, may be generally used for planting-out purposes. This will reduce the cost of planting any area with pure hardwoods to about that which is incurred in planting the mixtures under the present system, and it will undoubtedly give better results. Further, with rabbits kept in their proper place, there is no reason why natural regeneration should not be greatly resorted to; and where rabbits have been abolished. or sufficiently reduced, it is simply astonishing to see how many seedlings appear, where formerly not a single seedling more than one year old was to be found.

The plea of returns from early thinnings is another of the props of the mixture system, but a very weak one, as too early thinning has very often been the means of doing incalculable harm to the final crop; and even apart from this, it is questionable whether such thinnings can now be justified at all, because larch was the principal tree for early thinnings, and its proneness to disease has reduced its value in that respect; and what with creosoting and other methods of wood preserving, hardwood poles are almost of equal value, for fencing and other purposes, with larch or fir thinnings.

The above causes then, which have been responsible for the prevalence of the system discussed, and which, it is maintained, are not conducive to the best results in the cultivation of hardwoods, may be held to have been removed, or to have become of minor consideration compared with the importance of producing the best quality of timber, and of making the best of the land. Indeed, if the statements herein made are correct, the causes referred to, with the exception of the nuisance of ground game, are at the present time of little or no consequence; and if the injury done by ground game were estimated at its real value throughout the entire country, there would be every possibility of a reform being achieved in silviculture in general, and in the cultivation of hardwoods in particular.

(The author proposes to continue this subject in an early issue.)

# o. The Cultivation of Osiers.

By ROBERT SINCLAIR.

The following is a brief statement of an experiment in the cultivation of osiers on the Atlantic seaboard in the island of Harris.

The soil is partly deep peat, partly a loam of peat and boulder-clay débris, and partly a poor, brashy, gravelly boulder drift of an exceptionally hungry nature. The extent of land is one-eight of an acre, the aspect is northern, and badly exposed to Atlantic blizzards from the north-west. Referring to the Board of Agriculture's leaflet on osier growing (No. 36), it would appear that all the conditions were most unfavourable.

In March 1905 the plot was planted with cuttings 1 at 30 ins. by 24 ins. (much too far apart, as the writer has since learned), and all the sets rooted very well. When the young shoots got to be about 3 or 4 feet high, a gale of two days' duration from the N.W. loosened every stool in the plot, laying over the whole crop to an angle of 45 degrees. Shortly afterwards another strong wind from the E.S.E. threw the whole lot just about as far back the other way. Needless to say the writer was in despair, and made desperate efforts to firm up the stools by tramping, but to little purpose, and the plants kept playing battledore and shuttlecock with every change of wind until the crop was cut in February of 1906.

The produce was carefully weighed, and it scaled 1022 lbs. green off the stool, plus some small bundles given away unweighed. This is just 3 tons 13 cwts. per acre, and it may be pronounced phenomenally heavy for a first cutting, even under favourable conditions in the osier districts of England.

The second crop was cut in January last (1907), and scaled 1753 lbs., or just over 6 tons 5 cwts. per acre. This year the crop looks like making at least 10 tons per acre. The experiment is being extended this year by planting out more plots with other varieties, but it is too soon to give any statement regarding results.

No account has been kept of the cost, as most of the labour has been done by the writer himself. The best results appear to be got from the use of 2-year old cuttings, costing from

<sup>&</sup>lt;sup>1</sup> The author informs us that the trade name of the osier planted is Merrion osier. The staff of the Edinburgh Botanic Garden, to whom twigs were submitted, identified these as Salix viminalis, -Hon, ED.

9s. to 12s. per 1000, and as it takes about 17,000 to plant an acre, and, further, the fencing must be proof against all farm stock and rabbits, it is manifest that a large initial outlay must be faced, and that at least one year is (in a sense) lost waiting for revenue.

All the same, few crops pay so well, and none are so independent of weather, when once fairly established. Properly planted and cared for, osiers ought to form the mainstay of the small landholder, and need not be beneath the consideration of even the most advanced agriculturist on highly rented land. They like good land, well treated in every way. They make splendid shelter for other and more tender crops, they stand the sea blasts perfectly; those under the writer's observation here are now some 8 or 9 feet high, and have been frequently whipped by north-west blasts direct from the ocean, yet not a leaf has been removed or injured, nor are even the tender tops injured—a remarkable testimony to their value as a shelter-plant.

From a national point of view it may be presumed that silviculture will, ere long, take a very advanced place in the use of land in this country. It is fairly obvious that further depopulation over many areas is unpreventible unless by some constantly productive employment within those areas, and it is equally obvious that repopulation can only be brought about by similar means. There are vast areas of heavy rainfall within the United Kingdom of Britain and Ireland admirably adapted for the production of first class timber—that is a fact universally admitted by all who have any knowledge of the subject,—and it seems a reasonable belief that a great and comprehensive scheme of forestry, in conjunction with agriculture, horticulture, and their thousand and one allied industries, would not only go far to arrest further rural depopulation, but probably (perhaps certainly) be productive of a strong surplus population to carry on the industries of our large cities, as well as to help to stock our colonies.

In any such scheme the lowly osier deserves recognition. (1) It would yield an immediate and constant profit; (2) it would give immediate shelter; (3) it would yield an early and a rapidly increasing revenue, until the forest timber came to do so; (4) its cultivation is simple; and (5) its harvesting is independent of gales or rain.

## 10. An Attack by Sawfly Larvæ.

(With Plate.)

By FRED. MOON.

On the 23rd of June 1906, while inspecting a young Scots pine and larch plantation, I found it very badly infested with sawfly larvæ, and trust the following particulars and means taken to combat the attack may be of interest.

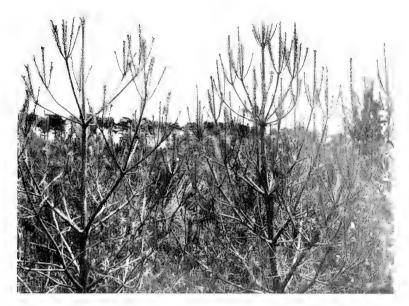
The plantation in question is about four and a half miles S.W. from St Boswells station. The elevation is about 700 feet above sea-level. The area of the plantation is about  $15\frac{1}{2}$  acres. The south half is ten years old and the north half nine years.

When first noticed, the larvæ would be about three weeks hatched, and the attack was by far the most severe met with in my experience, many of the plants being simply loaded with larvæ. I at once got a Vermorel sprayer, and after a few experiments with Paris green, had 10 lbs. of this and 10 lbs. of wheat flour mixed and put up in 1 oz. packets, each packet being mixed with  $3\frac{1}{4}$  gallons of water, this being the capacity of the knapsack-sprayer. The infested plants were sprayed with this mixture, the result being that after about twelve hours the insects lost their appetite, and in about three days died and shrivelled up.

The strength of the mixture was the maximum that could be used with safety. In fact, during a spell of very bright sunshine, a few of the sprayed plants were more or less scorched. This method of destruction was very efficacious, but as the water supply was from 100 to 200 yards distant, it had the disadvantage of being rather slow. I was therefore obliged to send two more men to crush the larvæ by hand. The plan adopted in the latter case was to put the infested branches into a small sack without severing them from the plant, and to rub the bag containing the larvæ between the hands, thereby crushing the pests. They could of course be crushed between gloved hands without using a bag, but the advantage of using the latter at this advanced stage of larval growth, was that it prevented the escape of large numbers which dropped off when the branch was touched.

Of the two plans tried, crushing by hand is certainly the quicker method and the most certain, as, though in this parti-

PLYTE VIII.



EFFECT OF SAWILY ON YOUNG SCOTS PINE PLANTATION.



THE SPRAYER AT WORK

[To face page 52.



cular case spraying was most effective, still one could readily understand that heavy showers of rain following the spraying operation would be apt to wash the Paris green off.

In spite of our efforts a large number of the larvæ passed into the cocoon stage about the 20th of July. Some which I kept in captivity emerged from the cocoons towards the end of August, when I noticed for the first time that the saw-fly was not the common form Lophyrus pini, and I suspected L. rufus. This suspicion was confirmed on my sending specimens for identification to Dr MacDougall, who informed me that the species was believed to have only one generation in the year, and that the eggs laid by the flies which emerged in early autumn pass the winter as eggs. This has proved to be the case. Hatching began on the 15th of May 1907, and continued till the beginning of June. On the first signs of hatching I sent two men with hedge gloves to crush the young broods. This was fairly easily done, as at this stage the insects do not exceed an eighth part of an inch in length, and are in compact broods on individual needles of the plants instead of being scattered over the shoot as is the case when they grow larger and more voracious.

The plantation has been gone over four times this year, and while I should not care to maintain that every larva has been killed, still, I think few have escaped. Last year  $\pounds_2$ , 14s. 9d. was spent in combating the attack. This year the figure has run up to  $\pounds_9$ . The damage was severe last year, but is comparatively trifling this year, not because there were fewer insects but because they were dealt with as they hatched out and never reached their most voracious stage.

It is to be noticed that *L. rufus* is at all stages rather smaller than *L. pini*. When first hatched out the larvæ of the former are about one-eighth inch long, with glossy black heads and dull grey-black bodies. When full-fed they are about three quarters of an inch long, with glossy jet black heads and dull grey-green bodies. There is a lighter longitudinal stripe down the back, and a broken black line above the abdominal and thoracic feet and legs. The body narrows from the thorax to the rear extremity, which is grey-black in colour. The thoracic feet have light and black bands alternately. There are 16 prolegs and 6 thoracic legs. In common with other sawfly larvæ, *L. rufus* when disturbed takes the characteristic S shape.

# 11. Forest Nurseries and Gardens-Some Suggestions.

By Lieut,-Colonel F. BAILEY.

I.

In a previous issue of the *Transactions* I drew attention to the recommendations made by the Forestry Committee (1902) in regard to State Demonstration Forests and Example Plots or Forest Gardens. The Committee's suggestion was that an area of from 100 to 200 acres, to be used as a garden, should be provided *at each educational centre*. The purpose of the garden is thus stated in pars. 15, 20, and 36 of the Report: 1—

"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. 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."

"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 to explain here 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.<sup>2</sup> Such an area cannot, from the very nature of the objects aimed at, be expected to yield a profit.<sup>2</sup> . . . 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,<sup>2</sup> to which resort can be more frequently made."

Referring to the above extracts, I observed that their perusal left no doubt that the Committee desired each teaching centre to have its own "Example Plots" or Forest Gardens (as I prefer to call them), and that they intended these gardens to be "close at hand," so that frequent visits to them might be made. It is, indeed, essential that lectures should be "illustrated" by means of such gardens, because in regard to most of the subjects

<sup>1 &</sup>quot;Example Plots or Forest Gardens," Vol. XIX. p. 317.

The italics are mine. - F. B.

dealt with by the lecturer, clear and abiding ideas cannot be imparted by means of class-room lectures alone, nor otherwise than by frequent visits with the lecturer (or without him in any spare time the students may find) to some place where practical illustrations may be seen. Students must make themselves thoroughly familiar with the appearance at different seasons of the year, and with the rate and manner of development in crown and root of the various species up to the age at which they are to be found in the garden. They must also be familiar with the behaviour during youth of the various species when grown in mixture, and with their effect on each other. They should also do nursery work, planting and direct sowing, with their own hands. The students have very little time at their disposal for excursions, and it is evident that unless the Forest Garden be "close at hand," effectual practical instruction in elementary forest work cannot be given. If a Demonstration Forest were so situated, there would evidently be no need to provide a Forest Garden; for in the former would be seen all that it could be desired to show in the latter, and a great deal more in addition. But there is no hope that a large forest can be established in the immediate vicinity of any of the present teaching centres, and hence arises the necessity for each such centre possessing its own Forest Garden, in which the evolution of a forest crop up to a certain stage in its development can be practically illustrated. If the Forest Garden is not near enough to the lecture-room to serve this purpose, it would be sheer waste of money to establish it. I would rather take a small area suitably located than a larger one situated at a distance which would render it very much less useful to me.

It is beyond doubt that the Committee intended the garden to be an adjunct to the lecture-room, provided to enable the lecturer to illustrate his teaching; and it cannot serve this purpose unless it be placed under the control of the teacher, who should be given a free hand in all details of its management.

It is of course necessary to provide a nursery, and a part of the garden must be devoted to this use; but on account of the difficulty of obtaining so large an area as 100 to 200 acres near to the lecture-room, it may be necessary to rest content with a nursery so situated, leaving the garden to be formed on the nearest suitable site that may be available. The nursery and the garden will therefore be considered separately.

#### II. THE FOREST NURSERY.

In the second volume of his Manual of Sylviculture, Dr Schlich deals with 32 species of trees, of which 21 are "hardwoods" and the remaining 11 are conifers. To these may be added some 8 or 10 exotic conifers, which it is desired to study with a view to their use as forest-trees in this country; so that provision should be made for the raising in the nursery of at least 40 species, of which one-half may be conifers.

If one-twentieth of an acre be allotted to each species, each may occupy a plot of ground 15 yards square, with 17 square yards over for seed-beds and minor paths.

In the case of conifers, seed-beds showing both one-year-old and two-year-old seedlings are required; and the nursery lines must show transplants that have stood in them (whether shifted or not) for one year and for two years. The plot of 15 by 15 yards may therefore be subdivided into two equal portions, each measuring 15 by 71 yards.

If the nursery lines are drawn at, on an average, 9-inch intervals, and if the plants are set at 3 inches apart within them, there will be, in each subdivision, 30 such lines, each 45 feet long, and containing 180 plants. The total number of plants will therefore be 5400. To keep the nursery going, this number of seedlings will be required annually, and they can be raised on a pair of seed-beds each covering 4 or 5 square yards. whole plot will carry some 10,000 or 11,000 plants.

In the case of "hardwoods," the nursery lines may be on an average 18 inches apart, and the plants may be placed at 4-inch intervals within the lines. On the plot of 15 by 15 yards there will thus be 30 such lines, each 45 feet in length and carrying 135 plants, the total number of plants being about 4000.

In addition to the two acres required to raise the 40 species above referred to, provision must be made for other species, which it may, later on, be desired to show in the nursery, and the area must be increased by one-third to allow of periodic green-crop manuring. Space must also be available for the carrying out of such special experiments as it may be necessary to undertake. On a part of the ground young trees will be allowed to grow beyond nursery age, and space will be required for buildings and roads, so that a total area of at least 4 acres is necessary.

In addition to its use for the ordinary work of raising young trees, the nursery will form an important section of the laboratory of the teacher of forestry in connection with the following, among other subjects of special study, viz.:-The germinative capacity of seeds of various species; intervals of time elapsing between sowing and germination; methods of treatment to hasten germination; methods of protecting sown seeds against the depredations of birds, mice, etc.; methods of storing seed; methods of husking and cleaning seed; weighment of seeds, with comparison of the results obtained by sowing relatively heavy and relatively light seed of various species; depth of soil-covering best suited to each species; root and stem development of the several species at various ages; preservation of root fungi promoting growth; green crop and chemical or other manure best suited for nursery work. Observations on the above and other subjects will no doubt be regularly made and recorded by the teacher of forestry, much of whose time will be thus occupied; and on this account, as well as to enable students to pay frequent visits to it, the nursery should be situated as near as possible to the class-room. It should be rectangular in shape. The soil should consist of light loam, and water must be obtainable on the ground. In conclusion, it may be added that all ordinary nursery work must be conducted on business lines, with a view to the production of the best possible plants at the smallest possible cost. Expenditure in connection with the subjects of special study above referred to would not form a fair charge against the nursery, as it would be incurred for instructional purposes, and it should be charged separately.

#### III. FOREST GARDEN OR EXAMPLE PLOTS.

Unlike the Demonstration Forest, in which crops will be grown to full size, the Forest Garden will exhibit them up to a certain age only, and this for the obvious reason that on the smaller area there will be no room to show all stages in the growth of the numerous species that will appear there. Any attempt to treat the garden as a Demonstration Forest, by permitting a desire for direct profit to influence its management, would greatly impair its capacity to fulfil its legitimate purpose.

In common with the forest nursery, the garden is an adjunct of the lecture-room, and it should, as regards all details of management, be at the disposal of the lecturer, who cannot otherwise ensure that it will suitably illustrate his lectures. Again, as the courses of lectures at the various educational centres cannot be modified in accordance with the silvicultural conditions of the surrounding locality, it follows that neither can the management of the garden be so modified without serious impairment of its usefulness. Most of the species it will be desired to grow in any garden will probably grow fairly well up to a certain age on any ground that might be selected for the purpose; and the further study of all species alike must be carried on in the Demonstration Forest; for the success or failure of the various species, as full-grown forest crops, cannot be proved in the garden. If, however, owing to unsuitable environment, any selected species should fail to serve its purpose in the garden, its cultivation there would be dropped. The elevation of the ground selected for the garden should not much exceed 800 feet. The site should have a moderate slope, with good natural drainage, and should not be much exposed to cold or to strong winds. The soil, which should be sufficiently deep, should possess a fair degree of fertility, judged by the forester's standard; and the area should lie in a single compact block, with as wide a range of altitude as may be compatible with this condition.

Suppose an area of 200 acres to be available. A commencement might be made by stocking a compact block of 25 acres in 1-acre plots of the following species, viz.:-

#### Hardwoods.

English elm. Scotch elm. Sweet chestnut. Pedunculate oak. Sessile oak. Beech. Norway maple. Sycamore.

Common alder. Hornbeam.

Ash.

Black poplar.

# Conifers.

Silver fir. Spruce. Larch. Austrian pine. Weymouth pine. Scots pine.

Corsican pine. Douglas fir (Oregon). Douglas fir (Colorado).

Hemlock spruce. Sitka spruce. Japanese larch.

Thuva sp.

Some others might be added later, such as Robinia, willow (sp.), Cembran pine, Mountain pine, Abies grandis, A. nobilis, Siberian larch, and Lawson's cypress. After successive intervals of say eight or ten years, these crops might be repeated on half-acre plots, so as to illustrate the development of the various species at intervals up to the age of 30, 40, or even 50 years, as might hereafter be desired in the case of each. reserving space for this purpose, and a small plot of say 3 or 4 acres as an arboretum to exhibit specimen trees of full age, the remainder of the ground would be available for experimental work, as, for example, for mixtures illustrating various combinations of species, arranged in differing proportions and in various ways; and also in connection with the other matters enumerated below. Ground not required immediately for the above purposes might in the meantime be devoted to agriculture; but if unsuited to that use, part of it might be stocked with a quick-growing species of tree, which would yield some revenue when the ground it occupies is otherwise required. On the plots thus established the following, among other matters, will be specially studied:—The botanical characteristics of the several species; their appearance at different seasons of the year; their characteristic development in height and shape; the pruning of hardwoods; treatment of attack by insects, fungi, or adverse atmospheric influences; direct sowing; method and density of planting, and size of seedlings or transplants to be employed; uses of various manures; measurement of individual trees and of growing stock, with yield under various conditions.

It will probably be possible to underplant some of the light-crowned species, such as larch, before they have reached the age limit of the garden. If the ground selected carries growing woods, these can be made use of temporarily for instruction in the measurement of trees and crops, until the space they occupy is required for other purposes, when they will, in most cases, be removed. It need hardly be said that if a nursery be provided separately, it need not be duplicated within the garden area.

### 12. The Afforestation Conference.

On the joint invitation of the Board of Agriculture and the Local Government Board, a Conference on the subject of Afforestation assembled in London on the 25th June 1907, under the presidency of the Right Hon. the Earl Carrington, President of the Board of Agriculture, who was supported by the Right Hon. John Burns, President of the Local Government Board. The Conference was called together in consequence of the receipt of the following resolution from the Association of Municipal Corporations:—

"That this Council expresses its opinion that the time has now arrived when the question of afforestation should be seriously considered by the Government, and that it should be referred to the Law Committee to take steps for urging upon the Government the necessity for initiating afforestation schemes." It was attended by a large number of persons interested in the subject of afforestation, and a verbatim report of the speeches and papers will be found in the official *Report* (No. 98), printed at His Majesty's Stationery Office, price 6d. This *Report* occupies 49 pages, and we here give a short summary of its contents, for the convenience of those among our readers who may be prevented by lack of time or opportunity from reading the original.

After a short speech by Lord Carrington, stating that the object of the Conference was to examine the proposals of the Association of Municipal Corporations, and to elicit opinion as to the course which should be adopted both by the Government and by local authorities to carry out the desired objects, Mr John Burns made a sympathetic speech on behalf of the Local Government Board, in the course of which he gave it as his opinion that afforestation had been too optimistically regarded as a means of giving immediate occupation to the unemployed, while at the same time he believed that ultimately, by the establishment and encouragement of rural industries, it might prove of great value in this respect. He further stated that, as an individual, he was greatly in favour of the establishment of a School of Forestry.

A sentence or two may be here quoted from the *Report:*—"I think," said Mr Burns, "the time has arrived either when the State or the municipality, or both combined, might give free

expert advice to municipalities and private owners for planting their catchment-areas and their woodlands or potential woodland possessions. . . . I should be only too pleased to consider possible loans for afforestation, and would favourably consider the practicability of loans that were applied for for the afforestation of land" (*Report*, p. 8).

These introductory speeches were followed by a number of others. For our purpose it may be well to consider their contents under two heads:—First, those which dealt with definite facts, due to observation or experiment, or both; and Second, those whose object was to bring forward suggestions, recommendations, or criticisms. Not a few speeches fall under both headings, but it is convenient to summarise first the facts brought out during the Conference, before considering the deductions made from these or other facts by the speakers.

The actual business was begun with a paper by Dr Schlich. F.R.S., who, by special invitation of Lord Carrington, spoke on "Forestry as an Investment." Dr Schlich pointed out that complete data, in regard to British woods, are not easy to get, because, for the most part, they have not hitherto been managed purely as business concerns; but he gave four examples of woods which have yielded a fair margin of profit, and concluded by saving that in his opinion the afforestation of surplus land in this country will pay, provided the lands are not situated above a certain height, which varies with latitude; that the right species are selected in each case. according to the condition of the locality; that the planting is done efficiently; above all, that the woods are properly tended, the chief art of the forester consisting in thinning his woods at the proper time and in the right way; and finally, that the work is done economically.

Mr S. Margerison of Leeds followed by reading a paper dealing with the "Comparative Qualities of British and Foreign Timber." He stated that in his opinion the natural conditions in Britain are such as to permit the growing of timber, of the species mostly required, of equal quality with that of other countries in similar latitudes, provided the culture is done on sound lines. As regards, first, the broad-leaved trees, he said that it is no empty boast to say that there is no oak superior to British oak, and that much of the foreign oak is vastly inferior to it. Best English ash has no rival which can compete with it in price and

quality combined, while British beech, sycamore, alder, and birch are equal to and often better than the imported material. As to conifers, much inquiry and observation have convinced Mr Margerison that there is no reason why we should not grow them of equal quality and in as large crops as those of Continental production, provided the system of cultivation is similar. English spruce, Scots pine, and even larch, where the disease is not too prevalent, form profitable crops, and the product is as good or better than that of Continental origin. These are the principal trees which, in the author's opinion, it is at present worth growing, and where the conditions are favourable, their cultivation will yield a fair profit. Where forestry does not pay in this country, this is often owing to injudicious planting and faulty methods of management-"a bold, continuous, well-planned policy will pay." Mr Margerison concluded with some observation on forestry and the unemployed, to which we shall return later.

Another paper dealing primarily with facts was that delivered by Mr Joseph Parry of Liverpool, who gave an account of the work done by the Liverpool Corporation at Vyrnwy and Rivington. The Corporation commenced systematic planting operations in the Vyrnwy area in 1896, but it was not until 1903 that much progress was made. Between the years 1897 and 1907 they have planted 1,034,056 trees, and the work is now being continued at the rate of 300,000 trees per annum. The total area selected for planting on the watershed is 1202 acres, and when planting is completed the total number of trees put out will be about 4,000,000. The trees here planted are chiefly larch, spruce, Douglas fir, silver fir, Corsican pine, alder, oak, and ash. The expenditure on planting has been at the rate of f, 6, 15s. 3d. per acre, but this includes the cost of clearance, which will not have to be incurred again; it also includes a large outlay for plants, which will in future be supplied from the Corporation nurseries at a much lower rate. As regards the Rivington area, operations were undertaken in 1904, when to begin with an area of 5711 acres was selected, which was afterwards increased to 1243 acres. In the period of three years which has since elapsed, 349 acres have been planted, and the total number of trees on the area is now 1,291,295. The species are chiefly beech, ash, oak, sycamore, spruce, alder,

and some willows. A good deal of this expenditure is exceptional and will not be repeated. A recent plantation has been made at an average cost for planting, including the purchase of plants, of  $\pounds 2$ , 8s. 9d. per acre, and it is estimated that in future the cost of planting in the Rivington watershed will not exceed  $\pounds 3$  per acre, this estimate including a certain proportion of bought plants. The Corporation are of opinion that ultimately the afforestation works will yield an asset of high value to the community.

Alderman Sir Bosden Leech gave a short account of what is being done by the Corporation of Manchester in the catchment-area of its waterworks. They have planted about 500 acres of land, and during the last six years have been planting at the rate of about 50 acres per annum. During the last two years 75 acres have been planted each year, 100,000 plants having been put out last year.

Mr Lees gave some account of the planting operations carried on by the Corporation in the Birmingham catchment-area. Work was commenced in this area in 1902, and 410 acres have been planted, at a total average cost per acre of  $\pounds_7$ , 6s. 6d., of which sum the actual planting cost  $\pounds_4$ , 2s. 8d. per acre, the remainder being accounted for by the expenses of clearing, fencing, etc.

The above summary may be regarded as containing the more essential facts brought to the notice of the Conference, and in considering the suggestions, criticisms, etc., put forward, it is important to note that the object of the Conference was to consider methods of forwarding afforestation by the Government or by local authorities. In this connection Mr E. J. Elwes, F.R.S., President of the English Arboricultural Society, pointed out that the possibility of profit in forestry depended greatly upon the price of the land, and that "municipalities always, and the Government generally, buy land a good deal too dear." Further, he emphasised the fact that for successful forestry a great deal of local knowledge is required, and that the commercial value of timber depends so much upon the proximity of a market, that forestry can never be anything but highly speculative—"the most distinct gambling in futures that can be imagined." The landowner's profit, which is not so large as has been supposed, is, Mr Elwes says, rather indirect. in increasing the amenity and thus augmenting the value of his land, than directly commercial.

Mr Harmood-Banner, M.P., and Mr C. H. Scott Plummer, of the Royal Scottish Arboricultural Society, both gave it as their opinion that private owners are not likely to do *more* for afforestation in the future than in the past, but rather less. Again, a number of speeches and papers seem to make it clear that large corporations, holding extensive tracts of land for public purposes, notably in connection with water-supplies, but also in connection with methods of sewage disposal, are almost necessarily committed to afforestation work of some kind.

We have given above some facts in regard to the work actually being done by certain corporations, but some of the papers are important in their clear statement of the reasons which make it probable that the necessity for afforestation work will be increasingly recognised by the larger corporations. instance, Mr Margerison pointed out that an increasing body of expert opinion is in favour of reducing or diminishing agricultural operations on water-catchment areas. This means a considerable loss of revenue to the community unless some other source of profit can be found. That afforestation is likely to be found desirable is further indicated by the fact that such areas are not infrequently, in the case of large towns, within reach of an industrial community where the demand for timber is likely to be great. Again, the actual effect of forest on the collection, conservation, and purity of the water-supply is of great importance. It may be said, in brief, that "forests cause an immense reduction in evaporation from the ground and reservoirs; they promote percolation and filtration through the ground to the shales and consequent water-springs; they reduce the surfaceflow of the precipitated rain, and, by promotion of ground percolation towards the shales, promote an increase of springwater, and at the same time conserve the flood-water and help to let it down more gradually to the reservoirs for times of scarcity; they prevent or reduce enormous quantities of silt being carried into the reservoirs; and lastly, the balance of evidence is in favour of the theory that they promote precipitation of moisture" (Report, 1 p. 18).

The subject of municipal action was discussed by Alderman Burgess, of Liverpool, to a similar effect. On the other hand, Mr G. Trevelyan Lee, the Town-Clerk of Derby, pointed

<sup>&</sup>lt;sup>1</sup> In the Report a line has been omitted, but we are authorised to state that the sentence should read as above,—Hon. Ed.

out that the smaller municipalities, and those which do not possess tracts of land which cannot be used for agricultural purposes, are in quite a different position, and that such municipalities could not undertake any form of afforestation whatever under existing conditions, that is, without some direct assistance from the State. The problem then, as it presents itself to municipalities, may be stated thus:-What kind of Government aid would enable those municipalities which have already begun afforestation on a small scale to extend their operations, and would at the same time afford encouragement to the smaller bodies to make a beginning. Before outlining the chief suggestions put forward by representatives of local authorities, it may be well to note that the problem is considerably complicated by the fact that it is closely connected with the unemployed question—first, because afforestation has been strongly supported by some as one, among other, means of providing work for the "unemployed"; and second, because some of the larger municipalities, notably Leeds, have been making experiments in this direction. The Report indicates a consensus of opinion that afforestation cannot be regarded as an immediate and radical cure for unemployment, and that the use of the unemployed for the purpose of planting, or even of clearing the land, is fraught with many difficulties. The following remarks by Councillor Ogden, Chairman of the Leeds Waterworks Committee, appear to represent a considerable body of opinion:-"If afforestation is complicated by being associated with the necessity for finding employment for the unemployed, the prospects of a profit absolutely disappear" (Report, p. 42).

A speech by Mr A. C. Forbes, Forestry Expert, Irish Department, states concisely the chief objections which have been found in practice to any considerable use of the unemployed in an afforestation scheme, and may be summarised as follows:—The first difficulty is in connection with the acquisition of suitable land. Near large industrial centres, such land is not usually obtainable except at a heavy outlay, and if the land be at some distance from the town, the difficulties connected with transport are very great. If the men have to be accommodated on the spot, a very heavy expenditure for huts or sheds is incurred, in view of the short period during which these huts are likely to be utilised. Again, a large number of the unemployed are found to be casual labourers,

unfitted alike by habit and physique for the laborious toil which forestry entails. Further, the need for temporary employment usually arises suddenly, and cannot be anticipated many weeks in advance, while forestry work is not of a kind which can be taken up and dropped at a moment's notice, but entails anticipation by months.

The absence of the necessary experience in the unemployed, and the fact that relief work is required at a period of the year when work in the open is unpleasant, were points also emphasised by Mr Elwes, who opposed the utilisation of the unemployed for forestry purposes, as did various other speakers. On the other hand, as was pointed out by Mr Thomas Shaw of Sheffield, all large corporations are faced with the fact that relief work has to be found not only for the unemployed, but also at certain seasons for members of the corporation staff, some of whom are thoroughly accustomed to open-air work, but for whom it is difficult to find sufficient employment during the winter season. As these men have to be employed, they are frequently put to stone-breaking or other useless work, which could be done much cheaper by other methods. Even, therefore, if tree-planting is not directly profitable, it might be found that the loss in it was much less than in some other methods of relief, while there is always a possibility of ultimate profit. For this reason, if for no other, it would be worth while for the Government to encourage local authorities to undertake afforestation work.

Another point was emphasised by several speakers—granted that afforestation cannot be looked upon as an immediate and commercially profitable cure for unemployment, it is important not to forget its potential value in reducing the causes which lead to unemployment. It may be granted that to turn a large body of unselected men-who, for the most part, do not desire anything but temporary employment—out on a hillside to engage in forestry operations is to court disaster; but, on the other hand, as Mr A. C. Forbes pointed out, many of the difficulties can be avoided by "associating afforestation, not with the temporary provision of employment, but by attaching it to a carefully thought-out scheme of a more permanent and progressive character" (Report, p. 48). Mr Forbes brought forward the suggestion previously made by Dr Schlich in a lecture delivered at the Carpenters' Hall, that an effort should be made to build up a permanent staff on afforestation areas with the casuals of large towns in such a way that the men might cease to be casuals, and would become permanent rural labourers. Mr Margerison and others emphasised a similar point of view—that afforestation work in connection with unemployment must be regarded rather as educative than as immediately remedial, and that the men employed should be carefully selected as suitable for the purpose. Others, such as Alderman Burgess, emphasised also the possibility of minor rural industries springing up in the vicinity of the planted areas, and thus helping to retain the population on the land.

It may thus be said that the result of the Conference was to show that certain local authorities are already committed to forestry operations on a moderate scale, and that, in the opinion of many, it is desirable that this scale should be enlarged, on the one hand because of the possibility of ultimately producing woods which will form valuable commercial assets, and secondly, because of the need of attaching more of the population to the land, and therefore diminishing the number of casual unemployed who constitute so serious a charge on the authorities of the larger towns. We may now sum up the suggestions made as to the best methods of encouraging the work.

Taking the more general points first, it may be noted that, as stated above, Mr John Burns favoured the establishment of a School of Forestry, and the giving of expert advice by the Government. Several speakers spoke of the need of some system whereby expert advice could be given to municipalities by a Government department, if possible free of charge. This was especially emphasised by Mr Parry, who spoke of the great importance of expert guidance; by Alderman Sir Bosden Leech. who thought that schools of forestry or experimental farms should be established with the object of giving advice, especially in regard to plant diseases; by Councillor Ogden, who thought that careful statistics, based on British forestry, should be collected by the Board of Agriculture for the guidance of municipalities; and by Mr Richard Johnson, who thought that the Department of Woods and Forests should give advice on the subject to local authorities.

Again, Sir J. Rolleston recommended that the effort to promote afforestation should be national rather than local, and urged that the Board of Agriculture should give a grant for the purpose of commencing operations; and Mr Trevelyan Lee

gave it as his opinion that if afforestation was left entirely to the municipalities, "practically nothing will be done except in the case of large municipalities who at present own land which is not profitable" (Report, p. 44). On the other hand, the Commissioner of Woods and Forests, Mr E. Stafford Howard, C.B., thought that municipalities should be encouraged to take action in the matter. The remaining speakers were in many cases representatives of municipalities already engaged in afforestation schemes, and we have to consider the detailed suggestions which they put forward as to the amount of Government assistance which they desired.

Mr Margerison suggested that the Local Government Board should assist by an extension of the Leeds experiment, "by making annual grants on labour account to meet the expenditure of municipalities on the other costs of afforestation" (p. 19). Similar suggestions, that the Government should make grants, or that the special outlay in connection with the engagement of the unemployed in afforestation work should be defrayed by Government, were made by several speakers. Others, notably Mr Lees of Birmingham, spoke more in detail as to the difficulties which municipalities experience in regard to the question of the account to which the sums expended on afforestation should be charged. Mr Lees said: "We have had calculations given as to the amount that may be anticipated after so many years—thirty or forty years,—but clearly no prudent accountant would venture to charge the interest and the sinking fund on the sums invested to any account but revenue account; and so, although the yield may come eventually, the effect upon our revenues for the time being, and during the period of growth, is an absolutely dead charge, and it is those who will come after us, if the crops turn out to be as successful as has been prognosticated, who will get not only the net profit, but the whole of the gross yield, because everything that has been spent in the meanwhile in the way of interest and maintenance charges must, under any prudent system of book-keeping, be debited straight away to revenue, and paid for out and out. One dare not suggest-it would be altogether too imprudent-that there should be any method of capitalising these charges, but in the absence of such method it seems to me inevitable that the prospect of providing for the future is entirely discounted by the necessity of heavy charges in the present. If afforestation is to be carried out to any large extent, that is an aspect of the

question that must be faced. While we are dealing with comparatively small areas, such as those we have been speaking about, the afforestation is comparatively a small one, and does not hurt any of us, but if carried out to a large extent, the question will be a most important one" (Report, pp. 41, 42).

Dealing with the same question, Councillor Ogden thought that, for the purpose of loans, afforestation should be deemed to be a sewage or waterwork's question, and should be subject to the same rules. Mr Richard Johnson thought that the Local Government Board should not only give grants, but should also "lend money for a long term, and practically without interest, until the scheme became profit-bearing." This would get over Mr Lees' difficulty. Mr Trevelyan Lee gave it as his opinion that since in other departments, such as education, it was clearly understood that where the local bodies performed a function regarded as national, they should be assisted by the Government, so in respect of afforestation, as the profit would be national rather than local, the Government should bear the expense.

Another point, emphasised especially by Mr Harmood-Banner, dealt with the question of rates. This speaker, along with some others, brought to notice the check to municipal effort given by the increased rates which are put on as soon as the local authority begins to develop land which has hitherto been waste. Mr Harmood-Banner proposed that municipalities "should be relieved from the payment of rates as regards those particular districts to which afforestation had been applied, as well as regards the sums which had been set aside for the Distress Committee" (p. 23).

Other points which were emphasised by certain speakers concerned difficulties which municipalities have in acquiring powers to enclose common land for afforestation purposes, and as regards ground game, but these are for the most part minor points, less important as regards the general question of municipal and national work than those named above.

#### FORESTRY AND THE UNEMPLOYED.

In connection with the above, we may note that on 31st August the *Times* gave some account of the afforestation work carried on in Leeds by the unemployed during the past year. According to this account, which is based upon the report of the

Leeds Distress Committee, the following work was done in connection with the planting of Washburn Valley. The work lasted from 19th November 1906 to 8th June 1907, and 199 men were employed, the period of employment ranging from one day to sixteen weeks. The total number of trees planted was 953,500, fresh unskilled men planting from 200 to 300 trees per day, experienced men an average of 816 trees in one day. On Beecroft's Moor 230,500 trees were planted, 3250 yards of wire netting fixed, and 400 yards of drains opened; on Bray's allotment 291,000 trees were planted, 3000 yards of wire netting fixed, and 400 yards of drains opened; on Swinsty Moor 39,000 trees were planted, and at Gill Beck Nursery 303,000 seedlings were planted, 200 loads of stone dug, and 1700 square yards of road formed. Three hundred acres have been planted, leaving 550 acres to be dealt with.

In a letter to the *Times*, commenting on this report, published on 12th September 1907, Dr Schlich says:-

"As I was the first to propose the afforestation of surplus lands as an auxiliary in dealing with the case of the unemployed, it is a source of great satisfaction to me that the Corporation of Leeds has been so successful in its afforestation work by means of the unemployed. My proposals have on several occasions been called unpractical, because first attempts, made more or less in the direction indicated by me, were not successful. But, then, Rome was not built in a day. The system of employing these men requires a little development; and I feel sure that a few years hence the initial difficulties will have been overcome, if an earnest attempt is made to do so. It is essential that there should be a small permanent staff of men on the area, the members of which will act as foremen when the unemployed come during the winter time, while they will find ample work during summer on nursery work.

"I sincerely trust that the Corporation of Leeds will continue the experiment, and thus prove that the unemployed can be successfully utilised on a work which is likely to lead to tangible results, whereas this is not the case of so many other kinds of work done by them.

"The price of timber has slowly but steadily risen since 1895, owing to the increasing difficulty of meeting demands; and there is little doubt, if any, that any surplus areas now planted will give quite satisfactory financial results, if the work is done systematically and in the right way."

### 13. A Forest Tramway.

(With Plate.)

By FRED. MOON.

The wood roads, serving the principal wooded area on the Roxburghe Estates, being at all times bad and occasionally impassable, the question of how to improve them became imperative, in order that the annual fellings might be conveyed to the saw-mill at a reasonable cost.

It was first decided to metal the existing rides, but as stones had to be hauled a distance of five miles, the cost for such a large undertaking promised to become prohibitive. The writer then suggested a forest tramway, and, after full consideration, this was sanctioned.

A brief comparison of the two systems of metalled road and tramway is as follows:—A substantial metalled road for heavy traffic is expensive to make and maintain, especially when good stone cannot be got on the spot. The road is a permanent structure which can only command a limited area, and in the case of a wood road is only used periodically, and deteriorates during the periods of disuse. A light railway is less expensive to lay and maintain, requires less power to haul over, and, above all, is portable, and commands a circular area with its own length as radius.

SPECIFICATION AND COST OF MATERIAL AND LABOUR. 1300 yds. light railway material, 24 ins. gauge, consisting of:— (1) 520 flat bottom steel rails, 14 lbs. per yd., in 15 ft. sections, complete with fish plates, bolts, and nuts; (2) 1300 single corrugated steel sleepers, 30 ins. long,  $3\frac{1}{2}$  ins. wide  $\times \frac{1}{8}$  in. thick, complete with their necessary bolts and nuts for laying 3 ft. apart, with rivetted clip for 14 lbs. flat bottom steel rails, with clutch bolts  $4\frac{3}{4}$  ins.  $\times \frac{1}{3}$  in., and with nuts and washers. The above at per yard of line, . £178 15 2s. 9d., Two sets points,  $\pm 3$ , Four sets each of two bogies with double screw brakes, swivel bolsters, chains, jacks, and all the necessary fittings complete, 54 16 1300 creosoted Scots intermediate sleepers, 3 ft.  $\times$  5 ins.  $\times$  1\frac{1}{2} ins., II 14 Labour on laying track and tarring rails, 35 0 £,286

or about 4s. 5d. per yard.

The intermediate wood sleepers sawn out of tops were, on account of the soft nature of the ground, used to supplement the steel sleepers, with a view of easing the strain on the rails.

The track was laid in the dead of winter, during the shortest days, and with snow and frost to contend with. Had it been possible to do this in summer, the labour bill would have been reduced by one-third, as the men are paid at the same rate in summer as in winter. The convenience, however, of doing the work at that season outweighed all other considerations, and the advance in the price of iron subsequent to purchase probably makes the difference more apparent than real.

The bogies are hauled from the saw-mill to the felling area by horse. The cuts, mostly 10 ft. and 18 ft., are hauled to the railway side, the heavier ones with their butts on a sledge and the lighter ones in the usual way. They are then loaded on to the bogies by skids, secured by chains and jacks, and returned to the saw-mill, one-third of the way by horse haulage and the remaining two-thirds down a declivity under control of the brakes and a rope.

The two sets of points are in use, one at the felling area to form a spur, and the other at the foot of the declivity and near the saw-mill, as runaway points, to automatically switch the loaded bogies, in case of accident, into a sawdust heap.

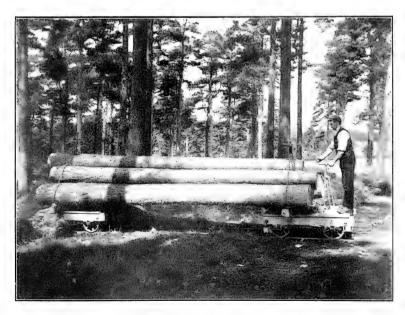
On the average, it costs 3s. per 100 quarter-girth cubic feet to bring timber from the felling area to the saw-mill by tramway. To cart the same quantity costs 6s. 3d.

One horse alone cannot keep the mill supplied by cart haulage, but by tramway one horse can easily do this in three days of each week. This leaves the horse available for other jobs on the remaining three days, which, taken by itself, is a great economy and convenience.

### PLATE IX.



A FOREST TRAMWAY--HAULING.



A FOREST TRAMWAY -APPLYING THE BRAKE.

To face page 72.

#### 14. Continental Notes-France.

By A. G. HOBART-HAMPDEN.

For those who desire to know how Forestry is progressing in France, a perusal of the Revue des Eaux et Forêts is to be There is a constantly increasing number of recommended. forest societies in France, like the Society of "Franche Comté et Belfort" and the "Touring Club," each no doubt with their own Magazine, or at least Transactions, but the Revue is the service magazine par excellence of the French Forest Department, and its contributors are the most likely to be "at the front of the march of ideas," in the expressive French phrase, besides. probably, being more likely to have access to the official forest publications than the private forest owners and others who chiefly make up the other societies. In Germany, we believe, every national schoolboy learns something about forests, and now the French Minister of Public Instruction appears to be taking up the subject. It is a most encouraging sign that the French generally (apart from the State, which is, of course, a large forest proprietor) should be thus awaking to the importance of Forestry in France, as we are doing at home. There is plenty of scope, for M. Paul Descombes states that France has over  $15\frac{1}{3}$  million acres of uncultivated land, on which, as a rule, forestry would pay better than anything else. Like us, the French encounter difficulties, but often of a somewhat different kind. One of their aims is to get communes to afforest their waste lands, and there they meet with the apathy of the peasant population and also the active hostility of the grazing interest, whereas we are mostly concerned with private property; and whatever the obstacles to the afforestation of private property, at least the owner is not, as a rule, hampered with the necessity of providing for the rights of other persons. Not but that it would, of course, be eminently satisfactory if the English Government were to become, as in other countries, a large forest owner. In the case of the present Crown forests, no doubt there often is, as in France and India and elsewhere, the irritating drawback of having to deal with rightholders, but in any additions that were made to the Government forests there would be as perfect freedom of action as in the case of private owners. All Continental nations, and some of our dependencies, make a good thing of their forests,-India

is beginning to look to its forests to in some sort make up for the loss of its salt and opium revenues. We, on the other hand, pay £30,000,000 (which to-morrow will be forty, and the day after fifty, millions) to outsiders—in many cases to potential enemies, who will use our money to build ironclads wherewith to threaten us. Not only do we pay all this for timber or timber products, but in doing so we leave in foreign countries the money spent in forest work and many forest industries. instead of keeping it within our own shores, and, incidentally, establishing colonies of wood-working people out in the country. It is said, "Yes, but the Governments who make their forests pay have found their forests ready-established and already in bearing; and where, we should like to know, are we to find the money to buy up land and grow our forests?" Well, there must be a beginning some time, and at least the Government could let itself off taxes. The shooting rents, too, would be a direct source of revenue. If the unemployed were put on the work, with a patient, but rigorous, thinning out of the unemployables, the labour would be found, for a certain proportion of this class is no doubt deserving. This, we know, is an aspect of the matter which appeals to Government, quite apart from any question of finance. If only they would put a tax on foreign wood, and with the proceeds form a fund for buying up waste lands and planting and working them, the money difficulty would disappear; but this is politics, and I suppose we must not enter on that here.

There is a good deal that readers could skip in the Revue des Eaux et Forêts. As we are only concerned with the forest part, we could leave out the articles on fisheries, although these are not without importance. All the part directly concerned with the personnel of the French Forest Department will only interest those who have friends in that keen and enthusiastic service. There is much about forest law cases, which is perhaps rather boring,-moreover, we have no special forest law. Once indeed we had one, and of the severest, but it seems to have become merged in the common law. Were a really large Government forest domain to be formed a Forest Code might become a desideratum, and it might advantageously contain a section (as in the Indian Forest Code) allowing private owners to place their woodlands under its provisions. Finally, a glance at the Budget discussions, reported in the Revue, will generally suffice.

In this connection it is satisfactory to see that the Chamber of Deputies is alive to the great necessity of afforesting the catchment areas of the great rivers, and the late tremendous floods will, we think, do much to force this matter still further to the front. The afforestation of mountains was, unless I am mistaken, begun in 1856, and several laws have been passed about it. British foresters desiring to see a really most interesting and magnificent work could scarcely do better than to visit some of the "perimètres de reboisement" in the French Alps, and elsewhere in France. We do not, indeed, suffer much here from erosion on hill-sides or from the silting up of rivers (as in the case of the Loire, or the Volga in Russia), but floods are not unknown to us, and afforestation generally - more especially the rewooding of hills - will always be of direct interest to us. I suppose if the State were to launch out into a real forest policy it would be principally in the hills of Scotland and Wales that the forests would be formed. Incidentally, I should like to mention that the French have an excellent plan of taking photographs, repeated at intervals of years, from fixed bench-marks, thus clearly showing the progress that has been made. This can be done, of course, not only with afforested hill-sides, but with forest operations generally, as, for example, at the period when an area has been just felled for, say, a seedfelling, and again five, ten, fifteen, etc., years after. The writer is himself doing this in Buckinghamshire, and looks forward to interesting results. The great difficulty is to get clear, sharpcut pictures of forest growth; pretty pictures are easy enough, but that is not what one wants.

One sees from the *Revue* that the stripping of oak bark has become as unremunerative in France as it has with us. M.M. Truchot and Mélard have articles on this subject. What has killed the industry in France is chiefly the importation of Spanish chestnut and Quebracho wood for working up into extract. One wonders, speaking without expert knowledge, why, if direct tanning from the bark is unsuitable, it should not do to make extract from oak bark. One would have thought that when there is a considerable fall of oak it would pay to send the bark to the extract factories. Surely the same machinery would do for dealing with the bark as with the imported materials. Of course rail charges in Britain are unusually high, and bark is bulky. In point of fact, where

there is plenty of room for storage and labour is cheap, tanners appear to prefer bark (of a good quality) to extract. At any rate that was the impression made on my mind when, a few years ago, I was on special duty in this connection at Cawnpore in India. Cawnpore is a large tanning centre, with several big tanneries, where some 60,000 tons of bark (nearly the whole being Babul bark, Acacia arabica) are annually used, and the country for a hundred miles along the railways is ransacked for this bark, for which about 1s. 4d. to 1s. 6d. a maund (82 lbs.) is paid. M. Mélard thinks that the present depreciation of oak bark may not last; the chestnut forests are probably being destroyed, and as for Quebracho, that species is a native of the Argentine, where there does not appear to be forest protection, without which the largest forest area will in time be destroyed, and that far quicker than is generally realised. Moreover, Quebracho wood is suitable for sleepers, and the great development of the Argentine will connote a great extension of railways. Also the influx of immigrants will go far towards the destruction of the forests. There are, however, some slight compensations to be had for the fall in the sale of the oak bark. The tendency to grow oak as coppice will decrease, and it is a sin not to grow such a timber-tree as oak to large dimensions, and with long boles fit for beams, in high forest. Also the necessity for felling the tree only when the sap is rising disappears.

M.M. Gallois and Buffault write on the difficulties of fire conservancy in the Maures et l'Estorel, in the south of France, where the fires are bad, the same difficulties applying to the pine forests of Gascony. They speak chiefly of the inertness of private proprietors in protecting their woods, which are mostly either cork-oak, or pine. The fact is the proprietors fear the expense of making fire-lines, and, when it is a case of completely clearing the lines of all trees, the direct loss. There is a law of 1893 which forbids fires being lit within 200 metres of the woods during the summer; permits a proprietor to make a border fire-line, cleared of all brushwood and all resinous trees, and then to force his neighbour to do the same; obliges all railways which traverse a wood to keep up similar cleared lines; and grants a certain subvention for constructing roads across the woods. In Britain, most fortunately, we are not greatly troubled with fire, but danger sometimes occurs from burning

heather on the borders of a wood, and also from railway engine sparks. In the former case, a relatively narrow line along the edge of the heath should generally suffice for protection, except, perhaps, in the case of species like Scots pine. The upkeep of a broad cleared line in such a case would be expensive, and it would probably be wise to thin the pine and underplant the strip with Spanish chestnut, or to completely substitute an edging of broad-leaved trees for the pine. M. Gallois is against the complete clearance of all resinous trees from lines bordering pure resinous woods. To say nothing of the loss of the land thus put out of forest cultivation, the upkeep of such a line-always liable to become again covered with inflammable brushwood—is very onerous. He quotes the method adopted in the Prussian State Forests where railways traverse pine forests, and as we believe a Bill to deal with this matter is shortly to be brought before Parliament, perhaps it may be useful to consider it. The plan is to clear the trees for  $17\frac{1}{9}$  metres (about 58 feet) from the rails, while for 13 metres (say 40 feet) they thin and prune the lower branches of the pines and remove the undergrowth. In reality, though M. Gallois does not mention it, we believe there is in addition, at a little distance, a path or road parallel to the railway, and also transverse paths. Forstmeister Dr Kienitz, proposes to clear of trees 12 to 15 metres only, cutting this belt across with alleys and ditches, and to thin and prune the trees, and clear the ground of brushwood, for another 18 metres. This, says M. Gallois, may suffice to catch the stray sparks of a railway engine, but the protectionbelt should be 180 to 200 feet wide where a real automatic fireline, to keep fire out, is wanted. One wishes it were possible in our Indian forests to rely on a row of spark-catching trees, and to save the loss of completely cleared lines, but, unfortunately, most trees there, including the pines, drop their leaves in the hot weather, thus completely covering with very inflammable material any lines burnt under the shade of trees. It may interest readers to know that they use telephones to connect the Forest Officers' houses with the Forest Guards' lodges in the south of France, and this, too, is done in the Forest of Dean.

M. De Gail writes of the progress of the insect invasion of the fir forests in the Vosges, near Gérardmer. The insects are

<sup>&</sup>lt;sup>1</sup> See Vol. XVII. p. 198.—Hon. Ed.

Bostrychus typographus, B. chalcographus and B. curvidens, and one of the *Pissodes*. The invasion, which has been something intense, appears happily to be passing away. The damage of 1004 was the worst, but the number of trees which had to be felled by reason of the attack of the first two of the above-mentioned insects is alone given, viz., 14,603. In 1905—for all the insects—15,701 trees were felled, while in 1906 only 4433 trees were attacked.

M. Hickel has a note to the effect that the approach of a good beech-mast year can be foreseen in the preceding autumn from the occurrence of swelled buds destined to bear fruit. These are some 8 millimetres in diameter, whereas the leaf-buds are only 3 or 4 millimetres thick; the former are generally shorter and always more obtuse, besides being thicker. Mathieu, the celebrated botanist, mentions this, and it is probably well known already to many. The following interesting quotation, from Mathieu, is also given by M. Hickel concerning these flower-buds: "Their abundance, their rarity, or their complete lack determines, nearly certainly, from the month of August the kind of mast of the following year. Thus the irregularity in the fructification of this species cannot be explained by the action of spring frosts alone. It is evident that the temperature of the year in which the buds are formed plays a preponderating part in the fructification." M. Hickel adds that, although a good acorn year cannot be prognosticated in a similar way, yet the fact that good beech and oak mast years have a way of coinciding renders it possible to tell to some extent when a good acorn year may be hoped for.

M. Émile Mer gives the results—in a number of tables and in a variety of ways—of the comparison of two nearly similarly situated plots of hornbeam coppice, the one thinned of its small shoots and the other unthinned. The thinning was made in 1891, but for certain reasons it was not possible to begin the measurements till ten years later. They were accordingly made in 1901 and 1906, and M. Mer shows that as a rule the coppiceshoots grew the more in diameter and height as there were fewer shoots on the stool; and that (in the case in point) the maximum volume and maximum value were attained with stools having four shoots. The figure would, of course, differ according to species and other factors, and the actual value of thinning an oak coppice would be less than thinning a coppice of a species which stands

shade, since the weaker shoots would, in the former case, die off of themselves. In the case of the hornbeam the figures very definitely showed that the operation resulted, not only in producing better *individual* stool-shoots, but also that the volume, and, more still, the value, of the thinned *plot* was the greater.

M. Berthon complains that the rules in vogue for dealing with Selection-worked forests of spruce and silver fir are the same for the two species, and consist in seeking regeneration by more or less evenly thinning the wood throughout. Though this produces silver fir seedlings it does not result in spruce regeneration till several repetitions of the operation have sufficiently opened the cover, while in the meantime the stems remaining have suffered through not being retained in close crop, which is essential for spruce. Consequently he suggests that regeneration fellings for spruce should be made in gaps, the remainder of the crop being only lightly thinned where there is actual congestion. The soil should be wounded in these gaps. This sounds rational, and it seems to show that the French are beginning to see the beauties of the Group system. a system of which, at anyrate twenty-five years ago, one never heard in France. I think this system will more and more come to the front, for broad-leaved species as well as conifers. The one danger, for conifers in the hills, is wind, but probably if the gaps are sufficiently far apart, and not too pronounced, there need be no fear. Then one of the worst drawbacks of the Selection method, viz., the necessity for felling trees on the top of smaller ones, will disappear, and the irregularity of growth found in selection-grown timber will also disappear. With the Group method one is not tied down to a fixed and restricted coupe. but, working over a relatively larger area, one can seek out spots showing the first signs of young growth, and there remove the overhead crop. For species difficult to regenerate the Group method has much to recommend it. Broadly speaking, it enables one to follow the young growth (for there are nearly always some signs of it to be met with somewhere throughout the length and breadth of a wood), instead of making holes in the canopy to produce a problematical one.

The Algerian forests appear to be doing well. I believe that the French have had much trouble there in the past, and can well imagine that some of their methods have not been understood by the indigenous population: forest administration on

correct lines is something altogether beyond the native mind. However, they seem to be doing well now. Whereas before 1898 the annual revenue was less than £,40,000, it was well over £,120,000 in 1904, and for 1905 the Budget estimate was nearly  $f_{177,000}$ . But new avenues appear also to be opening out, as, for example, in the direction of resin-tapping. It is estimated that there are in Algeria at least 20,000,000 pine trees (Pin d'Alep) capable of producing annually £,240,000 gross revenue. Incidentally the writer of the article mentions the Pin de Masson, in Tonquin, as a suitable tree for tapping. The world's demand for resin and turpentine has certainly greatly expanded of late, so this seems a promising direction for forest enterprise; but it should be remembered, as is perhaps not always sufficiently done, that although resin-tapping does not seem to adversely affect the quality of the wood, the timber, as used for planks or scantlings, is of course damaged at the points where the tapping has actually occurred. To tap a tree shortly before felling does not matter perhaps, for the wounds are only made in the sapwood, but tapping at intervals throughout the life of a tree must damage the timber permanently. It is interesting to note that 20,000 cubic metres of cedar (C. atlantica I suppose) is to be put on the market. appears that during the five years, 1902 to 1906, the Algerian Forest Department has built 176 forest lodges (mostly for subordinates, no doubt), made 3010 kilometres of roads and 2000 kilometres of fire-lines, besides reforesting 5000 acres and stripping 600,000 cork-oaks. A good record!

Reference has been made previously to the increase of interest among landowners in connection with French Forestry matters, but an article by M. Pardé, quoting M. Ména, Conservator at Troyes, shows that this is not altogether a new thing, for since about 1860 a number of private persons, acting independently, and entirely without extraneous assistance, have been afforesting waste lands in the department of the Aube, in a very extensive manner. The Aube is watered by the Seine and several of its tributaries. Here and there—almost throughout the region—this work has been going on, and in particular in one chalk region, with very thin soil, some 30,000 to 40,000 acres have been planted, chiefly with Scots pine. Most unfortunately, these patriotic gentlemen appear not to have taken expert advice, and this pine has proved to be most unsuited to the

locality, and, having very little vitality, it has succumbed to the Lasicampa pini and other troubles. At the same time, it has regenerated itself very vigorously. At some few places they. have used the Austrian pine, with very good results, but inasmuch as there is a prejudice against this pine, it being supposed, quite wrongly as some think, to be little good and almost unsaleable, its extended use has not caught on. As a small plant it suffers much from the rabbit, but when it has reached 11 foot high its thick lower branches save it from this pest. This is explained by the fact that it has been planted as much as 2 metres apart. With all the drawbacks to such wide planting, there is just this to be said, that as the layer of soil is so thin the roots have sought their nourishment laterally, and so have given vigour to the plants. It is most interesting to find, in quite a different article by M. Pardé, that the Austrian pine has elsewhere again come to the rescue. M. Pardé found it used at a place in Austria, where every sort of difficulty had to be encountered—a limestone rock with scarcely any soil, but many stones, a short rainfall, but heavy snow, bad frosts, and especially late ones, and finally, the "Bora," a violent N.E. wind, which dries the surface. Yet the pine was growing well, and at 26 to 28 years had begun to seed well. Normally this species only seeds well after 30 years, and earlier seeding is not perhaps a good sign. As to the perishing Scots pines in the Aube, they, too, have been indirectly valuable, for the population uses them as firewood. Had this source of supply not been available the peasants would have fallen back on cowdung cakes, after the manner of the Indian rvot.

M. Schlumberger enters once more on the old, old quarrel as to the respective merits of the Selection Method and that known as Shelterwood Compartment, or Uniform, or Successive fellings. In the course of this article he declares his adherence to possibility by area, instead of possibility by volume, in agreement with so many others nowadays. It would, however, be too lengthy a business to enter here on a consideration of these vexed questions.

M. Huffel calls attention to an ingenious invention by Friedrich, the well-known Director of the Research Station at Mariabrunn, in Austria. This is called the "Grimpeur," and by its means the tallest trees are safely climbed. It would be useful for measuring diameters at different heights for exact

dendrometric purposes, or no doubt for pruning very high branches, etc. It is described as consisting of two pieces,  $1\frac{1}{2}$  metres long, sliding along one another. Each piece has a sort of seat at its top, with a strong, but flexible, steel ribbon fixed at one end to it, the other end being free to be passed round the tree and then fastened to the seat, holding very securely to the tree. After the apparatus has been placed against the tree and attached to it, the second piece is pulled up its full length by a special, easily worked, contrivance, and is then fixed by its steel ribbon to the bole. The first piece is then unfastened and pulled up, and so on. It is claimed that a man can work himself up, without labour, 30 feet in five minutes.

There is also a notice of the American method of felling trees by electricity and a platinum wire, which is said to burn its way through a tree, with scarcely any smoke, as easily as a knife cuts through butter. If this is really so it seems a most useful invention.

Attention is drawn to a Circular of the Prussian Government, which has been so struck with the success of the Douglas fir that it intends to extend its cultivation largely in that kingdom.

The Revue often has interesting reviews of forest publications—not only French forest works. For example, we find a long account of Professor Graves' (Yale) new book on Forest Mensuration. Of French books that have appeared lately, probably the most important is M. Huffel's Économie forestière, in three volumes. This book is probably destined to become a classic.

# 15. Notes on the Forestry Exhibition at the Lincoln Show of the Royal Agricultural Society of England, held June 25th to 29th, 1907.

#### By A CORRESPONDENT.

This section was organised by the Royal Agricultural Society in conjunction with the Royal English Arboricultural Society, Mr George Marshall, Mr A. T. Gillanders, and Mr W. B. Havelock being responsible.

This is the fourth time that such an exhibition has been held, and there can be no doubt that it was the largest, the most interesting and best educational display of British Forestry ever seen in England.

It was decided by the Royal Agricultural Society to offer this year special medals for boards, gates, creosoted fencing, examples of damage by insects, squirrels, voles, of abnormal growths, etc., in addition to the usual Exhibition classes of previous years. The result was most satisfactory, as there were numerous entries in nearly every class, hailing from Northumberland in the north to Kent and Wiltshire in the south.

The success of the Exhibition was largely due to the interest displayed in it by the President, the Earl of Yarborough, who contributed largely from his Lincolnshire estates.

The following is a list of the principal awards in the competition classes:—

CLASS I.—Specimens of Oak, Elm, and Ash Timber grown in Great Britain and Ireland, two boards, 6 feet long, of each. (5 entries.)

Silver Medal: The Duke of Wellington, Strathfield Saye. Bronze Medal: The Marquis of Exeter, Burghley House. Highly Commended: The Earl of Yarborough, Brocklesby Park. These boards were very good indeed, particularly the English Elm.

CLASS II.—Boards of Larch, Spruce, and Scots Pine. (4 entries.)

Silver Medal: The Earl of Carnarvon, High Clere Castle. Bronze Medal: The Earl of Yarborough. The Larch and

Scots Pine shown by Lord Carnarvon were perfect specimens of what such timber should be; the Spruce was rather knotty, but sound and white.

CLASS III.—Boards of any other sorts of Hardwood or Broad-leaved Timber. (3 entries.)

Silver Medal: The Earl of Yarborough, who showed beautiful boards of Spanish Chestnut, Wych Elm, Sycamore, Hornbeam, Lime, Acacia, Walnut, Scarlet Oak, Beech and Plane. The Lime, Scarlet Oak, Walnut and Hornbeam were especially good. Commended: The Duke of Wellington, who sent Beech, Sycamore and Spanish Chestnut.

CLASS IV.—Boards of any other Coniferous Timber.
(2 entries.)

Silver Medal: The Earl of Yarborough, who showed 7 kinds, including very fine Cedar of Lebanon and Douglas Fir. Bronze Medal: The Earl of Carnarvon, who sent Weymouth Pine, Silver Fir, and very fine Corsican Pine, 2 feet wide.

CLASS V.—Specimens of Insect Pests injurious to Forest Trees.

(4 entries.)

Silver Medal: South-Eastern Agricultural College, Kent. This was really a museum in miniature, and well deserved the first place, but no forester could be expected to compete with the resources at the disposal of a college. Bronze Medal: Mr A. T. Gillanders, Alnwick Park. Great credit is due to Mr Gillanders for this valuable exhibit. Commended: The Earl of Yarborough. Damage by Tortrix Moth (Tortrix buoliana) to Scots, Austrian and Corsican Pines, with specimens of the insect in its three stages.

CLASS VI.—Specimens showing comparative Quality of Larch Timber grown on different Soils and Situations. (r entry.)

Silver Medal: Lord Burton, Burton-on-Trent, who was the only exhibitor. The difference in quality of timber from various soils was well marked.

Class VII.—Specimens showing comparative Quality of any Timber—other than Larch—grown on different Soils and Situations. (No entry.)

CLASS VIII.—Specimens of pruning Forest Trees. (3 entries.)

Silver Medal: The Duke of Northumberland. Commended: Sir Montague A. R. Cholmeley, Bart. There were only three entries in this class, and, though interesting, they were not worthy of special mention.

CLASS IX.—Specimens of Stems illustrating the effects of Dense and Thin Crops in Branch Suppression and Quality of the Timber. (4 entries.)

Silver Medal: The Marquis of Exeter. Highly Commended: The Earl of Yarborough. Commended: The Duke of Northumberland. This was one of the most useful sections of the show, especially to persons interested in the growing of firstrate timber. The methods of the exhibitors varied, and it would be as well on a future occasion if some definite system could be decided upon. It is obviously difficult to show trees as they grow in a forest, as was done by the winner of the medal, who sent Ash and Larch trees 45 feet long. Lord Yarborough's exhibit comprised stems 6 feet long, and boards cut therefrom, of Austrian, Scots and Corsican Pines, Larch, Douglas, Silver and Spruce Firs: and the difference between clean and coarse timber was well marked. The Duke of Northumberland sent Scots Pine and Spruce, in 4 feet lengths, from thin and dense crops, accompanied by valuable explanatory notes as to the number of trees per acre in each case, also the volume per acre from an unthinned crop 45 years old.

CLASS X.—Examples of the Damage done by Squirrels, Voles, etc., and Abnormal Growths. (2 entries.)

Silver Medal: The Earl of Yarborough. This exhibit may be said to be unique, containing as it did specimens of fifteen kinds of Witches' Brooms, several of which have never been recorded before, and thirteen kinds of Burrs. Many of the former, such as the broom on the elder, oak, and chestnut, are very rare. The burrs also were remarkable, especially the polished specimens from the oak and English elm. Trees and tree-tops of several kinds damaged by voles and squirrels were also included, and a curious root-growth on the trunk of a beech, following damage done by fire to the bark.

CLASS XI.—Gate for Farm or Estate Use, manufactured from Oak Timber, to be hung and shown in working order with fastening, unpainted. Prices, including the posts and ironwork, were attached to each gate, and are here given.

(5 entries.)

Silver Medal: The Earl of Yarborough, 41s. 10d. Bronze Medal: The Marquis of Exeter, 34s. Highly Commended: Sir A. R. Cholmeley, Bart., 35s. Commended: The Earl Fitzwilliam, 41s. The first prize gate was fitted—as were all Lord Yarborough's gates-with wooden swing-fasteners and wooden catches, and hung on good oak posts; the ironwork was simple, the top-band clasping the top bar 18 inches, and the top crook reaching through the post with a nut at the back. If all persons who are responsible for the gates on estates had themselves to open them on horseback, there would soon be an end to all the various sorts of iron spring-fasteners so much in vogue. No fastener is so easily adjusted, and so easy to open on horseback, as the swing wooden ones so generally used in parts of Lincolnshire and Yorkshire. The Marquis of Exeter also showed a gate made of riven oak, which attracted much attention.

CLASS XII.—Farm Gate made from any other Home-grown Wood, unpainted. (6 entries.)

Silver Medal: The Earl of Yarborough, Larch gate hung on creosoted Spruce posts, 24s. 9d. Bronze Medal: The Marquis of Exeter, Larch gate, 36s. Highly Commended: The Earl of Carnarvon, Larch gate, 28s. The first prize gate was similar in design and fittings to the gate in the previous class, but a special feature was the creosoted spruce posts, which reduced the cost of the exhibit considerably, as well as showing the utilisation of comparatively worthless timber. The larch of which Lord Carnarvon's gate was made was of extra good quality, and without a knot. Some judges would have given it the second place.

CLASS XIII.—Wicket or Hunting Gate, self-closing, made of Home-grown Timber, to be hung and shown in working order, unpainted. (5 entries.)

Silver Medal: The Earl of Yarborough, Spanish Chestnut gate on Oak posts, 24s. 6d. Highly Commended: The Marquis

of Exeter, Larch gate, 29s.; the Duke of Wellington, Folding Hunting gate, 20s. (excluding posts). Commended: The Earl Fitzwilliam, Larch gate on Oak posts, 30s. 6d. The folding hunting gate shown by the Duke of Wellington was so arranged that the upper half, on drawing a handle, falls down against the lower part, and though forming no obstacle to huntsmen, the remaining half is sufficiently high to prevent rabbits getting into enclosed young plantations. It is a very ingenious arrangement, but rather too complicated to be serviceable.

Mr W. Forbes, Shotwick Park, exhibited a so-called Hingeless Gate, 16s. 6d., but as a matter of fact it had hinges of a sort. The bottom of the back-head works on a coarse-threaded worm, which lifts up the gate as it opens, and the weight of the descending gate closes it again. It has a lift-up catch, which a rider would find rather difficult to open.

CLASS XIV.—Specimens of Home-grown Timber suitable for Estate purposes, manufactured or otherwise, showing the advantage of applying Creosote or any other preservative. (2 entries.)

Silver Medal: The Earl of Yarborough, who showed eight kinds of creosoted fencing used on the Brocklesby Park Estate, also creosoted Spruce gate-posts, and creosoted Larch and Oak poles with branches 9 inches long left on for climbing plants. The last-named were shown with roses in full bloom and other climbing plants trained to them, and were most effective. If the posts are allowed to dry for a time before using, no harm is done to the plants by the creosote, and the life of the post is trebled. Lord Fitzwilliam, the only other exhibitor, showed some creosoted fencing made of Scots Pine.

#### ARTICLES FOR EXHIBITION ONLY.

Mr Fraser Story, of the University College of North Wales, Bangor, had a large exhibit, comprising planks, boards, and transverse sections of Larch, Douglas Fir, and *Thuia gigantea*: hand-specimens of sixty different species of European woods, abnormal growths, damage done by squirrels to larch and birch, photographs demonstrating Continental forestry, specimens of damage done by various insects and diseases, etc., etc.

Included was a large well-hearted plank of Douglas Fir, 2 feet across, showing rapid growth but coarse quality. It was

grown on the Earl of Powis's estate, in a very thin wood, at an elevation of 1000 feet.

The Earl of Yarborough showed a splendid collection of boards 7 feet long, of 80 different species, grown on his estates, with photo-micrographs of transverse sections, at a magnification of 10 diameters, showing structure of the timbers. These were much admired, as such a collection from one estate had not been attempted at any previous Exhibition. Also handspecimens of 167 different species of home-grown woods, all polished and labelled; 49 photographs of the Brocklesby Woods, illustrating the evolution of forestry from the nurseries through the woods, and back to the creosoting plant; lists of trees planted during the past 121 years, amounting to a total of 23,828,316 trees; particulars and specimens of different tests, showing absorption of creosote oil by 27 and 56 kinds respectively, of home-grown woods, in the round and in scantling, and the loss of weight in seasoning. Also samples of creosoted and uncreosoted fencing, which had been in use 11 years, on sandy, clayey, and chalky soils, demonstrating the remarkable preservative effect of creosote on Spruce and other low-priced timbers. This part of the exhibit was most valuable to all owners of woods, demonstrating as it did the practicability of using at home for estate purposes all immature and rough timber, and selling only the best kinds. Included were also cast-iron date-pillars for young plantations; galvanised number nails for driving into timbers, to fix the date of creosoting or erection; a selection of forestry tools, etc.

Messrs Wm. Barron & Son, Elvaston Nurseries, had on view one of their tree-transplanting machines, which are now so well known.

Mr W. Forbes, of Shotwick Park, exhibited a timber book, timber table, etc., which are useful to foresters.

Messrs Richardson & Son, of Stamford, sent 13 fine photographs (framed in brown oak) of some noted oak trees which they had sold, and the recorded prices of the same; and also a superb piece of brown oak veneer, highly polished, showing the grain of the timber to perfection.

A very interesting exhibit, to the younger generation, was that of Messrs John Wisden & Co., London, showing six stages of the cricket bat, from the rough willow-timber to the finished article.

A collection of Willows, etc., suitable for basket-making, was sent by Sir Montague A. R. Cholmeley, Bart.

Mr Geo. Marshall exhibited specimens of common and Japanese Larches, which made out that the latter grew the quicker in its earlier stages.

Adjoining the Exhibition, several of our leading nurserymen had large spaces planted with conifers and ornamental trees and shrubs. There has seldom been seen at any Show a wider variety of plants, more tasteful grouping, and more striking and beautiful foliage. The chief exhibitors were Messrs Little & Ballantyne, Carlisle; Messrs Fisher, Son & Sibray, Ltd., Sheffield; Messrs James Backhouse & Son, Ltd., York; Messrs Kent & Brydon, Darlington; and Messrs Pennell and Sons, Lincoln.

It need only be added that the Exhibition was worthy of the place and the occasion, and should awaken a greater interest in the cause of British Forestry. Thousands visited this Section during the five days, and evinced an uncommon appreciation of it.

Professor Somerville, of Oxford University, acted as judge, and his decisions were received with practical unanimity.

# 16. Report on the Forestry Exhibition held in the Highland and Agricultural Society's Showyard, Prestonfield, Edinburgh, 9th-12th July 1907.

By A CORRESPONDENT.

The Society's seventh Annual Exhibition of Forestry, which was this year held in the Highland and Agricultural Society's Showyard at Prestonfield, may be fairly claimed to have been the best of its kind that has yet taken place. There were altogether 19 competitions for which prizes were offered, and, in addition, the usual invitation was extended to members and others to send articles for Exhibition only. In the competitive department there was only one section in which there was no entry; in eight there was only one entry; but in all the others there were several entries. The Directors of the Highland and Agricultural Society, as in previous years, kindly voted the sum of £,20 for prizes to be awarded for home-grown timber, and the Royal Scottish Arboricultural Society offered a large number of medals as prizes in the other competitions, besides authorising the Judges to recommend medals or other awards for interesting exhibits not sent for competition.

The prizes offered for timber were distributed over 4 competitions, in which there were 16 entries. The competitors were the Duke of Roxburghe, the Earl of Mansfield, Captain Stirling of Keir, Mr J. A. Stirling of Kippendavie, Mr Bryce Allan of Aros, Sir Duncan E. Hay, Bart. of Smithfield and Haystoun, and Mr H. J. Younger of Benmore. The timber exhibited in all the competitions was exceptionally good, and was generally admitted to have been the best yet shown at any of the The Scots pine, larch and spruce planks that Exhibitions. were awarded the first prize in the first competition were unique in quality and dimensions, but all the lots were of a very high standard. The second competition, which was for planks of three coniferous timber-trees other than those in Competition I., embraced planks of silver fir, Menzies spruce and Douglas spruce from Scone, and of Abies nobilis, Abies amabilis and Pinus insignis from Benmore. All the boards were fine specimens, but those in the second lot were specially attractive on account of their novelty. In the third competition for ash, oak and elm, the oak in the lots which were awarded the first and second prizes was

very fine. The feature of Competition IV., which embraced the other hardwood timbers, was the excellence of the beech in the lot which obtained the first prize, while the birch in the lot which was placed third was unusually good. In the competition for specimens of the fruits of trees, a very interesting collection of mounted specimens was sent by Mr John Patten, jun., Hulne Park, Alnwick. Mr Fred Moon, Forester to the Duke of Roxburghe, sent an instructive exhibit of the damage done by the pine saw-fly, an unusual feature of the exhibit being the live specimens at work. The Duke of Roxburghe, the Earl of Mansfield, and Captain Stirling of Keir sent farm gates; and Mr Fothringham of Murthly, the Duke of Roxburghe, Mr Alex. Pollock, Tarbolton, and the Earl of Mansfield sent self-closing wicket gates manufactured from home-grown timber. The first prizes in these competitions were awarded to the Earl of Mansfield, both of whose gates were much admired, though it was generally remarked that the cost indicated upon them appeared to be too moderate. Mr Fothringham's wicket gate had also many admirers. Mr Alex. Pollock exhibited along with his wicket gate a full sized section of a rustic fence made from larch thinnings.

In the competition for specimens showing the comparative quality of larch timber grown on different soils and situations, and the respective ages at which it reached marketable size and maturity, interesting specimens were sent by Captain Stirling of Keir and the Duke of Roxburghe. The latter also sent similar specimens of Scots pine, ash and spruce, which were well set up for inspection. The specimens of larch exhibited by Captain Stirling showed remarkable growth.

In the competition for specimens illustrating the beneficial effects of pruning when well done and its injurious effects when badly done, the Duke of Northumberland's exhibits were exceedingly well chosen, well labelled with descriptive accounts, and attracted a great deal of attention.

The Duke of Roxburghe and the Duke of Northumberland were also competitors with stems illustrating the effects of dense and of thin crops in branch suppression and quality of timber. The Duke of Roxburghe's specimens consisted of two samples of spruce, one with foliage down to the ground and the other showing a long clean stem. The Duke of Northumberland's exhibit included a specimen of Scots pine, taken from a wood

planted 4 feet apart, showing side branches much developed, which would be expected to produce knotty timber like a sample exhibited; and a similar tree taken from a plantation where the plants had been put in 3 feet apart, showing side branches with small development, which would be expected to yield in course of time clean timber similar to a board exhibited. These two specimens were further illustrated by diagrams of cross sections showing the strong branches projecting a long way into the timber from the centre in the one case and a very short distance in the other. Examples of the damage caused by too heavy thinning were also exhibited in this section by the Duke of Northumberland.

Mr Alex. Pollock, Tarbolton, sent a set of rustic chairs made from small oak-wood grown on the banks of the Ayr, and the Earl of Mansfield an interesting exhibit of turnery, which was entered under the competition for the best methods of utilising home-grown small wood. Both exhibitors, however, omitted to send samples of the round wood from which the exhibits were manufactured.—Mr Alex. Murray, Forester, Murthly, showed a collection of fungi injurious to forest trees and shrubs; while the Duke of Roxburghe sent samples of young trees damaged by squirrels and voles, with stuffed specimens of these pests.—The photographs of a forest tramway exhibited by the Duke of Roxburghe, which were accompanied by a descriptive report, were very interesting and instructive to practical foresters, wood merchants and others connected with the transport of timber.— In the general competition for any approved article either wholly or mainly made of wood, Mr Willian Sinton, jun., exhibited a neat plant-tub made from Jed Forest oak, and Mr Alex. Pollock a rustic seat made from home-grown oak.

In the non-competitive section of the Exhibition, Dr Borthwick, the Society's Honorary Cryptogamist, had an extensive collection of twigs and cones of conifers; and he also exhibited three newly-discovered fungi, of which he was kind enough to give an account at the General Meeting of the Society. (See note in the Proceedings of the General Meeting.)—The Society's collection of sections of British timber and photo-micrograph slides were again on view; and Mr James A. Weale, timber merchant, Liverpool, was kind enough to lend the photo-micrographs which were exhibited at Peebles last year, and were then awarded the Society's gold medal. Mr Weale's

collection this year included several new photographs.—Captain Stirling of Keir exhibited three large photographs of historical trees.—Mr Munro Ferguson, M.P., sent plants from his nursery at Novar, showing the good effects of transplanting when well done and the bad effects when badly done.—Mr James R. Barton, factor, 61 Frederick Street, Edinburgh, exhibited, in a neat case, specimens of the pine saw-fly and of the willow-moth in their various stages, along with the parts of the Scots pine and willow damaged.—Mr Alex. Murray, forester, Murthly, sent a very fine collection of 167 different varieties of tree-seeds well displayed for exhibition, with a descriptive report as to the best methods of collection and extraction.—Messrs Dicksons & Co., nurserymen, Edinburgh, exhibited a valuable set of tools used in forestry, a collection of cones, and a large number of transverse and longitudinal sections of timber of the principal forest trees illustrating the appearance of the wood.—The Earl of Mansfield had on view a large number of very fine planks of both coniferous and hardwood timbers, and also cross sections of various conifers grown on his estates, suitably labelled with particulars as to the age, volume per acre, and rate of growth. He also sent a set of tools and implements used in forestry operations, and a hunting wicket-gate made of split oak.-Mr Gillanders, forester to the Duke of Northumberland, had an instructive exhibit of turf and soil illustrating the advantages of pasturing woodland or waste land by stock previous to planting. The turf was in two divisions, one showing the rough heather previous to being pastured, and the other the grass from which the heather has almost disappeared after having been pastured for two years. He also sent a number of cases containing insects injurious to forest trees, with samples of the damage caused by them. A feature of this collection was the excellent way in which the specimens were labelled and described.—Lady Fowler, Inverbroom, Garve, sent a portion of a log of beech timber removed from the foundations of the choir of Winchester Cathedral in 1907, during the process of underpinning and the insertion of a new sub-foundation, rendered necessary in consequence of the subsidence of the structure. The logs were found to be laid horizontally and not driven as piles, at a depth of about 12 feet in a bed of chalky marl, fully charged with water, and overlying a peat-bed some few feet below. The logs were supporting the foundations of the main walls and piers of

the structure erected by Godfrey de Lucy (bishop, 1189-1204) in the reign of King John, and must therefore have been in position some seven hundred years. A framed plan of the foundations of the choir was also on view.—Mr John Methyen. Edinburgh, showed a small piece of oak taken from the sternpost of H.M.S. "Victory," and a small piece of Scots pine taken from Ballochbuie forest.—Mr Adam Spiers, timber merchant, Edinburgh, exhibited a remarkably fine plank of brown oak from the old Caledonian Forest, Dalkeith; a white beam of unusual size; a plank of sycamore of excellent quality; a very large plank of beech; a plank of Siberian larch; and a large larch tree grown on Yester estate, containing over 100 cubic feet of timber, and 110 years old,—Messrs Mackenzie and Moncur, Ltd., exhibited a plank of larch imported from Northern Russia, which was much admired. This timber is now being experimented with as a substitute for red wood in hothouse building.-Mr David W. Thomson, nurseryman, Edinburgh, was good enough to send the fine collection of ornamental trees and shrubs which decorated the Society's enclosure.

The Exhibition attracted a large number of visitors each day, and on the Thursday afternoon the Society was honoured by a visit to the Exhibition from H.R.H. the Prince of Wales and his suite, including the Duke of Buccleuch, Lord Tullibardine, Lord Rosebery, Lord Lovat, and other members of the Society. Mr John Methven, who had been presented on the previous day, received His Royal Highness, and presented the secretary, Mr Robert Galloway, S.S.C., who had the honour of explaining the principal exhibits to the Prince. His Royal Highness showed great interest in all the objects brought under his notice, and expressed himself as much pleased with what he had seen. Mr Methven thanked the Prince for his visit.

The thanks of the Society are due to Messrs Broom, Crozier, and Macbean, the judges, for the expeditious and satisfactory manner in which they carried out their difficult duties, and to the committee for the trouble taken by them in connection with the arrangements. Special thanks are due to Mr M'Hattie, convener of the committee, for providing the attendants, and to Mr Spiers, who was present not only during the whole of the Exhibition, but also before it opened and after it closed, in connection with the staging and removal of the exhibits.

# 17. The Thirtieth Annual Excursion, August 1907.

(With Plate.)

The Thirtieth Annual Excursion of the Royal Scottish Arboricultural Society was held on 6th, 7th, 8th and 9th August 1907, in the district of Speyside, permission to visit estates there having been kindly granted by the Dowager Countess of Seafield, His Grace the Duke of Richmond and Gordon, Sir George Macpherson Grant, Bart. of Ballindalloch, Mr J. W. Wharton Duff of Orton, and Mr John R. Findlay of Aberlour. Elgin was the headquarters of the Society during the tour.

## FIRST DAY.—SEAFIELD ESTATES (CASTLE GRANT DISTRICT).

A special train conveyed the members to Grantown, where they were welcomed on Lady Seafield's behalf by Mr J. Grant Thomson, wood manager on the estates, who put into the hands of the members a printed programme for the day, which he had very kindly prepared for their use.

One of the most noteworthy features in Strathspey forestry being the extent to which natural regeneration is carried on. the programme included visits to woods raised by that method. In a Scots pine wood of 16 acres, and about 100 years of age, beside the Highland Railway Station at Grantown, the first stage of regeneration was seen. This wood was recently enclosed, and young natural plants are now appearing among the heather, the presence of which indicates that the conditions are suitable for the natural growth of Scots pine. In certain parts the turf had been upturned, so that the exposed soil might catch the falling seed, and offer it a germinating bed. But the cold and backward weather of the present year having delayed the opening of the cones, fewer young plants were visible than would have appeared in an average year, though on several of the exposed surfaces young seedlings of this year's growth were observed.

The party then drove to Kylintra Saw-mill, and walked along the public road which intersects woods of about 70 acres in extent. On the left was a thriving young crop of natural Scots pine, growing between and below the old parent trees; on the right, where the old trees had nearly all been cleared away, was a dense natural crop about 70 years old.

After driving through Grantown village, the members saw on their left Lynmacgregor Wood, which consists of a mixture of larch and Scots pine about 50 years of age. This was originally a planted wood, and the larches still survive, but the pines were eaten by rabbits and beetles. A natural crop of pines then came up, and the ground is now excellently covered by them. Farther north, Lynmoor Wood, which was enclosed in 1877, and consists of a natural crop of larch and Scots pine, was visited. Unfortunately, time prevented more than a passing look at this thriving wood.

Returning, the party drove to Castle Grant, which, by the kindness of Lady Seafield, who personally welcomed them, they were permitted to visit. Milton Wood, extending to about 38 acres, was next visited. It is said to have been originally planted with young natural trees carted from Abernethy forest. and is believed to be now between 150 and 200 years old. It affords a view, probably unequalled, of lofty valuable Scots pine trees. Spruce, as well as Scots pine and larch, grows naturally in Strathspey, and two groups of spruce thus raised were seen from the carriages on the way back to Grantown. On reaching Grantown the visitors were hospitably entertained to lunch by Lady Seafield; after this the Scots pine woods of Drumindunan and Anagach were inspected. The former, which is said to be the oldest planted wood on the estate, exhibits various stages of the growth of the pine, from the largest timber-trees down to naturally sown seedlings. The wood of Anagach also contains an extensive and thriving crop of natural trees. Over two hours were devoted to the inspection of these woods. In the evening the members dined together in the Grand Hotel, and afterwards an informal discussion, opened by Dr Borthwick, took place on the effects of smoke on trees.

#### SECOND DAY.

The programme for this day included visits to Mr Wiseman's nurseries and to the estates of Orton and Gordon Castle.

#### WISEMAN'S NURSERIES.

The party left Elgin in the morning, driving to Mr Edward Wiseman's extensive nurseries, where an enormous quantity of young trees of various species, in which the Scots pine and the





Fig. 1. In Curr Wood, Scaffield Estates, Strathspey.

John Smith, J. Grant Smith, Factor, Thomson, B.D., Grantown.

Grantown.

J. Grant Thomson, Mood Manager, Grantown.

J. Grantown.

Grantown.



Fig. 2. Grig Wood, Orton. Probable date of planting, 1780-85.

To face page 97.

larch predominate, are raised. The nurseries, which give employment to a large number of men and women, are beautifully kept, and the whole stock appeared to be in a very healthy and vigorous condition. After spending about two hours in the nurseries, the party drove on to

#### ORTON,

where they were met by Mr and Mrs Wharton Duff of Orton, who had very kindly drawn up a programme for the visit. Mrs Wharton Duff, who is a daughter of the late Mr John Ord Mackenzie, one of the founders of the Society, is keenly interested in arboriculture, and personally conducted the party over several of the woods on the estate. The district, which contains many interesting features, presents a marked contrast to the Seafield estate visited on the previous day. The Darnot Hill Wood, composed of a mixture of Scots pine and larch, was planted about 1770, and contains some magnificent timber. The trees are of great height and girth, and rise straight and smooth as telegraph poles for a considerable proportion of their height. On the north-east and more exposed side of the wood there were signs of larch canker, and so much damage was done by rabbits and squirrels that it had to be replanted at different times. Professor Somerville, in the course of a few remarks addressed on the spot to the members, said that the trees had practically overcome the disease, and that they were now likely to grow into valuable timber. The Grig Wood, planted about 1780, also contained some very fine trees of pine, larch, spruce, beech and other species (see Plate X. Fig. 2). Mr and Mrs Wharton Duff kindly entertained the party to luncheon in the Mansion House, and afterwards the members drove to

## GORDON CASTLE,

where they were met by Mr Muirhead, the Duke of Richmond and Gordon's commissioner, Mr Cunningham, factor, and Mr Webster, forester and gardener. The deer-park was first inspected, several very fine specimens of Scots pine and larch attracting particular attention. Some of the larches showed a girth of 12 feet. An enjoyable walk down the Glen by Wishartstown brought the party to the Castle, near which the Duchess tree and several large specimens of yew and lime

trees were measured. After tea, which was kindly provided by the Duke of Richmond and Gordon, the members were shown round the gardens, which were greatly admired.

The Annual Excursion Dinner was held in the Grand Hotel. The President, Sir Kenneth Mackenzie, was chairman, and Mr Fothringham, vice-president, was croupier. The guests of the evening included Bailies Davie, Wilson and Gordon, Mr Hugh Stuart, Town Clerk, and Mr J. Grant Smith, factor, Elgin.

#### THIRD DAY.—BALLINDALLOCH.

The party at Ballindalloch Station were received by Mr John Macpherson Grant, Younger, of Ballindalloch. Sir George Macpherson Grant, Bart., received his guests at the end of the bridge over the river Avon, and gave them a most hearty welcome. The members then passed along the avenue, which is lined on both sides with magnificent larch and other trees. A splendid specimen of Abies nobilis attracted great attention. At 5 feet from the ground it girthed 9 feet 111 inches, and its height was estimated at 94 or 95 feet. This specimen was considered by the company to be the largest in girth in the kingdom, the only one approaching it being found at Murthly,—this girths only 7 feet 11 inches, but it is said to be a little over 100 feet in height. Sir George informed the company that this tree was planted in 1859 or 1860. A Douglas fir, with great outspreading branches, a number of which trailed on the ground, girthed 12 feet 8 inches, and was about 90 feet high. Sir George stated that it was planted in 1846. There were a number of excellent hardwoods-ash, limes, beeches and chestnuts-which were considered to be the finest the members had seen since they came north. The company were hospitably entertained to luncheon by Sir George.

#### ABERLOUR.

An enjoyable drive along the banks of the Spey brought the Excursionists to Aberlour House, where they were entertained by Mr and Mrs J. R. Findlay. A brief visit was made to the policies and beautifully laid out gardens, many notable trees being inspected in the policies. The home farm was also visited. The members then returned to Elgin.

## FOURTH DAY .- SEAFIELD ESTATE, ABERNETHY.

The party started early for Cromdale Station, where they were again met by Mr Grant Thomson and other estate officials. As in the case of the first day's excursion, Mr Thomson had kindly prepared a programme. Tominourd, a long hill about two miles north from Cromdale Station, rising to about 800 feet above the level of the Spey and about 1400 feet above sea-level, was first visited. An area of 1030 acres was planted in 1826, the plantation being about seven miles in circumference. It was enclosed in 1865 for the purpose of being naturally regenerated, and it now carries an exceptionally thriving young crop of larch and Scots pine. Parent trees are still standing from the base to the summit, but in course of time, as the seedlings grow up, these will be removed. Seedlings were seen of a year or two's growth, their heads just appearing above the heather, while others were a foot or two higher; but there were numbers of acres carrying trees which had reached a height of from 8 to 15 feet. They were all looking vigorous and healthy. When the wood was first thinned to allow the seedlings to spring up, sheep were allowed to pasture on the hill. Trees will not thrive under such conditions. When snow covers the hills and the herbage is scarce, the sheep are obliged to eat their tender shoots, with the result that the leaders disappear. In time new leaders appear, but valuable years are thus lost; and as it is acknowledged that sheep must be banished in order to ensure healthy and vigorous trees, about six years ago sheep were excluded from this hill. The effects of the nipping off the tops are still seen, particularly in the larch, but the greater proportion of the young pine trees have got their new leaders, and the older larches have quite reasserted themselves. There were many spots of considerable area where no seedlings were visible, but it was said that time only was required to clothe the whole hill from top to bottom with a forest of trees as thick as they could possibly grow.

After leaving Tominourd the party drove about nine miles up the banks of the river Spey to see the natural woods of Skye and Curr. The former was merely examined from the road, as there was no time to make a more careful inspection of it. Curr plantation (see Plate X. Fig. 1) was, however, carefully examined. It extends to 250 acres, and was enclosed in 1874. It contains

a natural crop of Scots pine, and also some larches produced by natural regeneration. The ground is so well covered that the soil and climate must be exceptionally favourable. No thinning has been done, though dead stems have been removed for firewood, and no thinning will be made until it becomes commercially profitable. Nature, which raises the crop, being left to do the thinning, the strong plants in course of time smothering the weak. M. Boppe visited this forest amongst others in 1881, and in the course of his report said: "It is easy in Scotland to perpetuate a forest by natural means, and of this a practical proof was given us in two forests which we visited, one near Grantown in Strathspey, the other at Beauly. In these the results obtained under the skilful and intelligent direction of the gentlemen who manage these forests for their employers form a striking example of what may be done in the way of reproducing forests by natural means. In fact, nothing had been neglected which even the most critical forester could desire; the gradation of age was here complete, and the reservation of specially vigorous trees of known pedigree, duly carried out" (see Transactions, Vol. XI. p. 202).

The large majority of the members had not had an opportunity of seeing natural regeneration before as carried out in the north of Scotland, and few were aware that such perfect examples as they had had the privilege of inspecting that day existed in the country.

After leaving Curr, Balgowan Wood was inspected. This wood was enclosed about seven years ago, and contains a natural crop of Scots pine seedlings, in vigorous condition, which will soon quite cover the ground. On reaching the nursery they partook of lunch, kindly provided by Lady Seafield. After inspecting the nursery, the party drove through part of the old Abernethy forest, which is a very extensive area of Scots pine of all ages. The part of the forest passed through was once devastated by fire, but is now all covered with a vigorous natural crop, though a few of the old trees which survived the fire are still visible. It was estimated that some of the older trees were over 300 years of age.

The party then drove to Nethy Bridge Station, where they took train for the south.

The following is a list of the members who took part in the Excursion:—Sir Kenneth Mackenzie, Bart., President; Robert

Allan, Polkemmet; Dr Borthwick, Edinburgh; John Boyd, Pollok; John Broom, Bathgate; Charles Brown, Kerse, Falkirk; Gilbert Brown, Kiltarlity, Beauly; Thomas Bryden, Ayr; Charles Buchanan, Penicuik, Convener; H. M. Cadell of Grange, Bo'ness; Thomas Christie, Forres; William Christie, Fochabers; Robert Cowan, Erchless, Strathglass; R. W. Cowper, Gortanore, Sittingbourne; Alfred G. Crabbe, Craigo, Montrose; John D. Crozier, Durris, Drumoak; W. S. Curr, Ninewar, Prestonkirk; Evan J. Cuthbertson, Edinburgh; William Dick, Hamilton; Walter Elgar, Hillside, Sittingbourne: James Forbes, Overtoun, Dumbarton; Robert Forbes, Kennet, Alloa; W. Steuart Fothringham of Murthly; Alex. Fraser, Inverness; Robert A. Fraser, Edinburgh; Robert Galloway, 19 Castle Street, Edinburgh, Secretary; Arthur P. Grenfell, London; George Halliday. Rothesay; James S. Keir, Raith, Kirkaldy; Robert Laird, Edinburgh; George Leven, Auchincruive; A. Lockhart, Huntly; Rev. J. S. Loutit, Foveran, Aberdeen; S. Macbean, Erskine, Bishopton; G. U. Macdonald, Haystoun, Peebles; Gilbert R. M'Garva, Innes, Elgin; J. W. MacHattie, Edinburgh; James Mackenzie, Inverness; John M'Kerchar, London; Donald M'Laren, Sundrum, Ayr; W. H. Massie, Edinburgh; Alex. Milne, Edinburgh; Alex. Morgan, Crieff; Andrew Morrison, Brodie, Forres; Alex. J. Munro, Edinburgh; George A. Munro, Edinburgh; A. D. Page, Culzean, Ayr; James Porteous of Turfhills, Kinross; W. M. Price, Minto, Hawick; W. Ralph, Corstorphine; John Rule, Huntly; H. Rutherfurd of Fairnington, Roxburgh; David T. Samson, Grantown; Thos. Sharpe, Monreith, Port William; James Shiel, Abbey St Bathans, Grant's House; Professor William Somerville, Oxford; Adam Spiers, Edinburgh; W. J. Stalker, Nairn; James Stoddart, Bonnyrigg; Robert Taylor, Broomhill, Charlestown; J. Grant Thomson, Grantown; James W. Watt, Carlisle; John Williamson, Grangemouth; David Wilson, Troon; Edward Wiseman, Elgin; George Wolfe, Bathgate; E. M. Worsfold, Dover; William M'Nae, Munches, Dalbeattie; Arthur M. Sleight, Brighton; Rev. W. B. Sleight, Northampton; F. Simmonds, M.V.O., Kensington; James Tait, Penicuik; D. Macmillan, Keir, Dunblane; W. Ramsay of Longmorn, Elgin; Daniel Scott, Darnaway, Forres; Alex. Robson, Aberdeen; William Mackenzie, Novar.

# NOTES AND QUERIES.

THE FORESTRY COMMITTEE (1902) AND TRAINING IN FORESTRY.

The Forestry Committee (1902) contemplated that the training in forestry of persons requiring it would be arranged as follows:—

I. Future Owners and Agents, to be Trained at Universities and Provincial Colleges.—The Committee considered that the scope and character of the instruction then given at the Edinburgh University was the least that should be aimed at, though it might with advantage be carried considerably further; and that better instructional facilities, including a Forest Garden, should be provided. Since the Committee's report was written, a Degree in Forestry 1 has been instituted at the Edinburgh University, with an advanced course in Forestry, and with new special courses in Forest Botany, Forest Entomology, and Forest Engineering. This involves two years' study at the University, and a third year occupied in practical work abroad.

It may be confidently anticipated that when work at Inverliever and in the Highland and Lowland State Demonstration Forests is fairly started, the financial potentialities of scientific forestry will become more generally recognised than they are at present; and that as soon as Bachelors of Science in Forestry have gained sufficient practical experience to be entrusted with a responsible charge, the owners of large estates will, when filling vacancies on their staff of factors or wood-managers, give them a preference, and will be willing to offer salaries sufficient to attract such men into their service. When this comes about, there will be no lack of candidates for the Degree, a further inducement to take which will be found in the better prospect it will secure of highly paid colonial employment.

2. Men who propose to take up Land Agency as a profession, but who cannot afford to spend Three Years at a University.—This class to be trained at Agricultural Colleges, by courses similar to those at the Universities. In this connection the Committee say: "Inasmuch as Land-Agents are entrusted with the management of large estates, which usually comprise a certain area under

<sup>&</sup>lt;sup>1</sup> For further information regarding the Degree, see *Transactions*, Vol. XX. p. 248.

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." The ordinary, or lower, course in Forestry, as given at the University of Edinburgh, which will include practical instruction in the Forest Nursery and the Forest Garden, when these necessary adjuncts have been provided, now forms part of the curriculum of the College of Agriculture. It is this year attended by 13 students, of whom 5 are from the College. That course, taken together with other relative courses at the University or the College of Agriculture, and with six months spent in a State Demonstration Forest, will meet the case of candidates for Land-Agencies who may be unable to enter a University. And it may safely be predicted that the day is not far distant when the proprietors of even moderate-sized estates will require both their Factors and their newly-appointed Head Foresters to possess at least the above qualification. Orthodox views on the subject of forest management are spreading with remarkable rapidity; and it may be expected that, even without the prospect of an immediate rise in the salary and position of the Head Forester, a considerable number of candidates for that office will before long come forward to follow the curriculum above indicated. But men who have passed creditably through it will certainly be found worthy of improved positions, and their employers will find it to their own advantage to offer them better prospects than they have at present.

3. Young Working Foresters and Woodmen.—The training of this class to be provided for in one or other of the following ways:—

(a) Selected students to receive two years' training at a school to be established within a State Demonstration Forest, where they will receive regular wages and perform manual work, supplemented by theoretical study. Outsiders to be admitted on payment of a small fee.

(b) Men unable to leave their posts to take the above, or whose prospective salaries do not justify their attendance for any length of time at Universities or Colleges, to be offered short courses, suited to their needs, by the Agricultural Colleges. A short course of evening lectures is now given at the East of Scotland College of Agriculture, and is being followed during the current year by 27 students, among whom are numbered

young men from factors' offices who are in training for landagencies. The average attendance during the past three years has been 28. This course is in every way suited for the class of men indicated under this head by the Forestry Committee. It serves as a valuable introduction to the higher courses referred to above.

(c) For the benefit of men who may not be able to attend either of the above courses, lectures to be given, under the auspices of County Councils, in neighbourhoods where woods are numerous; scholarships and bursaries being offered in these counties to enable men who attend the lectures to enter for higher courses of instruction. Such lectures have, for the past three years, been given at various centres, the average annual total number of students having been 115. The classes have included factors, head foresters, assistant foresters, gardeners, and others interested in the subject.

F. BAILEY.

#### FIRST STEPS AT INVERLIEVER.

Many questions are being asked as to the future of Inverliever, but the problem is one that may be summed up quite tersely. The first step is to put the whole organisation of the 12,000 acres under the most competent forest officer that can be found. This functionary should visit Inverliever at least quarterly.

The second is to appoint a competent Advisory Board of four or five level-headed timber-growers or managers,—not to assume any responsibility, but to advise on the practical application of the plan to local conditions, and to offer suggestions for its modification or improvement for the consideration of the forest officer as occasion may arise. They might possibly have some authority delegated to them, but their chief function would be to keep the expert in touch with practical necessities, so that he would have all information before him on which to make his decisions.

The third step is to appoint a local foreman, who is likely to plant at the lowest effective expenditure and with the fewest deaths, and could be relied upon to carry out intelligently the directions he receives.

*N.B.*—This foreman should either be a first-rate nurseryman, or he should have a first-rate nurseryman under him, for the financial success of the undertaking will depend mainly on efficient nursery work in the first instance, and on the economical transfer of the plants from the nursery to the new plantations.

R. C. Munro Ferguson.

# Note on Damage to a Young Coniferous Plantation by Water-Voles.

The attack occurred in April and May of 1907 in a five-yearold plantation of Scots pine, spruce, and larch, with an admixture of hardwoods, on the Broxmouth Estate of His Grace the Duke of Roxburghe, and was brought to my notice by my assistant on that property. A burn flows through the plantation.

Recognising at once the work of voles, I instructed my assistant to at once set traps in their underground runs, and to try poisoned bait set in drain tiles; and as I was returning home that day, I desired him to send me a specimen of his catch. I was agreeably surprised the following morning when a water-vole (Arvicola amphibius) arrived by post.

A couple of dozen Scots pine and several spruce and larch plants were damaged, the damage consisting in the smaller roots of these plants being entirely eaten, and the bark stripped off the larger roots and underground part of the stem up to the collum.

The underground runs of the water-vole are about two and a half inches in diameter, and close to the surface of the ground. A curious point in this case is in regard to the means taken by these animals to dispose of the excavations from so large a hole, as no trace of these could be found. The voles are very fond of sunning themselves on a warm day, and may at these times be surprised and killed by an active man with a stick.

As already mentioned, the plans adopted to destroy the animals were poisoned bait set in drain tiles and steel traps. The former was not a success, possibly owing to the bait used being bread. Had grain been used instead, better results by poisoning would probably have been obtained.

Trapping, however, was so successful, that poisoning was

abandoned in favour of that mode of destruction. The procedure was to set ordinary steel rabbit traps in the bottom of the underground runs, blinding the traps with chopped grass, and covering over with a sod the hole made in the roof of the run to admit the trap. This served the double purpose of excluding the light and marking the positions of the traps. Up to August about forty voles were trapped, about half of them being gravid females. In addition to these, the forester's spaniel has killed several.

The infested area, where the damage was detected, is a small piece of haugh land lying between the burn on one side and a steep brae with a terrace on the top. At first the catches were at the rate of two or three each day; gradually this rate decreased, and at the date of writing (August), while there are still voles in the plantation, they have been driven from their original haunt in the haugh to the higher ground, and are not now easily trapped. No damage to the plants has been done since the end of May. Next year, should we experience a recurrence of the attack, I intend trying bait treated with "Danysz Virus" and set in their underground runs, in addition to harrying them with traps. What I particularly wish to emphasise, however, is not the trifling amount of damage done, but the prompt and successful action of my colleague, which has prevented what might have been a serious attack by these destructive rodents. FRED MOON.

#### AN IRISH FORESTRY COMMITTEE.

The Vice-President of the Department of Agriculture and Technical Instruction for Ireland has appointed a committee to inquire into and report upon certain matters relating to the improvement of forestry in Ireland. The committee consists of the following members:—Mr Thomas Patrick Gill, secretary of the Department of Agriculture and Technical Instruction for Ireland (chairman); Lord Castletown; Mr William Redmond, M.P.; the Most Rev. Dennis Kelly, Lord Bishop of Ross, member of the Agricultural Board; Mr Hugh de Fellenburg Montgomery, member of the Agricultural Board; Mr William Frederick Bailey, one of the Estates Commissioners; Mr William Rogers Fisher, M.A., delegate for instruction in forestry at the Univer-

sity of Oxford; Professor John Rich Campbell, assistant secretary in respect of agriculture of the Department of Agriculture and Technical Instruction for Ireland. The terms of reference are to inquire into and report upon the following matters relating to the improvement of forestry in Ireland—viz., (1) the present provision for State aid to forestry in Ireland; (2) the means whereby, in connection with the operation of the Land Purchase Acts, existing woods may be preserved, and land suitable for forestry acquired for public purposes; and (3) the financial and other provisions necessary for a comprehensive scheme of afforestation in Ireland. The committee began its sittings in October.

#### RURAL EMPLOYMENT IN IRELAND AND RE-AFFORESTATION.

A writer in the Timber Trades Journal calls attention to some points in regard to the condition of the forests of Ireland which are of great importance. The existing forests of that country are, owing to a variety of causes, being destroyed at an alarming rate, and there is little hope that this state of affairs will be remedied by private effort. In the first place, the woods in many parts are being ruthlessly destroyed by the prevalence of temporary businesses in the shape of portable saw-mills, which, as a rule, belong to English firms, and which are not undertaken with the idea of establishing a permanent industry which may benefit the locality. Again, the tenant farmers who become owners under the Land Commission in many cases sell out the timber immediately on taking possession of the land, and this without having any intention of replanting. An increasingly widespread interest is, however, now manifest in the country, and this is mainly due to the disinterested and strenuous action of the Irish Forestry Society. They have succeeded in rousing the interest of the Agricultural Department to the possibilities of re-afforestation, but as yet no adequate steps have been officially taken towards the realisation of these ideas. It is rightly felt that in Ireland, owing to the state of the Land Question, the matter rests almost entirely in the hands of those particular bodies responsible for the buying out of the lands from the present owners, that is, such bodies as the Estates Commissioners and the Congested Districts Board. No amount of private

enterprise, no matter how enthusiastic or whole-hearted, could raise the large capital required for carrying out a scheme of afforestation extensive enough to be of benefit to the country as a whole.

The great need over large tracts in Ireland is for rural employment; and if fairly extensive tracts of land were acquired in different parts of the country by a Forestry Board under State control, a remunerative livelihood for a large number of able-bodied young men would be established in the draining, fencing, and general preparation of the land, and in the tending of the trees after they were planted. Coniferous building timbers are yearly increasing in price, owing to the exhaustion of foreign and colonial timbers near the sea-board, and it is time that the critical position of our whole timber-supply was realised. Ireland, with its bogs, its plains, and its hill-sides lying dormant and crying aloud for exploitation, stands ready for a scheme of afforestation that shall fulfil the purposes of giving employment where it is needed, of supplying a demand for timber that will be badly wanted, and of securing a good return for invested capital. Smaller and poorer countries have their profitable State forests. They have borne the brunt of the experimental stage, and the British Government can now step into line and reap the benefit of others' experience. In connection with this article, the announcement, quoted above, of the appointment of an Irish Forestry Committee is of great importance.

## PUBLICATION OF INDIAN DEPARTMENTAL LITERATURE.

The constitution of a Forest Research Institute, and the development of scientific investigation in the Forest Department, have shown the necessity of placing Indian Forest literature on a more satisfactory footing than heretofore, and the Government of India have sanctioned a proposal by which publications containing important information will remain available for permanent reference, and will be issued in a form both acceptable to the scientific world, and convenient for economic purposes. In future, therefore, the *Indian Forest Records* will be devoted to the publication of papers giving the results of the local investigations of the Research Institute staff, or of others, whether members of the Department or not; together with any short notes on pre-

liminary research, the publication of which may be considered of advantage in aiding others to carry out further observations on the same subject. Notes and observations supplied by forest officers on such matters as the effects of exceptional seasons on forest growth, the seeding of the valuable species of trees, sudden attacks of serious pests, etc., will find a place in the Records. The Records will deal strictly with professional matters, and should form a valuable current exposition of the work of the Department, which will be of interest and utility alike to the members of the service and to scientists and those interested in forestry throughout the world.

The *Indian Forest Memoirs* will only appear when monographs suitable for reproduction in this form are received. They will be devoted to the publication of complete and important monographs on particular subjects. For example, memoirs dealing with careful research made into the silviculture of a particular species of tree, or with a family or genus of insect or fungus pests or the description of new species; researches into the formation, growth and economic uses of a particular gum, dye, tannin, etc. The *Memoirs* will be kept strictly technical, and will be open to the papers of all authors, having a scientific or economic bearing upon Indian forestry.

The pages of the above publications will be open to all who desire to secure for their researches a permanent place in Indian forest literature, whence it will be available to all those interested in the science of forestry.

## THE ALBERT OR HEMLOCK SPRUCE AT LOGANBANK.

By invitation of Mr A. W. Inglis, and in company with Dr A. W. Borthwick, I recently examined the Albert spruces at Loganbank, Midlothian, where trees about 40 years old have attained a height of 80 feet, or, in other words, show an average annual height-increment of about 2 feet. They have a very healthy appearance, and have by no means done growing. A group of these trees standing in an old stone-quarry have developed straight cylindrical stems, on which the dead sidebranches persist after the manner of those of the silver fir and Norway spruce. The species can stand much shade, for we saw a bed of young plants which for the last four years have

been, and still are, standing under the crown of a beech tree, and are further incommoded by a considerable amount of lateral shade; they were not developing rapidly, but had an otherwise healthy appearance. The young trees are found to suffer from frost, as do many other shade-bearing species, such as silver fir and beech. The tree grows well on wet soil, and suffered but little from the sulphur fumes which, a few years ago, caused great damage to the woods of Loganbank. We were shown a fence-stob, made from the timber of this species, which, its point having been dipped in coal-tar, had stood in the ground for twelve years. It was as sound as on the day the fence was set up, the sawn point still showing its clean-cut surface and edges.

F. B.

## APPOINTMENTS BY THE DEPARTMENT OF WOODS.

The Deputy-Surveyorship of the Forest of Dean, vacant through the death of the late Mr Philip Baylis, has been filled by the appointment of Mr V. F. Leese, a qualified land agent.

We are authorised to state that Mr E. P. Popert, formerly of the Indian Forest Service, who has for some years past acted as assistant to Mr Baylis in the Forest of Dean, has been appointed Special Forestry Adviser to the Commissioners of Woods in respect of all the Crown Forests and Woodlands. He will arrange for the collection of data regarding their rate of development and other matters which form the basis of a rational management. He will personally superintend the working of the Forest of Dean and the Highmeadows Woods, keeping up the Control books and the records of the experimental plots, and submitting annually to the Commissioners, through the Deputy-Surveyor, a report on the work done in those woods, with proposals for their future management. He will also superintend the Government Forest School established in the Forest of Dean. The appointment of Mr Popert appears to secure adequate and long-needed professional control over the working of the Government forest estates.

#### TWO EXCEPTIONAL TREES.

On Newgate Bank, by the side of the road leading through Lord Feversham's splendid larch woods into Bilsdale, in the North Riding of Yorkshire, there stands a holly tree of uncommon size. The measurements of the bole are 2 feet long by 10 feet 8 inches circumference, and there are two limbs 3 feet by 7 feet 8 inches, and 4 feet by 6 feet 2 inches respectively. The tree has a large spreading top, and appears to be fairly healthy. Is not this a record size?

In Yarm-on-Tees, in the North Riding of Yorkshire, there may be seen a good specimen of the Californian Redwood (Sequoia sempervirens), trained as a wall-tree over the gable end of a building, and completely covering the whole wall from top to bottom. The total height is about 40 feet, and the tree is in a very healthy condition, and certainly has a splendid appearance. Do any of your readers know of a similar case?

W. B. HAVELOCK.

#### PLANTATIONS AT INVERLIEVER.

The following statement in regard to the timber crops now growing on the Inverliever estate have been supplied to us by Colonel Malcolm:—

NAME.	Position	Date of Planting.	Acreage.
Torran, .	East of farm buildings, between road to Inver- liever and Loch Awe,	1894,	6 acres.
Island,	. South-west of the junction of the Liever with Loch Awe,	1877,	15½ acres.
Arichamish,	North side of road at Inverliever boathouse,	1877,	16 acres.
Ford,	. Above Gray's Holding,	No record,	9½ acres.
New York,	West of Pier,	Supposed to be about 1863,	43½ acres.
		Total,	90½ acres.

POLTALLOCH ESTATE OFFICE, 27th November 1907.

#### ERRATUM.

Mr Fisher informs us that a somewhat important error occurs in his article on the Forest of Retz, in Vol. XVIII. (1905) of our *Transactions*, an error which he has only noticed recently. On p. 99, under the heading Revenue, the first sentence should read, "The average annual yield of the whole forest from 1898 to 1900 was 2,684,430 cubic feet (solid), realising £24,613," in place of "684,430 cubic feet" as in the text.

# OBITUARY.

SIR DIETRICH BRANDIS, K.C.I.E., F.R.S.1

By the death of Sir Dietrich Brandis, which occurred at Bonn on 28th May, a man of world-wide renown has been removed. Brandis was born on 1st April 1824, at Bonn, being the son of Dr Christian Brandis, professor of philosophy in Bonn University. As a boy he followed his father to Greece, where he spent several years. On his return to Germany he was educated at the universities of Copenhagen, Göttingen, and Bonn. He became, in 1849, lecturer (*Privat-docent*) on Botany at Bonn. In 1854 he married a daughter of Dr Marshman, of Bengal. This happened to be the turning-point in his career.

After the occupation of the province of Pegu in Burma, Lord Dalhousie was looking for a man to take charge of the important teak forests of that province, when his attention was directed to Brandis by the latter's brother-in-law, General Sir Henry Havelock. Lord Dalhousie wrote to Brandis that if he would come to India he would be appointed superintendent of the Pegu teak forests. The offer was accepted, and Brandis landed at Calcutta in 1856. He explained his views to Lord Dalhousie, who, in taking leave of him, said: "Dr Brandis, if you carry out the scheme which you have explained to me, you will confer a great benefit upon this country." Brandis never saw Lord Dalhousie again, but his parting words remained with him throughout his service. Brandis set to work to save the Burma teak forests, in which endeavour he had the full support of Major (afterwards Sir Arthur) Phayre. After a longcontinued struggle the forests were placed under systematic management, and they, with the forests of Upper Burma, are now the chief supply of teak timber to the world.

In 1862 Brandis was called to Simla, at the suggestion, it is believed, of Dr Cleghorn, one of the principal pioneers of forest conservancy in India, to advise the Government of India on forest matters in other provinces, and in 1864 he was appointed the first Inspector-General of Forests to the

<sup>&</sup>lt;sup>1</sup> Reprinted by kind permission of the Editor of Nature.

Government of India. He then set to work to introduce systematic forest management throughout India. A regular department was established and a forest law passed. Brandis travelled from one end of the Bengal Presidency to the other, advising and organising the department. He also visited Bombay twice, and spent two years (1881-83) in Madras. The department thus created has grown until it has now under its management an area of 239,000 square miles, equal to twice the area of Great Britain and Ireland.

When Brandis first started operations he had to do with what staff he could lay his hands on; but he determined to obtain one fit to deal with the requirements of the case. In 1866, while on sick leave in England, he obtained the sanction of the late Lord Salisbury, then Secretary of State for India, to train young Englishmen in Continental forest schools, and under this scheme a number of highly-qualified foresters have been sent to India. The training at Continental forest schools was subsequently supplanted by that at Coopers Hill College, and now at the University of Oxford.

But Brandis went a step further. In 1878 he started a forest school at Dehra Dun for the training of natives of India, which has now been raised to the rank of "The Imperial Indian Forest College," and sends annually from forty to fifty trained executive officers into the service.

By these means a trained staff of 200 Englishmen have been obtained, who control the operations of the Forest Department, assisted by about 11,000 native officials of various grades. The results are most gratifying. The supply of timber, firewood, grass, and other produce from the teeming millions of India has been placed on a satisfactory footing, while the net revenue from the forests has risen from  $\pm 40,000$  in 1864 to  $\pm 660,000$  in 1904, although produce valued at a similar sum is given free to the people of the country.

During his career in India Brandis wrote an endless number of reports, and in 1874 he brought out the Forest Flora of Northwest and Central India, a work which was so highly thought of by Sir Joseph Hooker and others, that he was made a Fellow of the Royal Society in 1875. It may not be generally known that Brandis was the first who compiled a rainfall map of India; it has been improved since, but as regards the main points it holds good to this day.

Brandis retired from the Indian service in 1883, at the age of fifty-nine years; but he continued to devote himself to the advancement of forest conservancy in India, by articles and letters of advice to his friends in India. From 1888 to 1896 he superintended the practical instruction in Germany of the Coopers Hill forest students.

The last eight years of his life he devoted to the writing of a general Indian forest flora, which he published in 1906 under the title of *Indian Trees*, a monumental work which is likely to be the standing book of reference on the subject for another generation. Scarcely had he completed this when he fell ill, and he never rose from his sick-bed. He was made a C.I.E. in 1876 and a K.C.I.E. in 1887.

It should not be omitted to mention that Brandis had a great share in the development of forest conservancy in the United States. He guided the studies of quite a number of young Americans, who have since established a great department in the United States. His influence in this respect has been so great that President Roosevelt presented him with his picture and the following dedication:—"To Sir Dietrich Brandis in high appreciation of his services to forestry in the United States, from Theodore Roosevelt."

Apart from India and the United States, Brandis's action has been felt in almost all parts of the British Empire, including these islands. He has left his mark upon every continent of the earth; at any rate, his name will go to posterity as the father of systematic forest management in the British Empire.

W. Schlich.

# M. LUCIEN BOPPE, C.I.E. 1

On the 21st of last May, the Ecole Nationale des Eaux et Forêts lost its Honorary Director, M. Lucien Boppe, who had been Professor there since 1881, and Director from 1893 to 1898. Born at Nancy on 3rd July 1834, first Garde Générale at St Dié and at Vézelize, Sous-Inspecteur first at Moutiers and then in the Department of Meuse, M. Boppe was called in 1868 to Nancy as Sous-Inspecteur, to take part in the administration of the forest attached to the School of Forestry. Retained in this

<sup>&</sup>lt;sup>1</sup> Translated from the French.

position after his nomination to the grade of Inspecteur in 1878, he acquired a most perfect knowledge of French broad-leaved forests, and was a past master in the conduct of those delicate operations which concern the conversion of coppice-withstandards into high forest. Nevertheless, being a born forester, M. Boppe fully appreciated the fact that the forests of the east of France are not the only existing type, and that such conversions are not the whole of forestry. In consequence, when, in 1881, he was appointed to a professorship in Forestal Sciences at the National School, before beginning to teach, he undertook a tour through the forest regions of France. During this tour he took cognisance of all the varied types of French forests, and studied on the ground the methods of treatment and of exploitation, the utilisation of the wood and of the accessory products. It is to his studies during this long tour that we owe the publication of the two most remarkable works of M. Boppe, his Cours de Technologie Forestière (1886), a book which was originally written by M. Nanquette, but to which M. Boppe added some valuable information, previously unpublished, on methods of conversion and utilisation of forest products; and his Traité de Sylviculture (1880). In this book, after setting forth in the clearest and most instructive manner the French methods of treatment, he strove to render justice to other methods which up to this time had been perhaps too much disregarded, such as selection fellings in beech coppice, and similar practices, justified by local conditions, and only requiring a little regulation to be rendered quite acceptable by French foresters.

His desire to study forest conditions on the spot, and to obtain first-hand information from those actually in charge, in the most diverse localities, led M. Boppe often beyond the confines of France. Of these tours he has left us some interesting narratives. I always re-read, with the greatest pleasure, his papers on—Les Forêts de la Grande Bretagne (1881); La Forêt de Spessart (1881, in collaboration with M. Reuss); L'Enseignement Forestière en Bavière et en Autriche Hongrie (1886, in collaboration with M. Reuss); L'Organisation Forestière en Bavière et en Autriche (1887, in collaboration with M. Reuss).

In 1900 I had the honour of collaborating with M. Boppe in the publication of his silvicultural treatise *Les Forêts* (1900). Soon after, unfortunately, his health gave cause for anxiety—

anxiety which was, alas! only too well justified—and this summer we had the grief of seeing our loved and honoured chief pass away. In him we lost a forester as devoted to his subject as he was learned and experienced.

A. JOLYET.

The writer of the above notice succeeded the late M. Boppe as Professor of Silviculture in the National Forest School at Nancy.

M. Boppe was Sous-Directeur of the school when I was in charge of the British students there, from 1884 until the India Office in 1886 ceased to train its men at Nancy. His high professional attainments, and his kindly, courteous manner, secured for him the respectful affection of our young countrymen. At this time I formed with him an intimate friendship, which was maintained until the day of his lamented death. It was my almost daily privilege to accompany him to his room after the delivery of his lecture, and there, greatly to my advantage, to discuss with him the subjects he had just treated of during his address to his class. In recognition of his eminent services in connection with the training of candidates for the Indian Forest Service, M. Boppe was made a Companion of the Indian Empire, a distinction which he prized very highly.

#### REVIEWS.

Forest Mensuration. By H. S. Graves, M.A. New York, John Wiley & Sons; London, Chapman & Hall, Ltd., 1906.

In the Preface Mr Graves tells us that the urgent need of a reference book on Forest Mensuration for class work at the Yale Forest School induced him to publish his lectures given during the last year, with such additions as were necessary to present the material in the form of a book. The work contains 436 pages, which is a very liberal allowance for one of the many branches of forest science. To give our readers an idea of the scope of the book, we give a short account of the contents:—

Chapter I. gives a definition of Forest Mensuration, and discusses the importance of its study, the Literature of the Subject, and the Units of Measurement.

Chapters II. and III. deal with Board Measure and Log Rules. What Mr Graves tells us of board measure and log rules proves that the system of measurement as yet followed in the United States is hardly in accordance with the general development of the country. There are some 43 different log rules, which lead to widely different results. Taking, for instance, the example on pages 24, 25, we find that the board measure for a log 16 feet long is given for diameters ranging from 6 to 40 inches, according to 43 different log rules. For a diameter of 30 inches, the board measure of the same log ranges from 942 feet down to 427 feet, according to the method followed. No wonder the author says (page 15): "One is inclined to advocate the abolishment of the board foot as a unit of measuring round logs."

Chapter IV. is devoted to Log Rules based on Standards. A standard log of specified dimensions is used as a unit of volume. For instance (page 54), the unit is a log 13 feet long and 19 inches in diameter at the small end inside the bark. Other logs are compared with this, according to their diameter at the small end and their length; thus a 10 inch log, 13 feet long, contains 0.28 standards. Standard measure is commonly converted into broad measure by multiplying the volume of a given log in standards by a constant. Mr Graves then shows that this is not correct. There are a number of other log rules

with different standards. It is hardly possible to imagine a more barbarous method. Why not take the ton (or 50 cubic feet), or simply the cubic foot, as the standard measure?

Chapter V. deals with the Methods of Scaling Logs; that is to say, the instruments for scaling, methods of measuring the diameters and lengths, allowance for defects, and the rules for scaling used in Forest Reserves.

Chapter VI. brings us at last to the Determination of the Contents of Logs in Cubic Feet. We were glad to be informed that the cubic foot is already used extensively in the United States, but even then the volume is finally expressed in board feet or other units common in commerce. What use the cubic foot is, under these circumstances, is difficult to see. The chapter goes into the minutest details of the case, showing how logs should be measured, the instruments used, formulæ for determining the cubic contents in quite a variety of ways, including the full volume in the round, the quarter-girth method, and others.

Chapter VII. deals with the Cubic Contents of Squared Logs. Chapter VIII. brings the Measurement of Cord Wood, Stacked, and the Solid Contents in a Stacked Cord.

Chapter IX. deals with the Contents of Entire Felled Trees, or a combination of what has gone before.

Chapter X. deals with the Determination of the Height of Standing Trees. Here we leave American soil, and go for a promenade to Germany, France, England, Austria, and Switzerland. The instruments dealt with in detail are those of Faustmann, Weise, Christen, Klausner, Winckler, Brandis, Gaulier, Abney and others. All these have been described in various European books. When we come to the "choice" of a height-measure, we were not a little surprised to find that Mr Graves considers Klausner's height-measurer the best of the small instruments for accurate scientific work, and Faustmann's measurer for general forest work. When it is considered that Klausner's instrument either necessitates a stand or must be screwed into a tree, and that, moreover, the clumsy sighting rule is quite unnecessary (since the ray from the eye is much straighter than a metal rule), we can only come to the conclusion that Mr Graves cannot have used the instrument in the field on an extensive scale. As to Faustmann's measurer, its theory is perfect, but the instrument is very delicate for work in the forest, and we certainly prefer Weise's instrument REVIEWS.

119

to it. On the general question, we have no hesitation in saying that Brandis's instrument is the most useful all round, and Christen's for trees not exceeding 100 feet in height.

Chapters XI., XII., and XIII. deal with the Determination of the Contents of Standing Trees, by the eye, Volume Tables, Farm Factors, etc. Here we are still chiefly on European ground.

Chapter XIV. treats of the Determination of the Contents of Stands or Whole Woods. It is a combination of German methods with American practice. There is the estimate by the eye "en bloc," or by tree: by Stand Tables and by Valuation Surveys (that is to say, the measurement of sample plots, which may take the shape of a strip or other form). Then comes the measurement of the trees; the recording; the methods by felled sample trees, such as the mean sample-tree method, the arbitrary Group method, Draudt's, Urich's and Hartig's methods, the method of form factors, and others, as described in European forest literature.

Chapter XV. brings the Determination of the Age of Trees and Stands in the well-known orthodox style.

Chapter XVI. deals at considerable detail with the Growth of Trees and Stands, that is to say, with the Diameter, Height, and Volume Increment.

Chapter XVII. is devoted to Yield-Tables, which is followed by a final chapter on Graphic Methods used in Forest Mensuration.

The Appendix deals with Legislation regarding the Measurement of Logs in the United States; a list of the most important works dealing with Forest Mensuration; tables showing the Contents of Logs; volume tables for standing trees, and tables for form factors; tables of growth and yield of spruce, beech, and Scots pine in Germany; again, yield-tables of American trees, such as white (or Weymouth) pine, Adirondack spruce, loblolly pine, chestnut, red cedar, red oak, and pitch pine, and miscellaneous tables.

It will be observed that the book is very complete, but it is also very big, and it contains a good many things which will hardly be of use in the United States for some time to come. Still, the book contains, in addition to the German methods of forest mensuration, original ideas, and we have no doubt that it will mark another step in advance in the development of scientific and systematic forestry in the United States.

Schlich's Manual of Forestry. Vol. IV., "Forest Protection," 2nd ed., by W. R. FISHER.

xxiii. + 712 pp. Bradbury, Agnew, & Co., London. 12s. net.

In the new edition, the number of pages has been increased by 119, which include an Index not found in the first edition. The number of plates has also been increased from 259 to 300. The author says in the Preface that he had been urged to write an original book on "Forest Protection," but that it would have been impossible for him to do so without borrowing largely from German authors, and that it therefore appeared preferable to continue his former plan of translating the best German work on the subject,—that by Dr Hess. The present volume is not, however, merely a translation of that book; Professor Fisher has added matter that he considered important for British and Indian foresters, and has omitted other matter as being of comparatively small interest to them.

We may remind our readers that this work deals with injuries to forests done by man, quadrupeds, birds, insects, weeds, fungi, atmospheric influences (such as frost, wind, snow, etc.), fire, flood, and shifting sand; also against certain diseases and the effects of acid fumes from furnaces.

It is very complete, and should be in the hands of all working foresters and others interested in wood management.

# Quarterly Journal of Forestry published for the Royal English Arboricultural Society. Vol. I. No. 4.

The October number of the above Journal maintains the high standard of excellence of former issues. It is made up of current topics and short notes on various subjects connected with forestry, obituary notices, two original articles, three reprints, and a number of reviews and notices of books. A report of the Afforestation Conference held in London on 25th June completes the number.

The original article, on the "Variation of Salix alba," by E. R. Pratt, is a well worked out and beautifully illustrated paper, which deals with a very difficult subject.

The current topics and short notes are very well chosen, and certainly cannot fail to keep the members posted up in the forestry happenings of the day, while the carefully written reviews and notices of books keep one in touch with the current literature.

# TRANSACTIONS

OF THE

# ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

VOL. XXI. PART II.
July 1908.

LIEUT, -COLONEL F. BAILEY, FR.S.E.,

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



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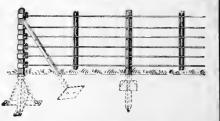


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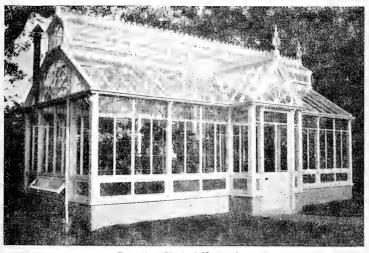
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# 19 CASTLE STREET, EDINBURGH,

where all communications should be sent.

A room has been secured there for the accommodation of the Society's books and papers; and donations of books on forestry subjects for the Library will be gladly received and acknowledged by the Secretary.

Members having books on loan will oblige by returning them to the above address.

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

which accompanies this Memorandum.

### The Principal Objects of the Society,

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

Meetings.

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

#### Prizes and Medals.

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

## School of Forestry, Afforestation, Etc.

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

Edinburgh in 1884.

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

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

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

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

Excursions.

During the past twenty-nine years, well-organised Excursions, numerously attended by Members of the Society, have been made annually to various parts of Scotland, England, and Ireland. In 1895 a Tour extending over twelve days was made through the Forests of Northern Germany, in 1902 a Tour extending over seventeen days was made in Sweden, and during the summer of 1904 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. In addition to the Annual Exhibition before referred to, a large and important Forestry Section organised by this Society is included in the Scottish National Exhibition which is being held in Edinburgh this year.

### The Society's Transactions.

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

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

#### Local Branches.

The Society, at a recent Meeting, approved of the formation of Local Branches in suitable districts, and Local Branches have now been established in Aberdeen and Inverness for the convenience of Members who reside in the districts surrounding these centres. The President of the Aberdeen Branch is Alex. M. Gordon of Newton, and the Honorary Secretary and Treasurer is Robert Scott, Solicitor, 230 Union Street, Aberdeen. The President of the Inverness Branch is J. Grant Thomson, Wood Manager on the Seafield Estates, Grantown, and the Honorary Secretary and Treasurer is Alex. Fraser, Solicitor, Church Street, Inverness.

#### Local Secretaries.

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

Register of Estate Men.

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

#### LOCAL SECRETARIES.

#### Scotland.

Counties	

Aberdeen, . John Clark, Forester, Haddo House, Aberdeen. John Michie, M.V.O., Factor, Balmoral, Ballater.

Argyle, . . John D. Sutherland, Estate Agent, Oban.

Ayr, . . Andrew D. Page, Overseer, Culzean Home Farm, Ayr. A. B. Robertson, Forester, The Dean, Kilmarnock.

Berwick, . Wm. Milne, Foulden Newton, Berwick-on-Tweed.

Bute, . . Wm. Inglis, Forester, Cladoch, Brodick.

James Kay, Forester, Bute Estate, Rothesay.

Clackmannan,. ROBERT FORBES, Estate Office, Kennet, Alloa.

Dumbarton, . ROBERT BROWN, Forester, Boiden, Luss.

Dumfries, D. Crabbe, Forester, Byreburnfoot, Canonbie.

John Hayes, Dormont Grange, Lockerbie.

East Lothian, . W. S. CURR, Factor, Ninewar, Prestonkirk.

Fife, . . Wm. Gilchrist, Forester, Nursery Cottage, Mount Melville St Andrews.

EDMUND SANG, Nurseryman, Kirkcaldy.

Forfar, . JAMES CRABBE, Forester, Glamis.

JAMES ROBERTSON, Forester, Panmure, Carnoustie.

Inverness,
 Lanark,
 JAMES A. GOSSIP, Nurseryman, Inverness.
 JOHN HART, Estates Office, Cowie, Stonehaven.
 JAMES TERRIS, Factor, Dullomuir, Blairadam.
 JOHN DAVIDSON, Forester, Dalzell, Motherwell.

JAMES WHITTON, Superintendent of Parks, City Chambers, Glasgow.

Moray, . . John Brydon, Forester, Rothes, Elgin.

D. Scott, Forester, Darnaway Castle, Forres.

Perth, . W. Harrower, Forester, Tomnacroich, Garth, Aberfeldy.

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, Strangaer.

H. H. Walker, Monroith Estate Office, When the

H. H. WALKER, Monreith Estate Office, Whauphill.

#### England.

Counties.

Beds, . . Francis Mitchell, Forester, Woburn.

Berks, . . W. Storie, Whitway House, Newbury.

Cheshire,
 Wm. A. Forster, Belgrave Lodge, Pulford, Wrexham.
 Devon, .
 James Barrie, Forester, Stevenstone Estate, Torrington.
 Durham,
 John F. Annand, Lecturer on Forestry, Armstrong College, Newcastle-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, . John Alexander, 24 Lawn Crescent, Kew Gardens, Surrey.
Professor Boulger, 11 Onslow Road, Richmond Hill,

London, S.W.

Notts, . Wm. Elder, Thoresby, Allerton, Newark. W. Michie, Forester, Welbeck, Worksop.

WILSON TOMLINSON, Forester, Clumber Park, Worksop.

Salop, . . Frank Hull, Forester, Lillieshall, Newport. Suffolk, . . Andrew Boa, Agent, Skates Hill, Glemsford.

GEORGE HANNAH, The Folly, Ampton Park, Bury St Edmunds.

Surrey, . . Andrew Peebles, Estate Office, Albury, Guildford.

Warwick, . A. D. Christie, 16 Oak Tree Lane, Selly Oak, Birmingham.

York, . D. Tait, Estate Bailiff, Owston Park, Doncaster.

#### Ireland.

Dublin, . . . A. C. Forbes, Department of Forestry, Board of Agriculture.

James Wilson, B.Sc., Royal College of Science, Dublin.

Galway, . . Arch. E. Moeran, Palmerston House, Portumna.

THOMAS ROBERTSON, Forester and Bailiff, Woodlawn.

King's County, Wm. HENDERSON, Forester, Clonad Cottage, Tullamore.

Tipperary, . DAVID G. CROSS, Forester, Kylisk, Nenagh.

# Royal Scottish Arboricultural Society.

## FORM OF PROPOSAL FOR MEMBERSHIP.

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

	Full Name, .
	Designation, Degrees, etc.,
Candidate's	Address,
	Life, or Ordinary Member,
	Signature,
Proposer's	Address,
, ,	Address,
Seconder's	Address
	Address

## 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:—
  - I. Proprietors the valuation of whose land exceeds £500 per annum, and others, subscribing annually . One Guinea.
  - Proprietors the valuation of whose land does not exceed
     £500 per annum, Factors, Nurserymen, Timber
     Merchants, and others, subscribing annually . . . . Half-a-Guinea.
  - Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, subscribing annually . . . Six Shillings.
  - 4. Assistant-Foresters, Assistant-Gardeners, and others, subscribing annually . . . . . . . . Four Shillings.
- IV. Subscriptions are due on the 1st of January in each year, and shall be payable in advance. A new Member's Subscription is due on the day of election unless otherwise provided, and he shall not be enrolled until he has paid his first Subscription.
- V. Members in arrear shall not receive the *Transactions*, and shall not be entitled to vote at any of the meetings of the Society. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.
- VI. Any eligible person may become a *Life* Member of the Society, on payment, according to class, of the following sums:—

  - 3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, . . . . . . . . . . . . . . . . 3 3 0
- VII. Any Ordinary Member of Classes 1, 2, and 3, who has paid Five Annual Subscriptions, may become a Life Member on payment of Two-thirds of the sum payable by a new Life Member.
- XII. Every Proposal for Membership shall be made in writing, and shall be signed by two Members of the Society as Proposer and Seconder, and delivered to the Secretary to be laid before the Council, which shall accept or otherwise deal with each Proposal as it may deem best in the interest of the Society. The Proposer and Seconder shall be responsible for payment of the new Member's first Subscription. The Council shall have power to decide the Class under which any Candidate for Membership shall be placed.

# CONTENTS.

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

18.	Trees of Western America. By F. R. S. Balfour,	PAGE I2I
19.	Soil: its Origin and Nature. By Professor James Geikie, LL.D., D.C.L., F.R.S. (concluded from p. 21),	131
20.	A Scheme for Establishing a National Industry of Forestry. By a Correspondent,	135
21.	Root Disease in Scots Pine on Farm Lands (with Two Plates). By Bert. Ribbentrop, C.I.E.,	143
22.	The Cultivation of Hardwoods. By J. Boyd (continued from p. 49),	150
23.	Impressions of Forestry in the Schwarzwald (with Two Plates). By J. F. Annand,	159
24.	Notes of Silvicultural Interest. By Thomas Hall,	176
25.	Continental Notes-Germany. By Bert. Ribbentrop, C.I.E.,	180
26.	The Selection and Training of Probationers for the Imperial Forest Service of India. By J. Nisbet, D.Œc., formerly Conservator of Forests, Burma,	191
27.	The Larch Shoot Moth (Argyresthia (Tinea) laevigatella) (with Plate). By R. Stewart MacDougall, M.A., D.Sc.,	195
28.	Underplanting. By LieutColonel F. Bailey,	198
29.	Experiments on the Relative Value of certain Timber Preservatives,	201
30.	The Northern Branch of the Royal Scottish Arboricultural Society—Visit to the Lovat and Novar Estates,	205
31.	The Aberdeen Branch—Excursion to Durris,	215
32.	Forestry Section in the Scottish National Exhibition, Edinburgh, 1908, organised by the Royal Scottish Arboricultural Society, 1st May to 31st October,	217
	• • • • • • • • • • • • • • • • • • • •	,

Notes and Queries:—Arboriculture and Arable Land—The Ardgoil Estate—Afforestation of Surplus Lands—Forest Preservation in the United States—Afforestation of Reclaimed Lands—Basic Slag on Seed-Beds (with Plate)—Working-Plan for the Ardross Woods—Forestry at the West of Scotland Agricultural College—Forestry at the University of Edinburgh—Chair of Forestry at Cambridge—Forestry Appointment at Inverliever—Wood: its Botanical and Technical Aspect—The Cost of Fencing—Experimental Study of Larch Canker—The Foresters' and Gardeners' Society of Argyll—Some recent Forestry Books,	PAGE 222
Reviews and Notices of Books:—Forest Entomology. By A.  T. Gillanders, F.E.S., Wood Manager to the Duke of Northumberland. xxii+422 pp., including Index. 351 Illustrations. Blackwood & Sons, Edinburgh, 1908. Price 15s.,	238
Trees and their Life-Histories. By Percy Groom. London: Cassell & Co. Price 25s. net. With 512 Illustrations,	239
Webster's Foresters' Pocket Diary (Sixth Edition) for 1908, for the use of Foresters, Estate Agents, Nurserymen. 2s. 6d. net. London: William Rider & Son, Ltd.,	240
Laws of the Society.	
Proceedings of the Royal Scottish Arboricultural Society, 1908, with Appendices.	

List of Members.

## TRANSACTIONS

OF THE

## ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

### 18. Trees of Western America.1

By F. R. S. BALFOUR.

My wife and I have recently made a trip to the Pacific coast, and perhaps our chief object in so doing was to see the trees of that region, the richest belt of coniferous timber in the world.

I have twice lived for eighteen months at a time in Washington, Oregon, and California, and have made a good many shooting and fishing expeditions into the western mountains, but never before has my sole object in such expeditions been to see the best of the timber. I hope to have something to say of our wanderings which will be of interest to those Members of the Royal Scottish Arboricultural Society who are here to-day; but I wish it to be understood that I can merely tell you of the observations of a lover of trees, who has little intimate knowledge of botany.

We sailed in July to Quebec, and crossed the continent by the C.P.R. We stayed for a few days at the Lake Louise Hotel at Laggan in the Rockies, about 6000 feet above sealevel, and 960 miles west of Winnipeg. The hotel lies at the north end of Lake Louise, six miles from the railway, and 1000 feet above it. Soon after leaving Calgary, the youngest and one of the most prosperous towns on the continent, the train begins to wind its way up the Bow River, with the towering Rockies to the north and south. The first tree we have seen for over a thousand miles is the ubiquitous *Pinus contorta*, springing up thick and straight in all directions. No tree in America covers such an area—from Alaska to Colorado. It is well called the lodge pole pine by the Indians.

<sup>&</sup>lt;sup>1</sup> Lecture delivered, with lantern slides, to the Royal Scottish Arboricultural Society at their Annual Meeting, 5th February 1908.

It was a mild rainy day when we arrived, and after reaching the hotel it did not take me many minutes to recognise, with my glasses, the light green of the Lyall larch, growing at timberlevel—7000 to 8000 feet. I started through the thick undergrowth of azalea and blaeberry, and was soon thoroughly drenched. The Pinus contorta had been left behind before Lake Louise was reached, and the timber here is Picea Engelmanni and Abies lasiocarpa solely. Both were covered with coneseven trees only 6 feet high—and indeed the two are much alike, but for the red drooping cones of the Picea and the black erect ones of the Abies. After a good deal stiffer climb than I expected, I reached the first of the Larix Lyallii, and managed to get some photographs taken while the rain was falling. The tree was first discovered by David Lyall, a Scotsman who accompanied the expedition which settled the International Boundary in 1857. It never exceeds 85 feet in height, and 2 to 3 feet in diameter. The woolly tomentum which covers the twigs and buds makes it easily recognisable. As far as I am aware, it has never before been brought to this country, but I arranged with a Chinaman to get me later on a supply of the seed and about a dozen plants which I have growing at Dawyck. The seeds ripen and are shed in the first three weeks of September; they do not remain in the cones as with our larch. I hope I may raise some plants and keep those I have got. This larch is so purely Alpine in its habit, that I have no expectation that it would ever be a useful tree in this country. Its great kinsman, Larix occidentalis, however, is perhaps better worth growing as a timber-tree in Great Britain than any other exotic. This tree, which unfortunately did not seed last season, does not grow so high up or extend so far north as Lyallii, and covers a much wider area throughout Eastern Oregon and Washington, parts of Montana and Idaho, and the Kootenay County of British Columbia. A splendid tree, it often grows to 200 feet high; the largest specimen I know of is 24 feet round, 6 feet from the ground; this tree is in the Wallowa Mountains of Oregon. This larch is incomparably the grandest variety of larch in the world. Throughout this country there is a thick undergrowth of azalea covered with lemon coloured blossom, not the azalea of the West, but one with small waxy bell-like flowers. We made an expedition on horseback to the glacier which discharges into the south end of

the lake, and also to two small lakes a thousand feet higher up than the hotel, where we left the timber-line behind, and found Lyall's larch growing pure. The trees of this region have their branches very short from base to top, owing to the immense weight of snow and ice which covers them for so much of the year.

I shall say little of our journey from the Rockies, across the Selkirks and Coast Mountains, to the Fraser River Cañon. Suffice to say that four miles west of Laggan the line crosses the continental divide through the Kicking-horse Pass, and almost at once the timber begins to grow western in its character. Douglas fir and Thuja gigantea are seen for the first time as we drop down into the valley of the Upper Columbia River. Then when we have crossed the river and begin to climb up the precipitous Beaver Cañon of the Selkirks, we see splendid Tsuga Albertiana, Pinus monticola, Picea Engelmanni and Pinus contorta giving way gradually to Thuja gigantea and Douglas. The day's run from Laggan to Revelstoke is through as splendid mountain scenery as exists anywhere; doubtless many here have made that journey, and stayed in the delightful hotels provided by the C.P.R.

In the lower Fraser River valley grows that finest of all birches—*Betula occidentalis*,—a tree practically unknown here, though there is no reason why it should not thrive in our climate, so like its own of British Columbia.

Our objective point was Tacoma, in the State of Washington, on Puget Sound. In the valleys of Northern Washington through which our line-the Northern Pacific-ran, we saw Douglas and Thuja gigantea growing as only they do grow on the mild sea-board of the North Pacific. Terrible burnt areas too we passed, where not a seedling was to be seen, and only bracken and willow-herb springing up among the blackened stumps. Happily this destruction by fire has been reduced about 85 per cent. during the past season, owing to the excellent arrangements, regulations, and active supervision of the officers of the United States Timber Reservations. We saw large specimens of the greatest of American maples (Acer macrophyllum) growing among the tangles of the vine maple (Acer circinnatum) in all the river bottoms. Here and there was an occasional Picea Menziesii-it never occurs over thirty miles from the sea, and we were now well within that distance of Puget Sound.

The luxuriance of all this western timber, its size, the freedom with which it seeds itself, and its rapidity of growth, render these forests quite unlike anything to be seen east of the Coast Mountains. It is the land, too, of flowering and berried shrubs, Spirea, Berberris of several kinds (including our well-known B. aquifolium), Ribes, numerous Rubus, Gaultheria shalon, sometimes a tree 20 feet high—the Sal-lal of the Indians,—that most striking of arbuti, the Madroña tree, the lovely western dogwood (Cornus nuttallii), two beautiful elders, one red and one blueberried (Sambucus arborescens and S. glauca), several Rhamnus, and five great blaeberries or Vaccinium, some red and some blue-berried, but all, as a rule, 6 feet high.

There is a range of mountains still almost entirely unexplored, occupying the triangle of land which forms the portion of the State of Washington that overlaps the south end of Vancouver Island. A couple of days after reaching Tacoma, we set out for these Olympic Mountains, crossing Puget Sound, and driving for two days over nearly impossible roads through as fine Douglas and Albertiana forest as I have ever seen. The summer climate of those parts is quite delightful, never too warm, with cloudless skies and only occasional showery days. Our first resting-place was the little log hotel on Lake Cushman, surrounded by Douglas fir and Thuja gigantea. Seven years ago I made a small expedition after black bears across the mountains at the head of this lake, and then found at snow-level whole gardens of lovely flowers, Fritillaria, Brodiaa, Calochortus, orchids, and, most charming of all, the beautiful Calypso borealis, but that was in June. The river which feeds the lake, for a couple of miles of its course, flows through alluvial land well sheltered by the surrounding mountains from the winds of the Pacific, and here we found a grove of extraordinarily tall Acer macrophyllum, intermingled with Populus tricocarpa, Alnus Oregona, and Thuja gigantea. Their branches are thickly clothed with dense growth of yellow moss and ferns: the height of the trees I judged to be rather over 150 feet. The poplar of this region commonly grows to nearly 200 feet, and is the largest deciduous tree west of the Rockies-or, I believe, on the continent—and this great maple is second to it. I here, too, saw the largest Thuja gigantea I ever came across; it measured just 40 feet round, breast high, and was about 300 feet high. This is, however, by no means the record. Throughout the valleys

of this range the Douglas fir must average about 250 feet, and the Tsuga little short of it. I stepped the trees in this photograph, and found they measured 210 feet before the first branch was reached. A guide whom I had taken with me when last in these mountains told us that a party of prospectors had cut a trail up the South Fork of the Skokomish River (the North Fork was the river flowing out of Lake Cushman, up which we had come). We determined to follow this trail for a few days' fishing and exploring. We were well repaid. The first day out, with four horses and our two men, we reached the river, and camped in a clump of aspen poplars (Populus tremuloides), sleeping on beds of Thuja gigantea boughs. Most of our day's march was through dense Albertiana spruce, and we noticed how wonderfully this tree seeds itself, more especially on the soft bark of a rotten fallen tree-trunk. Attempts at photographing it, however, were not very successful. We found Pinus monticola growing on the ridge between the North Fork and the South Fork. Next day we continued our way, and made our camp for three days on a little plateau in a bend of the river in a grove of Abies grandis, our tent shaded by the branches of Rhamnus purshiana—the tree from which the cascara sagrada bark is got. It was covered with ripe black fruit, of which I dried a portion, and am sowing it in the hope of establishing the tree here. The Rainbow trout fishing was too excellent to be neglected, even for trees, as I think vou will agree when I tell you that in my last four hours fishing on that stream I caught 53 trout, weighing just 60 lbs. My wife landed a 41 pounder off her second cast. To picture this country, you must realise that the whole land is dense forest, with open spaces nowhere except where the peaks of the hills struggle through in rocky pinnacles. Our trail was for the most part along the river-bed, which we crossed and re-crossed countless times. As in all the densely wooded regions of the North-West, one sees few birds and beasts. An occasional blacktailed deer, a still more occasional black bear, and a frequent mink in the river bottoms, were all we saw. Of birds there are a few small warblers, several woodpeckers, and a beautiful great grey kingfisher, this last to be seen everywhere.

We returned to Tacoma, and my next expedition was to the Nisqually Glacier, which flows down the south-west side of the great Mount Tacoma—15,000 feet. The United States Govern-

ment have made a national park of 3,000,000 acres, with this splendid cone in the middle, and no better or wiser thing has the American administration ever done than to establish the great timber reserves-and also the five National Parks, in the most interesting localities: these are the "Yellowstone" of Wyoming, the "Yosemite" and "Sequoia Forest" of California, the Grand Canon of Arizona, and this "Rainier National Park" of Washington, to be inviolate for all time. I may here digress for a moment to say a little on this subject. Until recently, the timber, in the West at any rate, was regarded as quite inexhaustible, and only in the last few years have the people awakened to the fact that unless a great part of the remaining forest were preserved, there would soon be no more. The total lumber cut in the United States in 1906 was about 40 billion feet, board measurement. It is estimated that the West has about sixty years of timber for itself—over 70 per cent. of which is "Oregon pine," or rather Douglas—but the East, whose own supply will probably last for not more than twenty years, is drawing on the West for prodigious quantities of sawn timber. Washington is now the State which supplies the greatest amount of timber of any. From 1870 to 1890 Wisconsin, with its white pine (P. strobus), had the predominance, then Louisiana, where Pinus palustris is cut in enormous quantities (the Americans call it "yellow pine" and we call it "pitch pine"1), but now Douglas fir provides more lumber than any other tree on the continent. The U.S. Government Timber Reserves now amount to 126 million of acres, by far the larger part of which is in the west. These are being well looked after when we consider the magnitude of the task, the supineness of the State legislatures, the opposition of the lumber magnates, and the fact that the whole organisation has only recently been started.

A little light railway through the Douglas and *Thuja* takes one to within a few miles of the boundary of the Mount Tacoma Government Reserve, and a drive of a dozen miles or more of

<sup>&</sup>lt;sup>1</sup> The following extracts are taken from Bulletin No. 10, U.S. Department of Agriculture, Division of Forestry, 1895:—"Yellow pine" is applied in the trade to all the Southern lumber pines; in the North-east it is also applied to the pitch pine (*P. rigida*); in the West it refers mostly to bull pine (*P. fonderosa*). "Pitch pine" includes all Southern pines, and also the true pitch pine (*P. rigida*), but it is mostly applied, especially in foreign markets, to the wood of the long-leaved pine (*P. falustris*).—Hon. Ed.

steep climbing brings one to the hotel recently built at Longmires Springs. The Government carriage road is completed to a little beyond this point, but the intention is that it shall be continued to Paradise Valley-9000 feet above the sea-which is at timberline. The spot is well named, as, perhaps, there is no finer Alpine garden in the world than this huge belt immediately above the trees, and below the eternal ice of the mighty cone of Mount Tacoma. The trees here are very fine, Thuja, Douglas fir, and Tsuga Albertiana, Abies grandis in the river-bed, and an occasional Menziesii, till the eastern limit of this tree was passed. Then Abies amabilis, Pinus monticola, Pinus Murrayana, and at Longmires Abies lasiocarpa, Tsuga Pattoniana, and Chamæcyparis nootkatensis (Thujopsis borealis). I never before saw this tree, and feel sure it is worthy of general planting in our country as a forest-tree. It covers a wide area from Alaska to Washington. The specimens in this country have mostly been raised from cuttings, and I believe it would be desirable to get large supplies of seed from its native place. Its wood is practically imperishable, but is no use for shingles, as it cannot be split like Thuja or Libocedrus. I went on to the Nisqually glacier, to which the Government road has just reached. The difficulties of blasting out stumps and rocks for such a road may be imagined. I found here the charming little Acer glabrum, which only grows at high altitudes in the western country. I know of no other valley in Western America where such a variety of conifers may be seen growing together, and all at their best-2 hemlocks, 4 Abies, 2 pines, I Picea, I Thuja, I cypress, the omnipresent Douglas— 12 altogether.

We next travelled south to Grant's Pass in South-West Oregon. Unfortunately our day in Portland was cloudy, and no view could be had of Mount Hood, the great rival of Mounts Tacoma and Shasta. The Siskiyou Mountains, which run east and west more or less, divide Oregon and California, and this is the home of that rarest of all spruces, *Picea Breweriana*. The character of the soil is greatly changed here from that of the north. The ground is dry, and there is not the great depth of rich humus in all the valleys which one sees in Washington. We drove thirty miles to the old mining settlement of Kerby, and next day started over an impossible road to find our spruce. A friendly placer-miner acted as guide, and after a climb of 4000 feet through almost impenetrable and what seemed interminable thickets, we found

our tree just at timber-line, growing singly among Douglas fir, Pinus ponderosa, and Pinus tuberculata (the knob-cone pine). It is a beautiful tree, utterly distinct in character, with drooping branchlets often 8 feet long. The tops of the trees were covered with cones a good month from being ripe. The tree was first discovered in 1884, and named after an eminent Californian botanist. Its cones, when the seed is shed, reflex their scales, and are of a rich brown. The unripe cones are purple, about 2½ inches long. I imagine the wood of the tree is extremely hard, growing as it does at a fairly high altitude, and evidently making small annual growth. The bark is grey, and in flakes not unlike that of our larch. The trees of this district are very different from what we had left: Pinus ponderosa and Pinus Lambertiana-those two kings among pine trees-predominated. Thuja gigantea had given way to Libocedrus decurrens, and in the valleys grew the Umbellularia Californica—a mighty bay which occasionally reaches 100 feet; the Castanopsis chrysophyllum, with its shining leaves, bright yellow underneath, and chestnut-like fruit; and the Pasania, or tan-bark oak. The Fraxinus Oregona I saw here finer than elsewhere; it is an ash which I hope may succeed admirably in our own country, judging by the fine young tree at Kew. is the most valuable hardwood in the west. I have distributed the seed of this tree to sixteen or more localities in Great Britain. I saw the Chamacyparis Lawsoniana that day—3rd September for the first time; but to see this splendid tree at its best we ought to have gone west a farther fifty miles to the coast. No tree in Western America is more prized than this "Port Orford Cedar," as the lumbermen call it. Its wood is almost imperishable, and its delicious scent makes it highly suitable for interior finishing, etc.

A stranger in the country has a little difficulty in identifying trees by their local names. For instance, I was told I ought to see the "larch" on Mount Tacoma. This I found was Abies nobilis. "Red cedar" in British Columbia and Washington means Thuja gigantea; "red cedar" in South Oregon and California means Libocedrus decurrens. "White cedar" in Washington means Cupressus noothatensis; "white cedar" in Oregon means Cupressus Lawsoniana. But, worst of all, the name "Tamarack" is applied in different neighbourhoods to Larix occidentalis, Pinus tuberculata and Pinus Murrayana. This confusion of nomenclature also extends in America to the birds and beasts.

We made a four days' camping expedition from Kerby southwards to the main ridge of the mountains, crossing the Californian boundary. It is a beautiful country-side. There are several fine oak trees-Quercus densiflora or pasania, mentioned above, Quercus Wizlizeni, and Quercus Garryana-said to grow to 150 feet high, and nearly a dozen species of willow; quantities of gentians occur in the marshy spots, with the yellow pitcher plant (Darlingtonia Californica). We found groves of Prunus demissa with the fruit ripe and hanging in bunches—a charming tree. The hill-sides are clothed with Manzanita and Ceanothus bushes. Our guide was anxious to take us to what he believed to be the "weeping spruce" we were in search of; but after a hard day's toil up steep hills, over trails which none but a backwoodsman would differentiate from the surrounding brush, we found ourselves among a number of Douglas fir, whose branches, growing in a curious bunchy form, had misled our man. However, the scenery well repaid the extra labour. That night we camped close to the divide, and next day, while hunting the hill-tops for black-tail deer, I came quite unexpectedly on a splendid grove of Picea Breweriana in a corry facing north. I took numerous photographs of the trees; they were growing among Abies concolor, Abies magnifica, Libocedrus, and Douglas. saw no cones on these trees. They stood distinct and beautiful, with their long fronds often hanging 8 feet to the ground. On this ridge the Libocedrus and Douglas were gnarled and twisted by the wind into the most fantastic shapes. We returned to Kerby and Grant's Pass highly satisfied with our week's trip, and pleased to have found what we had gone so far in search of.

We took train from Grant's Pass, by night unfortunately, as we were limited as to time, and next morning found ourselves at Sisson, at the base of Mount Shasta in North California. Here a small branch line leaves the Southern Pacific, and proceeds due east to a timber settlement called M'Cloud, after its founder—doubtless a Skyeman. Six miles from here is the charming house of a friend of mine, on the edge of the great Shasta Timber Reserve, in a bend of the M'Cloud River. Its banks are clothed with a huge saxifrage, among which the vine maple leaves were just turning scarlet. The timber is Douglas and Abies concolor close beside the river; higher up Pinus ponderosa and Pinus Lambertiana, growing finer than any I have seen elsewhere in California; while still higher are Pinus monticola and Abies

magnifica—the Shastanensis variety, which has dark bark instead of red, as in the common form; and last of all Pinus albicaulis, sometimes dwarfed to a tree 2 or 3 feet high, although a hundred years old. The photographs of Mount Shasta-14,400 feetwill show you how that splendid cone overlooks the whole country for at least one hundred miles in every direction. Down by the M'Cloud Taxus brevifolia is abundant, never such a large yew, however, as our T. baccata, but very beautiful, with its red berries and dark branches sheltering the lovely Shasta and Humboldt lilies, which grow tall and straight in the moist glades where the sun seldom penetrates. I found here, for the first time, Cratægus Douglasii, the only hawthorn which grows in the western country, although 400 or 500 species are known east of the Rockies. also saw a small mountain ash which I could not identify. The brushwood is wild plum (Prunus subcordata), at this time covered with fruit, much sought after by the Indians, the Californian hazel (Corylus Californica)—to me quite indistinguishable from our own, and, of course, the universal manzanita scrub and alder. While we rode with our host to "salt-licks," where the deer were to be found in the early mornings, we got many lovely glimpses of Mount Shasta towering above the surrounding forests. We scrambled up banks of incredibly slippery pine needles to gather the huge cones of the sugar pines, many of them 20 inches long: these we brought home in sacks tied to our Mexican saddles. Our host every year has new trails cut through the brush, and this summer came on two enormous specimens of sugar pine and yellow pine. My photograph of the latter was a failure, but you will see to what a gigantic size Pinus Lambertiana sometimes grows. The summer climate of this Northern California country is well-nigh perfect, six months of unbroken sunshine.

I have a set of interesting photographs of "lumbering" in the yellow pine forests of this country which may be of interest.

Of our other expeditions far south into the Sierra Nevada and Coast Range Mountains, and of the *Sequoias* and other trees we saw, there is no time to speak now.

I fear that my paper is little else than a list of trees seen by us on our wanderings, but I hope my photographs may make up to some extent for its other deficiencies.

## 19. Soil: its Origin and Nature.

By Professor James Geikie, LL.D., D.C.L., F.R.S.

(Concluded from p. 21.)

#### III.

## (b) Drift Soils.

These are soils which do not arise from the disintegration of immediately underlying bed-rock, but are simply the modified upper portions of superficial formations of every kind. The materials of which they are composed have been transported for shorter or longer distances.

GLACIAL SOILS.—These soils overlie superficial accumulations of glacial origin—the more typical of which are certain kinds of clay.

Till or Boulder-Clay. - This clay is usually tough and tenacious, more or less highly impermeable, and abundantly crowded with stones and boulders of all shapes and sizes. From an agricultural point of view its most notable character is not so much its impermeability as its composition. It consists almost exclusively of "unweathered" rock-material—its mineral constituents are quite unaltered, and it is, therefore, in no sense of the term a "subsoil." It plays the part, in fact, of unweathered bed-rock. It appears to have originated under the great ice-sheet which formerly covered our country, and which, flowing off in various directions, crushed, ground, and pulverised the underlying bed-rocks. Its formation, therefore, was entirely mechanical—the chemical action of the atmosphere and rain being excluded. The "clay" consists, to a very large extent, of a fine rock-meal or flour, which, although it may contain all the elements met with in ordinary fertile soils, is nevertheless barren, since the constituent mineral matter is not in a fit condition to be assimilated by plants. Owing to the general impermeable character of boulder-clay, a soil-cap forms very slowly upon it. But all tills are not alike in this respect. In some parts of the country, where till consists largely of crushed sandstone, it is somewhat more permeable, and yields a thicker soil-cap, the upper part of which, a foot or less in thickness, forms a strong loam or loamy clay-soil. Not only the composition but the colour of the till varies. This is readily

understood when it is remembered that till consists simply of crushed bed-rock, and that its character must change with that of the bed-rock of a district. Thus, in regions occupied by Old Red Sandstone, the till is red and more or less arenaceous, and not infrequently yields a fertile soil. Where, on the other hand, the dominant rocks are white and grey sandstones, and black argillaceous shales, together with fire-clay, coals, ironstones, and limestones, the till is greyish-blue or leaden-coloured, and usually very tenacious—yielding a most ungrateful soil. In some places, again, the till contains a large admixture of crushed basalt or other igneous rock, and, when not too impermeable, such a till is overlaid with soil of good quality. Chalky boulder-clay, composed chiefly of pulverised chalk, yields a clay-soil, from which, in most cases, the calcareous constituents have been in large measure removed. Upon the whole, the best soils met with in districts covered with till are brown and red-coloured—forming, as these frequently do, strong loams rather than clays.

Stoneless Clays.—These clays are also of glacial origin, but have been accumulated in water. Most of them were laid down in the sea at a time when the land was partially submerged, and they are therefore confined to low-lying maritime districts. Good examples are met with in the lower reaches of the great valleys of Central Scotland, where they form a considerable proportion of the carse-lands of the Tay, the Forth, and the Clyde. In composition these clays do not differ from true till. Like the till, they consist of unweathered rock-material. They represent the fine mud, etc., swept into our estuaries by turbid rivers escaping from glaciers, too short a time having elapsed before they settled down on the sea-floor to allow of much chemical alteration. Except when they alternate in thin layers with beds of sand, they naturally form exceedingly tenacious clay-soils. When interbedded sand is present, the resulting soil is less ungrateful.

In the case of both the stony and stoneless clays of glacial origin, it is obvious that deep ploughing ought to be avoided. The soil-caps covering both are alike thin, and have taken a long time to form. Deep ploughing, therefore, simply buries the soil and subsoil below a raw clay, in which seed is just as unlikely to germinate as it would on the bare surface of any unweathered bed-rock.

ALLUVIAL Soils.—Superficial alluvial deposits consist of disintegrated and decomposed rock-materials which have been transported and spread out by water. Some of these formations have been accumulated in fresh water, others have been laid down in estuaries and upon the sea-floor. They and their soilcaps naturally vary much in character. The coarser deposits consist of water-worn shingle and gravel, which, as they rapidly absorb rain, are usually barren. When the interstices amongst the stones are filled with finer grained materials-grit and sand, -a light porous soil is formed. Between such coarse accumulations and the finest mud and silt, all gradations occur. Although some alluvial sands are infertile, yet such is not often the case, for the finer arenaceous alluvia usually contain larger or smaller proportions of clay, and not infrequently form loamy soils of good quality. From loams capable of high cultivation, we pass on to clays, many of which are tenacious—although no alluvial clays are so stiff and tenacious as the tills and stoneless clays of glacial origin. Moreover, alluvial clays, muds, and silts often contain much organic matter, and are frequently rich in soluble mineral salts. The chief distinction, however, between alluvial and glacial clays is simply this, that the former consist essentially of mineral matter in an advanced state of decomposition, and, therefore, readily assimilated by plants, while the latter are composed almost exclusively of undecomposed mineral matter-of crushed and pulverised rock, which had previously experienced little or no chemical alteration.

ÆOLIAN SOILS.—In this country the only important accumulations of æolian origin are the sand-dunes of our low-lying maritime districts. As the dominant ingredient of these sands is quartz, they can hardly be said to yield a soil. Nevertheless, certain sand-loving plants find sustenance upon them, and succeed in binding the loose particles together, so that eventually some humus is accumulated, and a thin soil is formed. In other regions, however, the fine dust swept by the wind from dry desiccated regions, and distributed over adjacent tracts, has not only added to the fertility of such tracts, but in some cases has accumulated so as to form thick sheets of the finest loam, which cover and conceal the native soil-caps and bed-rocks of extensive areas. The fine loams of the Rhine Valley and the low grounds of the Danube, and the far-spreading "black earth" of Southern Russia, are believed to be of wind-blown origin.

In the first of these articles (see Vol. XX. p. 178) reference was made to the fact that disintegrated rock-material is constantly travelling, slowly or more rapidly as the case may be, from higher to lower levels. This is, of course, most perceptible on hill-slopes, and in places where the ground is periodically ploughed, and the soil exposed to the mechanical action of the superficial agents. The soil derived from some particular kind of bed-rock or superficial formation must thus come to invade and overlie subsoils and bed-rocks of a different character from that which gave it birth. When we have recourse, therefore, to a geological map as a guide to the nature of the bed-rocks and superficial formations, it must be borne in mind that the map does not profess to show the precise limits of the soils, but the boundaries of the more important groups of bed-rocks, and overlying glacial and alluvial accumulations. For example, the map may show that a certain hilly tract is occupied by some igneous rock, say basalt. Over that tract, therefore, we may expect to encounter a dark loamy soil, but this soil will naturally extend down the hill-slopes, and thus cover a wider area than the rock from which it originated. Again, it may be noted that the colours upon geological maps refer, as a rule, only to the socalled "solid rocks," and these may or may not appear at the surface of the ground where they are represented by the map to occur. Wide regions which may be shown on the map as occupied by limestone, or by sandstones and shales, or other kinds of bed-rock, may, in fact, be deeply buried under superficial accumulations, and thus may have had no influence whatsoever on the nature of the overlying subsoils and soils. The Government Geological Survey, however, is now issuing maps which indicate the actual areas where bed-rocks are exposed at the surface, and the tracts over which superficial formations are distributed. Agriculturists and others interested are thus supplied with reliable data for forming some opinion as to the general character of the soils that are likely to be met with in the areas represented on such maps.

# 20. A Scheme for Establishing a National Industry of Forestry.

By A CORRESPONDENT.

Proprietors as a class seem now to be sufficiently awake to the profit and advantage to be derived from a well-considered scheme of silviculture, but nevertheless we see throughout Scotland very little evidence of any general development of what may be called Commercial Planting. There are few proprietors of large estates interested in their improvement who cannot point out considerable parts of their property which might profitably be devoted to growing timber, without material injury to the farms but with advantage to the rest of the estate, through giving shelter and adding beauty. Some proprietors will add the remark that they would rather have trees to deal with than tenants. The former never grumble—if they have complaints they keep them to themselves; there is no fear of their agitating for troublesome legislation; and if there is too big a stock of game, no ill-feeling is bred.

Why is it that so little commercial planting is being done in Scotland in spite of these advantages in the eyes of the landlord, and in spite of the small net return now to be got from farming land of inferior quality? The reason is not far to seek. There are few proprietors who can afford to sink capital in planting, and fewer still who, if they can afford it, are inclined to part with their money in the certainty that they will get little or none of it back, however great may be the return to their successors at some remote date.

Nor can we wonder. Few proprietors who have money in addition to land will incline to reduce their incomes for the rest of their lives by investing it in a private enterprise which cannot possibly yield them any return; and fewer of those who have land and no money will choose to burden themselves with the interest charges and expenses which will be the only outcome to them of sinking a large sum in planting—for commercial planting can only really be successful on large areas of ground, even if the plantations are gradually formed. Indeed, it might, in many cases, be rather an additional burden than a relief, that the money expended in planting would have to be borrowed in instalments. Apart from the interest charges, a hard-up laird

will consider that he will lose some income from loss of rent for the planted land, even though the land be poor and the rent small.

All these circumstances lead to the conclusion that if commercial planting is to be seriously developed in this country, some furthering scheme of finance must be devised. Government loans at once suggest themselves, as they do in the case of most well-intentioned schemes that cannot quite stand on their own legs. If one regards this scheme as for the benefit of the public, and especially for the benefit of the working classes in developing a great industry which will employ labour in the most healthful conditions, it seems a clear case for opening the nation's purse. But in these days of dear money and national economy, with heavy demands for educational and other public purposes, Government money is extremely difficult to get, and, if it is obtainable, it must be on terms that will strongly tempt the Chancellor of the Exchequer to loose the strings of the nation's purse. Can such terms be proposed? To answer that question is the purpose of this paper.

To tempt the Government successfully, two conditions must, if possible, be attainable—(1) immediate and substantial public advantage through the expenditure of the money provided; and (2) ultimate financial success, and the return of the money to the nation's coffers with a sufficient interest or profit. My object is to show how both these results can be attained, with reasonable if not indeed absolute certainty, in the case of commercial planting at the public expense.

The first condition should not be difficult to fulfil. Any commercial planting scheme should be carried out gradually, the area to be ultimately dealt with should be large, and there should be regularity in the extent planted each year. This means steady and continuous work for those employed in planting up the land and managing the woods, over a long series of years, even though the work may only cover a portion of each year. This latter point I shall deal with immediately. Following the correct modern system of silviculture, a definite plan or course of cropping should be followed, under which the plantations will come to maturity as far as possible in regular divisions. Under this system the areas will be planted in regular and equal divisions, and the intermediate thinning operations will likewise fall to be carried out in equal and consecutive parts. Thus the forest

work should be regular and constant in quantity each year, and its amount should steadily increase. To commence with, a definite acreage would be fenced off, prepared and planted each year, and in connection with this a definite and regular amount of nursery work is required in growing the seedlings to supply the plants. After a few years the first planted division will be ready for thinning, and continuously thereafter this work will be added to the planting. Ultimately the cutting operations will be added, division by division. Thus it will be seen that a steady and increasing amount of labour will be called for year by year, until the entire forest has been fully constituted. It will be noticed that while those different operations can be carried on at different times, most of the work falls to be done in the winter months. This suggests the suitability of combining the forest work with agricultural employment, the latter work being more constant in the spring, summer and autumn months, and the possibility of connecting with such a scheme of commercial planting, small agricultural holdings to be let to employees with enough land to keep them employed at such times as the forest does not require their labours. This, too, would help to spread the work provided over a larger number of men, and there can be no doubt that ordinary agriculture and forestry are sufficiently kindred employments to let a man be good at both, and that in most forestry work there is sufficient elasticity as to times and seasons to allow successful farm work to be carried on alongside.

Any large scheme of commercial planting can thus suitably include a scheme of small holdings, and in the selection of areas for planting care should be taken to secure suitable land for small holdings near by, so that both schemes may develop hand in hand. Apart from the employment of the men, there will be considerable mutual advantages as regards horse labour, not only in winter, but in carting thinnings and cut timber during the intervals in summer when farm work slacks off, and on days when the weather does not suit for tillage or harvest. Of course the arrangement of the work, so that it may be carried on harmoniously, efficiently and economically on these lines, implies supervision by a competent head forester.

The second condition of the proposal, namely—ultimate financial success, involves the necessity for careful selection of suitable areas, and also strict provision to secure constant good

management. Enough has been written of late in proof of the fact that on suitable land in Scotland timber can be grown not only to yield, at present prices, an adequate return on the outlay, but probably to yield a handsome profit. The proofs of this apply particularly to the low-rented, light land specially suited for the growth of larch, which includes a large part of the Highlands, where the soil and climate favour that tree. But the careful selection of suitable areas for commercial planting must always be a fundamental condition for ensuring success. Fortunately the subject of silviculture has been taken up in recent years so seriously and scientifically in this country, that there need be no difficulty in obtaining skilled advice as to areas suited for successful commercial planting, having regard to soil, climate and accessibility to market.

The question of the actual value of the timber seventy or eighty years hence must remain, of course, more or less problematical. Unless, however, timber is going to be substantially superseded by some other material, there seems no ground for doubt that, having regard to the steady diminution of the supplies of timber within easy reach throughout the world, the demand must continue to be at least as great as at present-indeed, the serious fear is that the demand will far outrun the supply, at least for all kinds of fir wood. But even though reasonable profit may be regarded as well assured, what security can be given to the State that it will receive its full share of this, and that it will not all go into the proprietor's pocket? The proposal has been made that the State should buy out the proprietors of suitable land for planting, and we are often told that there are plenty of estates in Scotland which can be purchased at a fair price, like Inverliever on Loch Awe, which the Government bought recently to form a forestry station. But is the country prepared to sink large sums in buying land for planting, and would it be likely to be able to buy land suited for planting without also encumbering itself with farms, mansion-houses and shootings which it could not use to profit? Moreover, we may be sure that at the best the money the Treasury would agree to give would be limited, and the more spent in buying land, the less there would be left for the direct purpose of creating a silvicultural industry. This condition drives us back to consider the possibility of devising methods of applying the money so that it be expended for planting purposes alone.

A simple method would be by long period loans to the proprietors of suitable land on sufficient security. No doubt a mortgage might be given by the proprietor over his estate for such a loan, but as the advance would be spread over many years, the amount of the mortgage required to secure it must be uncertain, and difficulties would arise on this account, particularly in the case of heavily-encumbered estates. Moreover, strong objection would certainly be raised by many people to the Government lending on terms that would really imply its taking all the risk and the proprietors getting the whole surplus profit at the end, after paying off the capital expenditure and the accumulated moderate interest. Such would indeed be too favourable terms to the proprietors, whose personal obligation for payment of the debt and interest, if any were given, would be postponed to so remote a date that no reliance could be placed upon it. How, then, could the State be secured of a fair share of the ultimate profit commensurate to the capital contributed to the undertaking? This might be effected under a system of joint account, the Government, however, retaining the power to secure efficient management, and having a prior lien over the subjects for its fair share of the timber profits.

The plan could be worked out in this way, - a proprietor of suitable land would offer it for a planting scheme on the footing that its value for present letting purposes be placed to his credit in an account to be kept by a Government Forestry Department. To this account the Government would contribute all the expenses connected with its utilisation for forestry purposes, and these sums would be placed to its credit. Interest on the respective credit balances would be added periodically, but when the forest became revenue-producing, interest would stop, and a balance be struck, and thereafter the net annual returns, after meeting all expenses, would be divisible proportionally to the amounts standing at the credit of the Government and the proprietor respectively. Connected with the land actually to be planted, suitable land for occupation by those to be employed might be permanently rented and let to the employees.

The management of the forest might generally be left to the proprietor of the estate. His management would be usually more economical and careful than that of Government officials from a distance, but strict conditions would be necessary to guard against mismanagement or neglect. The general lines of

management would be laid down by the Government department,—the head forester would be a man whose qualifications had been approved by the department,—the work would be carried out on the basis of annual estimates, and the woods would be inspected from time to time by the department's representative. If the management for any reason proved unsatisfactory, the department would step in and take it into its own hand.

The legal form in which such a scheme could be constituted might be a simple conveyance of the land included in the scheme to Government with a back agreement setting out the terms of the arrangement, including the return of the land to the proprietor or his successor at a fair value if and when the scheme was wound up. The holders of any mortgage would need to concur in the conveyance, but in return they would receive an assignation in security of the proprietor's interests under the forest agreement.

The general result would be the establishment of a forest under Government for public and private benefit, on land belonging to a private owner and under his private control so long as well managed. Undoubtedly the bogey of "dual ownership" will be set up to frighten people from such a scheme. But, after all, have we not more or less of dual control in almost every undertaking? Who is free from State control and State interference in their business? Take, for instance, the railway companies: they have the Board of Trade revising their management in every detail; they have to admit public rights in the use and control of their property as a condition of the powers and privileges they enjoy. Yet does the system prove unworkable in this country? Again, we have the factory and mines inspectors interfering in the management and conditions of industries. Yet apart from an occasional growl, no harm is done and often great good. In the case of such a co-operative scheme as is roughly suggested above, friction and differences of opinion would be less likely, inasmuch as the Government and the proprietor would alike be interested in its financial success and in the welfare of its local employees.

Undoubtedly the establishment of a Forestry Department would be required for Scotland under Government to control and supervise the working of such a scheme, but it is a national concession to be pressed for on every ground. A Department of Agriculture and Forestry should be given us to remove the

humiliation we feel in having to go to Whitehall in all matters of public business affecting Scottish agriculture, and even in private business, to settle the most trifling disputes between a laird and his tenant, for it is there they must apply before an arbiter is named. It is indeed no drawback to this scheme that it might call for more local attention to forestry business by Government, and emphasise the advantages that will be gained through the establishment of a Scottish Experimental Station as a basis for practical forestry work.

Let us see how such a co-operative scheme as is above suggested would work out in practice. Imagine it applied to some Highland estate near the west coast of Scotland, with a considerable extent of hill land, at present used for deer or for carrying a moderately healthy stock of sheep. Suppose a considerable belt of the land available above the lower arable and pasture land to be of the free open soil that suits the larch, not too high for profitable tree-growing, and within easy reach of an arm of the sea or other road to market. Perhaps there is a small neighbouring population, poorly employed on their crofts. Anyone who knows the Highlands at all can readily recall such a place. The proprietor wishes to establish a permanent industry for the people, and to do something for his country and for his successors in his lands by commercial planting, but has no money to invest in such a scheme, and cannot borrow more on his heavily-mortgaged estate. He finds opportunity to very gradually withdraw such land as is described from sheep or deer, at no very serious sacrifice of rent, to an extent in all of say 2000 acres. So he applies to Government to join him in putting in practice these good intentions. The Government inspection is satisfactory, and the exact extent of land to be included in the scheme is adjusted and planned off. The present value of the land for its ordinary purpose is agreed on, a planting plan and system of management is adjusted and an agreement signed. The lands to be ultimately included are say 2000 acres, worth f, 3 per acre, 25 acres to be planted each year, with croft and grazing land worth say £50 per annum attached.

In the first year a nursery would be formed to provide plants after the first two or three years. The first 25 or 50 acres to be planted would be fenced off, drains cut, and a 25 acre division might be planted at a cost of say  $\pounds_5$  per acre planted—or  $\pounds_{125}$  per year. The cost of this work would be estimated each

year, and the amounts passed paid by Government and placed to its credit in the account, the proprietor being credited with the agreed value of his land taken possession of each year. The croft and grazing land would be dealt with as might be arranged—perhaps that the proprietor would continue to receive the same rent as the land brought when taken over, the Government defraying the costs of any buildings or other improvements required, and being credited therefor in the account. Each year would add similarly to the capital contributed on each side, till the years were reached when the crops of trees became saleable and further capital expenditure would cease, and returns came in to the Government and the owner of the land. Meantime more and more labour would have been required, and more and more men employed.

This is an example of the scheme worked out on a modest scale—25 acres per annum—but the larger the scheme the better the results would be, as the larger undertakings would justify the employment of more skilled and better paid managers, and would in various ways secure greater economy. Nor would there be any insuperable difficulty in two or more proprietors being associated in one permanent scheme along with Government.

The advantages which would be attained in securing continuous good management of the forest areas dealt with, and in facilitating the establishment of forestry stations in different parts of the country under Government control for scientific study, have not been touched on above. These and the climatic improvement to the districts in which such large masses of trees would be introduced, are considerations which must not be overlooked.

Undoubtedly this scheme would mean the sinking for many years of public money—mainly in wages paid out for work—but would the nation grudge this to establish what would really be a new national industry under the healthiest conditions of life and work? The expenditure would be very gradual, while the benefits to the nation would be immediate, substantial and increasing.

[We hope that these interesting suggestions will be fully discussed by other writers.—Hon. Ed.]

#### 21. Root Disease in Scots Pine on Farm Lands.

(With Two Plates.)

By BERT. RIBBENTROP, C.I.E

Does any direct connection exist between root disease in Scots pine and the condition of the soil on farm lands? This is the question which has been propounded by Professor Dr Albert. Prior to his investigation, the ravages of Polyporus annosus had assumed disastrous dimensions, and seemed to be in process of increasing, both in virulence and extent, in all parts of the Continent. In northern Germany especially the ever-increasing destruction of afforested lands constituted a grave calamity, for since the middle of last century very extensive areas of farm lands had been afforested—chiefly with conifers—in the pious but unrealised hope that inferior fields would become at once productive forest. How can Scots pine forests, grown on old fields, be saved from total destruction by *Polyporus annosus*—became the question put on all sides, by private owners and at forest conferences. It was only in 1902, however, that Professor Albert was officially entrusted with the solution of the problem. That he was the right man for the work no one who follows the logical sequence of his scientific work, and the guarded nature of his deductions, will be disposed to deny. We sincerely hope to hear more of his valuable researches, especially in regard to the afforestation of heather lands.

When Dr Albert started on his work, it was the general belief that the attacks of *Polyporus annosus* were the prime cause of root disease in pines: that a virulent and frequently fatal disease existed prior to fungoid infection was not known, although a predisposition to fungoid infection on farm lands was generally believed in. All sorts of speculative explanations were given of this predisposition, such as the presence of animal matter in the soil, etc.

The history of Scots pine on old farm land is always the same—a particularly rapid development of the young crop takes place in the early stages; after some years the growth in height ceases somewhat abruptly, and this is followed by the death of single trees here and there. From these centres the disease spreads in ever-widening circles, which only change their form when they meet. The first deaths occur between the ages of 8 to 10 years, and trees of upwards of 60 years old are safe.

The disease varies considerably in its degree of virulence; in many cases only twenty trees per acre escape, in others a large percentage of the original crop may survive, but it is very rare to find that a full crop reaches maturity without active artificial measures of amelioration, by the interpolation of other species.

The circular expansion of the disease proves without doubt that it is spreading by root contact, and that *Polyporus annosus* is the immediate cause of death. All visible signs, moreover, point to this fungus as the original cause of the disease, but as all direct infection experiments on growing roots failed, Dr Albert refused to accept this view without further inquiries and direct proof. No instance had been observed of the fungus attacking trees growing on forest soil, although mycelia and spores of *Polyporus* and other similar fungi are found everywhere in the immediate vicinity on dead and rotting wood. This fact suggested that, whether *Polyporus* was the primary cause of the disease, or was merely a secondary infection, the predisposing cause must be looked for in the condition of the soil on farm lands, and this was where Dr Albert looked for it.

In the first instance, he verified by personal observation the fact that Scots pine and red pine planted on farm land, whether the original soil was rich or poor, were invariably attacked by root disease. Second, he found that where the first crop had failed, and the area was restocked with the same species, the disease greatly increased in virulency.

Dr Albert next made, in numerous localities, careful and searching analyses, physical 1 as well as chemical, of soils on

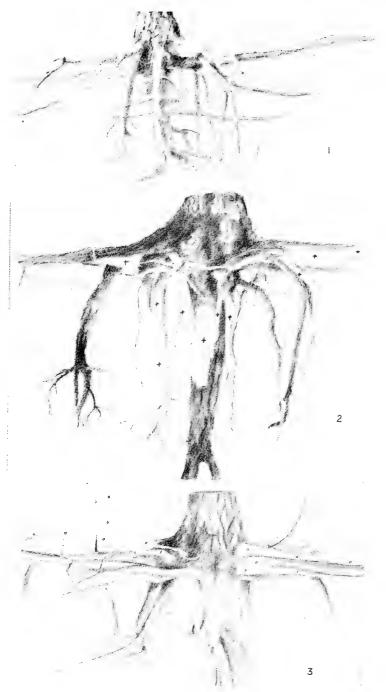
<sup>1</sup> The chemical constituents of the soil can be fully utilised only if the physical ones are favourable. We obtain the most reliable picture of these conditions by measuring the porosity of the soil, recording the result as a percentage. Thus a porosity of 40 per cent. would mean that 100 parts of soil contain 40 per cent. of hollow spaces and 60 per cent. of solids. This gives us a direct measure of the density of the soil, and shows us at a glance how air and water circulation are affected. Numerous and reliable observations can only be made on the spot, but nothing is easier. All that is required is a specially constructed steel receptacle of known dimensions and weight (Ramann's), by means of which equal portions of the soil can be taken up in their natural position, a very accurate scale, and a number of air-tight tubes of known weights. The exact weight of the soil taken out by means of the steel receptacle is ascertained on the spot and recorded, and specimens of the same soil are put into the test-tubes. Those specimens are carefully tested in the laboratory as regards water and specific weight. This done, the porosity percentage can be ascertained by arithmetic.

existing farm lands, on afforested fields under pine crops of. various ages, and on the adjoining forest lands. The physical analyses were always made on the spot, which naturally is the only way of obtaining reliable results. The chemical analyses of the various soils showed in no instance sufficiently pronounced differences to account for any marked changes in the growth of the crop, for although a gradual decrease was observed in the percentage of humus and nitrogen in the surface-soil of farm lands, which had been for some time under Scots pine, this was nowhere considerable enough to produce any marked decrease in the rate of growth, and certainly could not cause its entire cessation. A remarkable and constant difference was, however, found to exist between the physical condition of forest soils and of farm-land soils. The porosity of the latter was invariably much less than that of the soils in adjacent forest tracts, and this difference increased in most cases down to a depth of 12 to 18 inches and more. In many instances the porosity of farm lands fell below 40 per cent. Dr Albert's researches proved that no improvement had taken place in these conditions, or at least the very slightest only, on areas under a pure Scots pine crop, but that, where Acacia had been planted in destroyed portions of the original pine afforestation, the forest soil conditions were produced in an incredibly short space of time. It was found that the same physical conditions had established themselves on farm-land areas which had been afforested 65 years ago with a mixture of Scots pine, beech, and birch. No root disease ever took place in these crops, though they were surrounded by especially severely attacked afforestations of pure Scots pine. Even an inter-mixture with equi-aged oak was found to have protected the pine from root disease, and to have restored the forest soil condition to a considerable extent.

As soon as Dr Albert had established the existence of a constant difference between farm-land soil and forest soil, he assumed that if the disease was due to this fact, then all trees growing on farm lands should show at least primary symptoms of the disease. This proved to be the case. As Dr Albert began his detailed studies of roots only after he had finally established the existence of an unvarying difference in the physical condition of the soils, his observations in this respect are not spread over as many localities, but they are nevertheless very instructive and convincing.

The early primary symptoms of disease are very widely spread, and Dr Albert found them on upwards of 90 per cent. of all farm-land grown Scots pine. They are easily recognised in the shape of dark or black spots on the still living roots, which in these places contain a more or less decomposing fluid, and frequently exude resin. The first appearance of these symptoms was usually observed on the wide-spreading surface-roots, entirely unconnected with each other, thus showing that the disease starts simultaneously in many places. Numerous entirely dead roots were also found in every case. The fact that practically every Scots pine tree grown on old farm land suffers from a root disease, seems to have been proved, but that this disease kills a large proportion of the trees it attacks is at least doubtful. The actual slayer is, unquestionably, Polyporus annosus or one of its relations. At what period of the original root disease this scourge begins to take an active part in the work of destruction, and in what condition the roots have to be to allow it to thrive, are questions which merit the most careful investigation. Without this secondary attack, a regeneration of the root-systemthough this remains marked with numerous scars—seems mostly to take place; with it death is the inevitable fate of the tree.

The root-system of the Scots pine growing on farm land is quite different from that of forest-grown trees, for though the young plant develops long tap-roots, these are mostly smooth like a carrot, without bifurcations or branches, and the sideroots-which start from the very root necks-keep almost entirely in the upper layer of the soil. This may be because they find easily assimilated food near the surface, and experience more difficulty in penetrating the soil, which is denser than nature intends them to penetrate under ordinary circumstances. Albert suggests that this surface position of the roots exposes them to periodical and rapid changes between excessive moisture and drought, thereby starting the disease. He may be right, and the reasons he gives for his belief are not without value; but here we enter the field of speculation, and we must leave it to physiologists and mycologists to ascertain the exact nature of the primary disease and the course it runs. All I think we can safely accept is, that on the Continent a primary pine root disease is universal on all afforested farm lands; whether, however, the disease is as active in England is a matter for inquiry. The soil conditions must be subject to the same laws, but it is conceivable



ROOT DISEASE IN SCOTS PINE. (For explanation see Text.)

[ To face page 146.

that the greater equality of the climate does not encourage the actual outbreak of the disease to the same extent.

The early cessation of growth, and the gradual dying-out of both Scots pine and red pine, in the very extensive State afforestations of heather tracts in the north-western parts of Germany (Luneburger Heide), had for a long time been ascribed to the inherent poverty of the soil, but laboratory analysis proved that this conclusion was not quite tenable. A commission of inquiry was then appointed, of which Dr Albert became a member in 1906. When he examined the soil of the afforestation area in question, he found that exactly the same conditions prevailed here on heather lands as he had observed on farm lands; the same vigorous growth for some years, and the same attack by a primary root disease, ending in death, occurred if *Polyporus* took the field. This of course does away with the animal manure theory of the causation of the disease.

It is then at present believed that Scots pine and red pine are invariably subject to root disease, if cultivated on any other but forest land. This would naturally apply to the larch as well, for it also is not a soil-improver. The trees, as explained above, do not all die if not infested by the fungus pest, but, under the most favourable circumstances, they lose years of growth whilst readjusting their root-systems by sending down vertical branches from their surface-striking side roots; and all this time they are doing nothing for the next crop.

These facts are very serious for this country as well, for bona fide forest soil is not too plentiful in Great Britain, and, if our pine and larch crops on other types of soil should fail, and prove liable to fungoid attacks, the present undoubtedly growing enthusiasm for afforestation with pines and larch would die out.

We may be certain that further researches will be made in Germany in the direction pointed out by Dr Albert, especially by the Heather Afforestation Commission; but we should not stand aside, but should institute investigations of our own (always to be made on the spot) as regards the comparative physical condition of soils on forest lands and on farm, heather and waste lands, and should study the root-systems of our pines under the various soil conditions, and examine them for disease spots or scars. I consider it quite possible that, owing to the climatic conditions, the results of researches in this country will prove more favourable in every respect than on the Continent.

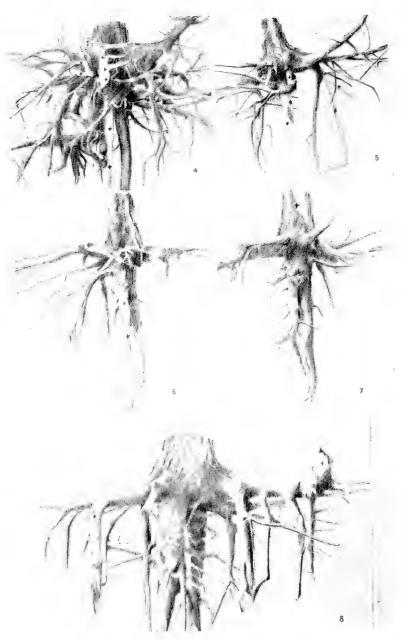
The question naturally arises, how can the primary disease be prevented, and what steps have to be taken when the crop has been attacked? Prevention is certainly easier than cure, and, to judge from the investigations so far as they have gone, it would seem to be sufficiently safe to cultivate Scots pine or any other conifer on farm or waste lands, after establishing forest-soil conditions by a preliminary crop of some soil-improving species. Even a liberal admixture of such species, Acacia in preference, with an original pine crop would probably suffice to prevent any root disease. When the young growth has been attacked, the stems that lag most behind in height-growth, especially those which have sent out no new shoots at all, should at once be removed, and replaced by some fast growing soil-improving species. To sit and await results means merely waste of time, and is courting further disaster.

We have no absolute proof that the spread of *Polyporus* when it has once established itself in a diseased afforestation area can be controlled, but experiments with isolating ditches made over an area of over 2000 acres, by Herr von Klitzing, Charlottenhof, have so far had the desired result. This the owner of the forest ascribes to the early application of the measure, for as soon as a young stem was seen to be in a dying condition, it was at once surrounded with a circular ditch of 30 feet diameter. These forests have not yet passed the critical age, but favourable reports regarding the efficacy of the measure are also received from France, and any forest owner would be rash not to try isolation.

In India, the field of my former labours, most of the pines, especially *Pinus excelsa*, but also *Pinus longifolia*, which is certainly no soil-improver, take fairly rapid possession of deserted fields, but still this is a gradual process, in which bushes of all sorts probably play a considerable rôle. Only once, in 1871, did I try my hand on sowing some old fields with *Pinus longifolia*. The first results were excellent, but when I returned in 1883 no vestige of my attempt was left.



# PLATE XII.



ROOT DISEASE IN SCOTS PINE.

'For explanation see Text.)

To face page 140.

#### EXPLANATION OF PLATES.

- The accompanying Plates, which are drawn from Photographs, show Scots pine roots grown on old farm lands.
- Figs. 1 and 8. Roots of trees growing in close portions of otherwise severely attacked afforestations—55 and 60 years old. Neither of these roots systems shows any traces of the disease, and they are almost normal in their development. They represent exceptions.
- Fig. 2. Roots of a 50 year old tree left on a large blank—its foliage was still normal, but height-growth had almost ceased for some years. The tree was, however, still struggling with the disease.
- Fig. 3. Roots of a 45 year old tree, in a heavily diseased area, still living but doomed; the foliage was thin and off colour. The shape and development of the root system are quite typical of those of farmland grown Scots pine.
- Fig. 4. Typical formation of roots of a tree that has got over the disease after a severe struggle. The tap-root was dead, but had been replaced by numerous deep-reaching branch roots. The crown development, also typical, showed by its rounded formation that for a considerable time no growth in height had taken place, but a vigorous shoot growing out of it proved that the crisis was over.
- Figs. 5 and 6. Roots of trees 45 and 50 years old, which had passed the crisis and were convalescent. The regeneration of the root system had established itself, and growth in height had recommenced.
- Fig. 7. Roots of a dying tree, 40 years old. A severe struggle for life was evidenced by the formation of a second large root, after the first had died.

## 22. The Cultivation of Hardwoods.1

By J. Boyd.

II.

It is my intention, in continuing this subject, to express briefly my opinions regarding the formation and cultivation of hardwood crops, the method of treating the subject being to begin by making some general remarks; then to refer to the principal broad-leaved trees individually, with a short reference to the tending of woods composed entirely of these; and lastly, to mention some cases where it may be permissible, or even advisable, to have a mixture of conifers with hardwoods.

Trees in general—hardwoods included—may be cultivated either in "pure woods" or in "mixed woods," and the latter may be either "even-aged" or "uneven-aged." Although these terms are now more or less familiar, it may be advisable to state briefly what they imply, and what is the object of having mixtures. A pure wood is one composed of one species of tree; there may be stray trees of other species throughout the area, but they are ignored in the management, the whole being treated as if there was one species. On the other hand, a mixed wood is one composed of two or more species of trees, and, as already stated, it may be even-aged or uneven-aged.

# (a) Even-aged Woods.

In this case there are four different methods of mixing, any one of which may be adopted, according to circumstances:—
(1) by single plants; (2) by alternate lines of different species;
(3) by strips—or several lines—of each species; (4) by groups.

1. In the case of a mixture by single plants, the mixture should be composed of two kinds of trees—and two only—or at least two kinds only should grow together on any given area of a wood, e.g., oak and beech might be the principal crop in a wood; but if it were desirable to introduce, in suitable places, such trees as ash or elm, they should not be mixed with the oak and beech, but should be planted, instead of the oak, along with the beech. This method of mixing is suited only to soils which are more or less regular in character, and on which

<sup>&</sup>lt;sup>1</sup> Continued from page 49.

the oak will have a good chance of holding its own with the beech; otherwise the latter will tend to suppress it, and to prevent this in a situation which favoured the development of the beech would be a well-nigh hopeless task.

- 2. A mixture by single lines should, like the former, be composed of two species of trees planted in alternate lines, and is only suited to situations which will favour the growth of the light-demanding species. The advantages of this system over the former are—(1) that the planting is simpler, and (2) that the trees are more easily tended in youth.
- 3. A mixture by strips, which is a modification of (2), is composed of several instead of single lines of each species planted alternately. It is suited to a soil and situation which will be likely to favour the development of the shade-bearing species; because in this method the light-demanding plants can be more easily fostered by checking the growth of the other.
- 4. Mixture by Groups.—A mixture by groups is one composed of groups of various kinds of trees, or, in other words, an aggregation of miniature pure woods, a proportion of which must be good soil preservers, these being so arranged that they may be of the greatest advantage in maintaining the fertility of the soil throughout the wood. Such a mixture may be composed of as many kinds of trees as the nature of the soil and situation will accommodate or necessitate, and is preferable for a variable soil; but in the formation of such woods great care and judgment are required to ensure success. In some of our best hardwood-growing localities, it will frequently be found that within the area of an ordinary sized wood such vagaries are met with in the soil that the adoption of the group system on certain parts will be most advantageous. In such cases it may be not only permissible, but advisable, to combine this system with any or all of the preceding ones.

# (b) Uneven-aged Woods.

In this country uneven-aged mixtures are not very common, but as time goes on they may become more so where heavy timber is required. Such mixtures will, as a rule, be started as pure woods, or as mixtures of light-demanding trees, and will be cultivated as such until about middle life, when they will be gradually thinned out to a certain number of trees per

acre, and underplanted with a good shade-bearing and soil-preserving species.

### THE OBJECT OF MIXTURES.

The object of having mixed woods in preference to pure woods in the case of hardwoods is twofold—(1) to preserve the fertility of the soil; (2) to improve the quality and outcome of the timber.

- 1. Some trees are capable of maintaining or improving the fertility of the soil, whereas others are absolutely incapable of doing either; indeed, under a crop of such the soil is certain to deteriorate, and it is a notable fact that the most valuable of our hardwood timber-trees belong to this class: therefore in forming a mixture, one of the species of trees must of necessity be one which will be capable of preserving the fertility of the soil.
- 2. Certain trees, and very notably oak, if grown in pure woods, are apt, in middle and later life, and particularly after a heavy thinning, to develop, from dormant buds in the stems, a crop of shoots which are a very serious objection, insomuch that they do incalculable harm by reducing the quality, and therefore the value, of the timber, 1 and it is most essential that such a state of affairs should be prevented. All situations and localities are not alike subject to this evil; the danger, other conditions of management being equal, seems to be in inverse proportion to the suitability of the soil for the development of the trees. If by any chance, however, a crop is allowed to get into a bad state with side-shoots, there is practically no cure. Therefore, as already mentioned, the plan is to prevent the evil, and this can only be attained by having such trees properly mixed with shade-bearers. The proportion of shade-bearers required to prevent this will depend largely on the nature of the soil, fewer being necessary on a deep fertile soil than on a poor shallow one. Of course it is quite possible to grow a crop of hardwoods of light-demanding species on a soil of high quality without any risk of injury from the cause referred to; but if the preservation of the soil be considered as well, it will be found that under such a crop, with a long rotation, the soil will have deteriorated. There is therefore

<sup>&</sup>lt;sup>1</sup> And by tending to render the timber "stag-headed."—Hon. Ed.

only one conclusion to be arrived at if the two objects of mixtures be considered conjointly, and that is, that for the proper cultivation of the most valuable hardwoods a mixture with shade-bearers is absolutely necessary.

### INDIVIDUAL TREES.

Oak.—In speaking of mixtures, a good deal has been said regarding oak, indicating at least its characteristics, but as it is considered the premier tree among our hardwoods, a little repetition may be pardoned.

It stands high in its demands on the locality, requiring for its proper development a soil of good quality and depth. It is decidedly a light-demanding tree, being even sensitive to side shade, and after early life is about the worst soil-preserver of all trees. When young, that is until it has passed the pole stage, it will protect the soil to some extent, but afterwards it opens up very rapidly, and the light penetrating the open canopy encourages an undergrowth of grass and other weeds which utilise the humus on the surface of the ground, thus depriving the trees of much nutriment. As the wood gets older, there is added to this the worse evil of the loss of humus through the wind blowing the leaves either out of the wood altogether or into ditches, hollows, or depressions, thus robbing some parts, if not the whole wood, of its natural fertiliser. leaves of oak are slow in decomposing, and are thus very subject to being blown away, so much so that the leaves of the previous year may be found blowing about in late spring. To cultivate oak on a successful basis, means must be taken to counteract these tendencies, or the certain result will be deterioration of the soil, and consequent loss of annual increment, and this can only be averted by mixing it with another species which will supply the necessary density and protection to counterbalance the deficiencies enumerated. Beech is the tree which, by all authorities, is considered the most suitable for this purpose.

Beech.—Like oak, beech requires a soil of good quality, although it is not so exacting as to depth. It is decidedly a shade-bearing tree, having a dense crown which at all stages of life forms a canopy sufficiently dense to keep down any undergrowth which would be detrimental to the soil. It also

makes a good wind-break, thus reducing the chance of loss of humus through blowing of the leaves, which are very abundant, and form a rich and plentiful supply of humus. Beech leaves are quite as slow of decomposition as those of oak, but they lie more closely to the ground, so that, apart from their being better protected, they are in themselves less liable to be blown by the wind. This combination of qualities possessed by the beech enables it not only to protect, but even to improve the fertility of the soil, and in it, therefore, are found the qualities which are deficient in the oak, thus making it a suitable companion for that tree. It is scarcely necessary to add that, if desired, beech may be grown in pure woods; but if it has its proper place in the cultivation of oak, there is not much chance of it being necessary to cultivate it thus, excepting under circumstances where it will be more profitable to have it grown alone.

Hornbeam.—In situations where beech is apt to suffer from frost, hornbeam is recommended as a suitable companion for oak. It possesses all the qualities of the beech in a lesser degree, and should only be substituted for it when the climatic conditions necessitate its use.

Ash.—From a commercial point of view, ash as a timber-tree stands on about a level with oak. Its requirements as to soil and light are also somewhat similar, except that it requires a little more moisture in the soil. Its capabilities as a soil-preserver are, however, considerably higher than those of the oak; this is partly due to the fact that it has rather heavier foliage, and partly because the leaves decompose more quickly, and for this reason are much less liable to be blown away; but apart from all this, the compound form of the leaves render them less liable to be blown than the simple leaves of its confrères. Yet, with all these advantages, it cannot be recommended as a suitable tree for general planting in a mixed wood, it being, as a rule, better adapted for growing on suitable spots along the sides of streams, on the sides or in the bottoms of glens, or in fresh hollows. In such places it may be mixed with beech, but, for the reasons enumerated above, there is not the same occasion for this mixture unless the suitable areas are large; in ordinary cases, the best results are likely to be got by growing it in pure groups throughout the wood in such situations as have been referred to.

Elm, Sycamore and Maple.—These three trees may be classed together, as the same treatment may be applied to all of them. Commercially, the sycamore is the most valuable of the three, and in large sizes it is probably the most valuable timbertree grown. Like the sycamore, the maple is valuable in large sizes, whereas the elm is at its best as ordinary sized timber. In their soil requirements these trees are somewhat similar to ash, except that sycamore and maple do not require the same degree of moisture. In their light requirements they may be termed middle class, none of them being very exacting in their demands. They all form a fairly dense canopy, their leaves are rapidly decomposed, and not very liable to be badly blown; thus they may be ranked as fair, but not as good preservers of the fertility of the soil, and they are therefore not suitable for growing in large areas as pure woods. To cultivate them successfully, they should be treated in the manner recommended for ash, if their timber is likely to be in demand; or where the demand is not so great, by planting single trees throughout, or round the margin of, woods.

Birch.—The birch, in this country, is more frequently treated as a weed than as a timber-producing tree; yet considerable quantities of birch wood are used in various industries,1 and if the proper variety of birch were grown, there is no reason why it might not become a more profitable tree, as it grows rapidly and comes to maturity at an early age. It makes small demands on the fertility of the soil, and will even flourish in a poor dry soil, but will do much better on a good and fairly humid one. It is essentially a light-demanding tree, and after youth affords poor protection to the soil. Little can be said from experience as to its cultivation, but presumably from its very rapid growth in youth, and from its tendency to lash and destroy the tops of adjoining trees with its whip-like twigs when subjected to even a moderate breeze, it should be grown pure at first, and underplanted with a shade-bearer when it has reached a suitable stage. Some varieties of American birch may yet prove to be useful trees in this country, and are certainly worthy of a fair trial.

There are several other broad-leaved trees which are timber producers; some of these, viz., sweet chestnut, horse-chestnut

<sup>&</sup>lt;sup>1</sup> Considerable quantities of clean birch logs are imported from the Baltic and other northern ports.—Hon, Ep.

and lime, need not be treated of, as they are usually planted more from an æsthetic point of view than anything else, whilst others—poplars and willows—are more worthy of passing note.

Poplars.—The black Italian and Canadian poplars—excepting the balsam varieties of the latter—are the best timber producers in this genus. They require a moderately deep and fertile soil, with a fair degree of humidity—but no stagnant water—for their proper development. They are rather above middle class in their light requirements, and afford a fair amount of protection to the soil. Their soft leaves decompose quickly, and do not blow readily, consequently they maintain the fertility of the soil fairly well. They should be cultivated in groups in suitable situations, never as single trees throughout a wood, because they grow so much more rapidly than any other trees. A crop of good sized marketable timber may be produced by these trees in a period of thirty-five to forty years, a feat which no other tree can equal.

Willow.—The characteristics and requirements of the tree willows are very much the same as those of poplars. They will stand a little more moisture in the soil, afford less protection to it, and be rather more exacting in their light requirements. The method of cultivation should be the same as has been recommended for poplars.

#### TENDING OF WOODS.

It is claimed that if hardwoods—or broad-leaved trees—were cultivated on the principle advocated, the management would be simplicity itself compared with that of a compound mixture of conifers with hardwoods. In the early stages the usual precautions against weeds will have to be taken. Afterwards, when the trees have become established, and have developed into the thicket stage, care will have to be taken, when dealing with mixtures, that the shade-bearing trees do not overtop the others. When the Society visited the French forests a few years ago, a very good object-lesson for the prevention of this danger was brought before their notice in the forests near Nancy. If the hornbeam or beech were threatening to crush out the oak, the forest guards went round with long-handled bill-hooks, and wherever a good oak sapling was being threatened, he simply slashed off the tops of the offending trees, thus giving the oak ample head room, and still maintaining a complete canopy for

the protection of the soil. This method of procedure is an admirable one, and well worth copying, and is altogether preferable to the method usually practised in this country, viz., cutting out the offending tree or trees, which, besides encouraging lateral-growth at the expense of height-growth, destroys the canopy of the wood. Another point in favour of cultivating hardwoods as recommended, is that, in tending the crop, the necessity for having to resort to pruning in extensive woods is obviated to a great extent. When the ground is stocked with a limited number of trees per acre, pruning is almost always necessary, in order to ensure a final crop of good trees. Whereas, if the ground is fully stocked with the trees which are to form the permanent crop, either as a pure wood or as a mixture, pruning will rarely be necessary after they have reached the thicket stage, because in such woods there will always be found a sufficient number of good stems. When thinning becomes necessary, great care should be exercised in conducting this operation, overthinning, in all cases, being guarded against. The first thinnings should be limited to a removal of dead and dying stems, and the succeeding ones should be conducted with the object of encouraging the development of the best stems, regardless of returns from thinnings. With regard to thinning, a practice was noticed in the treatment of oak and beech woods in France, which is well worth mentioning. In passing through a middle-aged forest near Nancy, it was very noticeable that a great many small, and what appeared to be useless beech had been left growing under the oaks, whose stems were frequently surrounded by them, and the Excursionists were informed that these had been spared purposely with the object of keeping the light off the oak-stems, and thus preventing the development of side-shoots. This plan serves the purpose well, and could be put into practice in this country with advantageous results.

In connection with the cultivation of hardwoods, the old proverb that "the exception proves the rule" holds good, as there is a possibility of having a mixture of hardwoods with conifers giving successful results. In the case of underplanting oak or other light-demanding hardwoods in localities where beech would be unmarketable, some shade-bearing species of conifer might be substituted with advantage to the financial returns, e.g., if the hardwoods are very open, Douglas fir—

on suitable soil—might be substituted. Probably the most notable example of the successful cultivation of a mixture of hardwoods and conifers is that of larch with beech, but in this case the mixture is for the benefit of the conifer and not of the hardwood.

### CONCLUSION.

It can scarcely be expected that all readers will agree with the opinions recorded here, but it is hoped that the expression of them may be the means of causing reflection on the subject, and that it may be found that there is something to be said in favour of the statement that, generally speaking, hardwoods, or rather broad-leaved trees, should be cultivated by themselves, and conifers likewise, and not mixed one with the other.

# 23. Impressions of Forestry in the Schwarzwald.

(With Two Plates.)

By J. F. Annand.

The writer of the following notes, having been fortunate enough, through the kind recommendations of Dr Schlich and Dr Somerville, to obtain admission to an admirable course of lectures under Herr Oberförster Philipp of Sulzburg, Baden, had subsequently the privilege of spending a part of last summer in the forest, under the tuition of that distinguished forest officer. Herr Karl Philipp's name is well known to many American foresters and British colonial forest officers, who have received much of their practical training under him. In addition to some German forestry students, the party receiving instruction last summer included two forest conservators from British colonies and the present writer. The comprehensive scheme of study taken up under Herr Philipp's guidance embraced such special subjects as methods of forest valuation, the construction of yield-tables, the preparation of working-plans, etc., but it is not proposed here to trouble the readers of the Transactions with minute particulars of such matters. Rather is it the writer's aim to give only such details of the silviculture, and such of his general impressions of the forestry systems practised in South Germany, as are likely to be of special interest to those concerned with the forestry problems of this country.

#### Systems of Silviculture.

More than a third of the whole area of the Duchy of Baden is covered with forest, largely State property, but partly owned also by communes or townships, and partly by private individuals.

The tree most largely cultivated is the silver fir, along with which there is in some regions a proportion of beech. The latter, however, in the higher altitudes, gives place to spruce.

On the lower mountain slopes, in good deep soils with a considerable proportion of lime in their composition, oak and beech are cultivated. But as the better soils are, as a rule, more profitably used for agricultural (or viticultural) rather than for forestal purposes, the area under broad-leaved species is now small, and is not likely to increase.

On the plains in the Rhine Valley, coppice and coppice-with-

standards are still to be met with in small quantity, but these are being as rapidly as possible re-converted into high-forest.

Under all the systems practised in the high-forest of Baden, Nature does the planting or regenerating, except where large areas have been damaged by windfall, where thinnings have been neglected or mismanaged in such a way as to introduce bad soil conditions, or where the parent stems are too old to produce sufficient seed-crops to restock the ground.

In districts with very steep mountain land, one finds in the Black Forest irregular-aged crops ("femel wald"), which are managed under what is described in the English forestry text-books as the "selection" system. Of all systems this is the nearest approach to natural virgin forest. All age-classes are mixed together either as individual stems, or better, in very small groups. By this system the ground is always covered with tree-growth, and soil denudation, even in the steepest land, is entirely prevented.

The "selection" forests are usually found at altitudes of from 1000 to 3000 feet. The yield of good timber is much higher than one would at first anticipate. Measurements of numerous sample-plots have proved the current annual increment to be as high, very often, as 8 cubic metres per hectare, or about 112 cubic feet per acre.

According to Herr Philipp, the growing stock in most of these irregular woods is made up of the following species, and, in e.g., the valley of the Kinzig, in the following proportions:—

Silver fir,			60 per cent.
Spruce,			30 per cent.
Beech,			8 per cent.
Pine,			2 per cent.

with sometimes a little oak in the lower ground. The proportions of the different species vary, however, in different localities.

The silver fir is by far the best coniferous tree for selection crops. It endures a great amount of shade and has great recuperative power when set free after having been overshadowed and suppressed for a long period. Its wounds heal rapidly, and the damaged part does not decay as in the case of spruce.

Amongst other advantages, the silver fir has good seed-years at short intervals. It is very wind-firm, and, as regards density

<sup>&</sup>lt;sup>1</sup> Irregular Woods in the Black Forest, by Karl Philipp—reprint from American Forester.

of growing stock, it is unsurpassed by any other conifer, so that it is an excellent soil-protector.

The stems approach very near to the cylindrical, the form factor being higher than for any other coniferous species. In the Black Forest, also, silver fir is only very slightly affected by injurious insects.

From an altitude of 2000 feet and upwards the spruce gets more numerous in the mixture, and at 2500 feet, where there is greater humidity of soil and atmosphere, it is the prevailing species. The spruce is not wind-firm like the silver fir, and, owing to its liability to damage from gales, it does not lend itself so freely to natural regeneration on the flat moist ground as silver fir, but higher up in the mountains, in the rocky soils, the roots get better anchorage, and with cautious thinning, natural regeneration is not only possible but is successfully practised. In the low ground, however, the spruce is planted amongst the naturally regenerated silver firs.

The pine is not used to any extent on soils in good condition. Where it is used its growth is satisfactory in the Black Forest, and it almost equals spruce as regards shape of stem, whereas, as is pointed out by Herr Philipp, the pines in the hot valleys of the Rhine are frequently crooked. They are often thinly crowned and poor in quality, thus showing that *locality* has often a good deal to do with the fixing of the value as timber of any particular species.

Turning again to Herr Philipp's article, we find it stated that "the timber-market of the Rhine prescribes a minimum diameter without bark at breast-height, for different classes of timber, as follows:—

"Class IV., 14 centimetres at the length of 8 metres.1

And "the average prices during the last few years in the Black Forest were:—

"13 marks for one cubic metre of the IVth Class.

<sup>&</sup>lt;sup>1</sup> Centimetre = about '39 inch. Metre = 39 inches. Cubic metre = 35 cubic feet.

According to investigations carried out by Herr Philipp, a silver fir, in order to belong to the first class, must have the following proportions (diameter measured at breast-height):—

"A minimum diameter of 55 centimetres if 30 metres high.

,,	"	53	77	31	,,
"	,,	50	,,	33	,,
,,	,,	48	11	34	22

Stems which have reached the prescribed diameter for a given height would after that only have a quantity increment, whereas those under that diameter of the same height would have not only a quantity increment but a quality increment as well, and in such cases as these the discriminating powers of the skilful forester in regard to thinning might be exercised with the most valuable results. Though apparently simple, a "selection" system, in order to obtain the best financial results, really requires more skill on the part of the forester than any other.

Theoretically no part of the forest is ever at rest—a system of felling and regenerating is going on continually all over the area, but in practice the forest is worked by compartments. Healthy growing trees are considered mature when they attain to the dimensions of Class I. stems. This financial maturity is reached between the age of 100 and 140 years, the general average rotation being 120 years.

In order to maintain proper forest conditions and keep up the irregular character of the crops, a normal growing stock has to be maintained, corresponding to the normal mean annual increment, with age-classes also normally distributed. Working-plans are renewed every ten years, when the volume of timber in each compartment of forest is measured in diameter classes, the amount of sound timber being separately reckoned from what is faulty.

Besides the regular cuttings, confined to prescribed compartments, accidental fellings—the result of snow-break, windfall, etc.—are continually taking place under good management, and these accidental fellings amount to as much as from 20 to 30 per cent. of the whole. Where there is no good system of roads, much of the accidental fall is not fully utilised.

Beech is less encouraged in the silver fir forests than formerly. Its chief use is for fuel, but as the silver fir is a sufficiently good soil-protector, the beech is less required than in woods of oak

and pine. The cultivation of oak, however, is never attempted without the help of beech.

In every range in the Black Forest there is a proportion of "selection" woods, but the largest proportion of them are worked on the Shelter-Wood Compartment System, or in some cases on a modification of this, namely, the Shelter-Wood Strip System.

The greater part of the Sulzburg range (chiefly silver fir with a little beech and a very little spruce) is worked on the shelter-wood compartment system. This method is so well known that it is not necessary to describe it in detail here.

In this range, as in most others, there are forests belonging to communes and forests belonging to the State. All these are placed under one Oberförster, who controls the working of the whole. A share of his salary is paid by the communes, who have, however, the right, under certain restrictions, of prescribing the details of the working-plans for their forests.

As has been already stated, under normal conditions Nature does the restocking, but where windfall occurs, or where there are blanks from other causes, the ground is artificially planted up without loss of time. As a matter of fact, "repair plantings" or "cultures" are, under good management, constantly going on. Formerly planting was not so much resorted to, but with the value of forest produce constantly rising, and with increasing facilities for transport in the shape of new roads in the forest, the system is really becoming more and more intense, and if Nature is not, for some reason, likely to perform the work sufficiently well and in time, planting is resorted to without hesitation. In some cases nurseries are formed on the spot, but as the ground to be planted is usually scattered in small patches over huge areas, it is a common practice for an Oberförster to purchase his planting stock direct from nurserymen.

The cost of labour, and consequently the cost of planting, is high, but as the planting has to be done only on a very small percentage of the whole area, this is of less consequence, and the forest manager can afford to make a judicious outlay in this respect. In the Sulzburg range the species most commonly used for "repair" plantings are common spruce, Sitka spruce, Douglas fir and white pine (*Pinus strobus*); occasionally larch and Scots pine are used. Very dense planting is not resorted

to in Baden. Formerly 10,000 plants per hectare¹ were used, now 6000 is considered ample stocking; but it must be kept in mind that with the hot summers of South Germany the energy of growth in height is probably much greater than with us, so that it does not necessarily follow that what would be sufficient for South Germany would be equally so for us. It has further to be remembered that in those forests the timber of finest quality will be had from the naturally regenerated stands with a very dense young growth. Consequently it is not so highly important to have very dense artificial cultures.

The average rotation period for the silver fir worked on the shelter-wood compartment system is 120 years, and natural regeneration requires from 30 to 40 years to complete. Experience has recently proved, however, that the average age of 100 years would probably make a more profitable rotation period in the lower reaches, and the tendency now appears to be to aim at working into this rotation.

As regards actual money returns from the silver fir forests, it will readily be understood that with areas so vast and with conditions so variable in the matter of soils, altitudes, etc., the financial results must also vary. In some stands where the situation is exceptionally favourable, the net returns appear to work out as high as about £3 per acre per annum, but, excluding poor and unproductive sections at extreme heights, 30s. an acre would probably be nearer an average money return. Even this very favourable result would not be possible without very skilful management and the help of natural regeneration. It has to be kept in mind also that all timber, small and great, has a market value, while the market for high-class timber is very good indeed.

On a forest range near Baden-Baden, where the forests occur at an altitude of from 1000 to 3300 feet, the average annual increment, over 80 per cent. of the range, worked on the shelter-wood compartment system, amounts to about 92 cubic feet per acre. On the very high reaches the production is of course less, and the limit of profitable production is reached somewhere about 3000 feet.

One thing which strikes even the casual visitor from our own country is the extraordinarily successful results obtained in natural regeneration. In some of the compartments of the

<sup>1</sup> One hectare = 2.47 acres.

## Pratt XIII.



[Photo by I. F. A. NATURAL REGENERATION OF SILVLE FIR (Shelter-wood Compartment System).

Dense young growth: 3 to 5 feet high.

Large proportion of "mother" trees removed.



[Photo by J. F. A.

ADVANCED STAGE OF NATURAL REGENERATION.

Most of "mother" trees have been removed.

Sulzburg range, under the skilful management obtaining there, the natural regeneration is as near perfection as one could well imagine.

If the advantages and disadvantages of the "selection" system and the shelter-wood compartment system are compared, it can be claimed in favour of the former, that there is a complete protection of the soil and less liability to damage from storms. These are very important matters in high altitudes on the steep mountain sides where the system is chiefly practised. On the other hand, the "selection" system is one which requires a greater amount of skill than any other, not only on the part of the forest officer but on that of every grade in the service. Another objection to the system is that there is a greater percentage of rough branchy timber than under the shelter-wood compartment system; but this disadvantage is less pronounced when regeneration proceeds by means of small groups or hursts, in preference to that by means of individual trees, and experience in Baden has shown that the financial results are at anyrate as good as under any other system.

The shelter-wood compartment system also provides for good soil-protection, and is productive of a much larger percentage of clean timber of high technical value. There would, however, be a somewhat greater liability to damage from storms than under the "selection" system. Natural regeneration is usually very complete under this system also, and it is the preferable one at the lower altitudes where the better class soils are more abundant. When the time for regeneration comes round, if there is a mixture of beech trees in the silver fir stands, the former are cut away almost entirely, otherwise there would be too much beech in the young crop, and there would be a danger of the silver fir being suppressed unless expensive cleanings were resorted to. Two or three good beech seed trees per hectare are usually considered sufficient to leave at the seeding stage, but old suppressed beech trees not likely to produce seed are left for a time to protect the soil and the young growth. Later on, when no longer required, those suppressed beeches are cut away. By means such as these, almost perfect regeneration of the silver fir can be effected.

The oak forests do not occupy a large percentage of the whole. They occupy the lower slopes with limestone soils of better quality. Their area has been much curtailed by the

encroachments of the vine-grower. They do not present any exceptional features of cultivation. There is usually maintained a sufficient quantity of beech to seed the ground under the oak for soil-protection, but where this condition is absent beeches removed from thickets elsewhere are planted in the open parts. This is usually done when the oaks attain the age of 40 to 50 years, and, when the undergrowth is sufficiently established to prevent the growth of epicormic shoots or "water sprouts," a regular and free system of thinning is commenced.

## MODERN SYSTEM OF THINNING PRACTISED IN BADEN.

One of the practices in our so-called system of forestry in Great Britain, which has deservedly met with severe criticism on the part of those who have been accustomed to the scientific methods of the Continent, is that insane one of thinning out young woods immediately they enter, or even before they have entered, the thicket stage. The practice is one which cannot be too strongly condemned where the production of commercial timber is the main object in view.

At the same time, it is just possible that in the building up of the more rational systems which are at present slowly taking shape in this country, we may err in rushing to the opposite extreme by following too rigidly what may now be described as the *old* Continental method of thinning, that is to say, the method which in practice consisted in the removing of very little more than the suppressed trees. It may not be without interest, therefore, to follow from its origin the past history of the old method of procedure, and also to examine the results as one finds them in various regions of the Black Forest, where the effects of the old method are still apparent in some regions.

In the beginning of last century pasturage by cattle and other stock was general throughout the forests of Germany. This had the effect of retarding natural regeneration. The forest would get more and more open, grasses and other weeds would have free scope for development, the quality of the forest soil would gradually become deteriorated owing to the open condition of the canopy, and ultimately the forest would become incapable of restocking itself. At anyrate, this appears to have been a common condition of matters about a century ago in the silver fir forests of Baden. By and by rights of pasturage appear

gradually to have been bought out, and now in some States pasturage in the forest is prohibited by law.

In order to bring the soil back into fertile condition, the German forester, recognising that the openness of the canopy was the cause of the deterioration, set about remedying matters by once more introducing close order, and with a view to hastening this, the thinnings were restricted to the removal of suppressed trees. At anyrate, theoretically, this was the system adopted. Now if there had been no disease, no windfall, no insect attacks, no accidents of any sort to the standing trees composing the forest, probably this system would have had very highly satisfactory results. But unfortunately there was and is windfall, cankerous diseases are by no means rare, in particular that caused by Acidium elatinum. The mistletoe also is common, and produces bad defects in the timber. The method of thinning out then took no account of dominant trees which might be affected by cankerous growths or which might have other defects. These would in course of time get broken off by the wind, and large gaps would be caused in the canopy. This system then, carried to extremes, had to a certain extent the effect of defeating the very objects for which it was chiefly intended, namely, the preservation of good soil conditions and the natural regeneration of the forest. Further, the omission to cut defective trees, such as those with wide spreading branchy crowns, if they happened to be in the dominant class, had often the effect of prejudicing the growth of probably several surrounding smaller but much finer stems.

Now, however, the younger German foresters are practically unanimous in upholding the more modern system, which, by the way, does not seem to have originated in Germany, but rather in Denmark or France. Now it is being adopted in some parts of Germany in a more thoroughly scientific manner perhaps than either in Denmark or in France. It has been given various names. It might be called the "Danish" or the "French" system or the "free thinning" system. It should not be confounded, however, with the very free system which had, until recently, come to be considered the correct one in Great Britain during, at least, the latter half of last century.

Thinning should properly only begin when the larger part of the height-growth has taken place; whereas under our arboricultural method even the thicket stage was never permitted to exist. "Free thinning" permits this, but later on takes more account of the thinning of the crowns, the best 500 or 600 stems per hectare being always favoured. Dominant faulty trees are freely removed. In the silver fir forests those with cankerous growths are worst. Others may be spoiled by having broken tops or frost cracks, or mistletoe growths. Others again have forked growth, or are rough branching trees with low spreading crowns - called by the Germans "wolf" trees, etc. Then again, the suppressed or overshadowed trees (other than dead or sickly ones), instead of being cut out are purposely retained, not only to protect the soil but also to retard natural regeneration until the proper time -often a very necessary precaution. Overshadowed beeches are found excellent for this purpose when they occur in mixture with the silver fir. They seldom produce any seed, and they serve the purpose of soil-protection admirably. When the proper time for natural seeding is reached they are gradually cut away.

Under the "free thinning" system, the proportion of thinnings to final yield is very much larger than it was under the old regime, and in the case of light-demanding species like the oak, the proportion may be as high as 150 per cent.

As regards total production under the two systems, the yield of timber would, at least, be as high under the new system as under the old, and the financial outcome would be much better, because the quality of timber would be better, and the forest could be worked with less locked up capital.

It is certainly due to this vigorous method of "improvement" thinnings that such excellent results in natural regeneration are obtained in various forest ranges in Baden, but the method is, of course, applicable to all forest species and under every silvicultural system.

The question is often asked, "How is it possible to carry out the felling of the mature timber during the various stages of the natural regeneration, without destroying the young growth?" The work certainly requires a large amount of skill on the part of the woodmen. But it should be remembered, in the first place, that there is no desire to grow trees of excessively large diameter. Tall, straight, cylindrical boles of sufficient but not extra large diameter are most numerous. Then, secondly, trees of the largest dimensions are always removed

first, after the initial seeding stage is past. Thirdly, regeneration is completed and the balance of the overhead protection trees removed as speedily as possible. Nevertheless it often happens that large trees have to be felled after there is a considerable covering on the ground of fairly advanced young growth. When this is the case, the woodmen very often do a thing which seems at first sight to be the worst possible practice. They fell the old trees, not on the comparatively bare ground with few seedlings, but right into the very thickest and best of the young growth. The reason for this is that in these thickets there are perhaps 50 per cent. more young trees than are necessary for a crop, so that it is no disadvantage at all if a considerable number are destroyed. On the other hand, there may be no young trees to spare at all in the thinly stocked parts. Sometimes it is necessary to lop the branches of the heavy crowned old trees previous to felling, in order to prevent damage, but if the felling is promptly and skilfully pressed on through the various seedling stages, little harm results to young growth.

The tree cutters are very clever workmen, and they speak somewhat contemptuously of the unskilled "tree-killers" who do the felling in the plains, where the clear-felling system is practised. The tree felling is done with the axe and the saw, almost precisely in the same way as we find it done in Scotland.

#### TREE DISEASES AND INSECT ENEMIES.

The disease of most practical importance in the silver fir forests is that causing the cankerous growths and swellings on the stems, that, namely, due to *Æcidium* (*Peridermium*) elatinum.

Owing to a too rigid adherence to the system of thinning, by which suppressed trees only were removed, this very objectionable disease has got a considerable hold and does a great deal of harm. Its effects are apparent in two ways. In the first place, it reduces the value of the timber, which is absolutely useless at the affected parts except for fuel; and secondly, when the cankerous growths entirely encircle the stems, the trees are constantly being broken over at the affected parts whenever gales occur. The canopy thus gets much interrupted, weeds gain an entrance, there is a loss of increment,

and natural regeneration is interfered with. The most obvious remedy, and the most practical one, is to diligently remove affected stems in the course of the thinnings. This is now being done in the Black Forest.

The disease is quite a common one on silver fir in some parts of Ireland and in the south-west of Scotland. It used to be regarded by Scottish foresters as a "freak" growth. Another plant (not regarded quite as a true parasite) which causes defects in silver fir timber in the Black Forest, almost as bad as those produced by the \*\*Ecidium\*, is the common mistletoe (Viscum album). It is very prevalent, and owing to its easy distribution by birds, it is difficult to stamp out. Next to trees with cankerous growths, those having mistletoe plants on them are the most favoured for removal in the course of thinnings under the modern system.

Insect enemies are not particularly numerous, and in any case they are always kept well in hand.

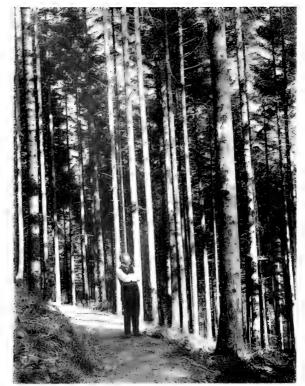
Tomicus curvidens is to be found on the silver fir on dry slopes in unthinned stands where there are weakly trees. This beetle may also in course of time attack healthy trees, but it prefers weakly ones. According to Herr Philipp, there may be two or three broods in the course of a season. The remedy is to fell weakly or diseased trees, bark them and burn the rubbish. Mr Gillanders says the beetle has not been recorded in this country.

Tomicus (Trypodendron) lineatum is another beetle found in the silver fir and spruce stands. Owing to an excellent rule, strictly adhered to, which requires all coniferous trees felled and left lying in the forest to be at once barked, serious insect attacks are really non-existent.

The species of *Chermes* which attacks the silver fir in this country with such fatal results, is certainly present in the Black Forest, but the natural constitutional vigour of the trees there is such that any bad effects are not apparent.

Everybody can walk at pleasure through the roads and paths in the forest, and yet not one single instance of wilful damage, either by old or young, ever came under the observation of the writer during the whole of his stay in Baden. A line of conduct such as this must have taken time to develop like the forestry systems themselves.

How very different often is the state of matters with us!



[Photo by A. F. A. WELL-THINNED STAND OF SHAER TIK. Average Age, 55 Years,



[Photo by M. J. PIECES OF SILVER FIR TIMBER SHOWING INJURIOUS EFFECTS OF "SINKER" ROOTS OF MISTLETOE.

[To face page 170.

### Town Water Supplies from the Forest.

Modern sewage systems and water supplies are gradually being developed in the towns and villages of the valleys and plains. All new water supplies are being taken from the forest. Generally (but not necessarily) the supply for any particular town or commune is taken from the range of forest belonging to it. These water supplies have their source where there may be said to be absolutely no contamination either from human habitations or from the grazing of live stock.

While we are still debating (somewhat senselessly, perhaps) whether or not a pure water supply could be got from forest land, the question has been settled very effectively and in a very different way in Baden. The forests have been developed first of all, and now without exception the towns look to the forest for a pure water supply.

Further, the forests themselves often provide the necessary capital for the laying down of the water supplies. As a rule, for various reasons there are large surplus stocks of standing timber in the forests, and when a commune or town requires extra money for such purposes as road construction or water supplies, it can very often be provided by means of one or more extraordinary fellings of surplus timber, and that without in any way interfering with the normal growing stock of the forest.

#### ROAD MAKING.

One of the many works of improvement going on in the forests at the present time is the building in some ranges of a very complete system of mountain roads. These new roads are broad, well built and thoroughly macadamised. They are made with easy gradients, and are preferred to tramways. Ultimately they will entirely displace timber slides and other somewhat primitive methods of transport in the Black Forest.

One chief result of the making of these roads is that an enhanced price can always be obtained for the timber, and they make it possible for the smaller timber merchants to penetrate farther into the forests for their supplies.

## RURAL LIFE AND FOREST LABOUR SUPPLY.

The rate of wages for workmen is much higher in Baden than in North Germany. Forest workers earn from 4 to 5 marks

(shillings) a day. They are, however, an extremely hardworking set of people. They walk or cycle long distances to their work, and they have much longer hours than British workmen. Most of those workmen are either small-holders themselves or they are the relatives of small-holders, and generally, but not always, they are the owners of their little farms. The average size of such a holding is about 12 acres.

In limestone soils on the slopes, the vine is one of the chief crops, and it requires a large amount of hand labour during the summer season. The cattle, which do a great deal of the carting work in the forest, are all stall fed. The grass is mowed for hay at least twice during a season. The farmyard manure is used chiefly for the vines, and much artificial manure is also required both for the vines and for the ordinary field and market garden crops. The system of cultivation of these holdings has therefore of necessity to be of an intensive character. There is no waste land in the sense in which we use the term. Practically every yard of soil is utilised.

Large farms are also to be met with, but they are not so numerous as the small holdings. The whole of the valleys present a charming and varied picture, made up of cultivated farms, grass meadows and vineyards. Here and there in the lower hills the oak and beech forests obtrude themselves, while higher up in the mountains, where cultivation is no longer possible, an intense system of forestry, with the silver fir as its main element, prevails. The towering mountains, the apparently irregular character of the forest, the deep valleys, the clear running streams, all add a variety and a charm to the scenery which is entirely absent in localties having what may be called a more artificial system of forestry.

Probably no patriotic Briton would willingly admit that the scenery is equal to our own, but surely not even the most fastidious lover of the beautiful in nature could take any exception, from the æsthetic point of view, to such a system of forestry as prevails in Baden.

But to return to the question of labour supply. The small-holder, living in the village or town in the valley, is very fully employed during spring and summer on his own farm or on his vineyard, but during late autumn and winter he has very little to occupy his time, and he generally turns to the forest for employment. This is an arrangement which works admirably. It

provides the regular skilled workman, so necessary for the proper conduct of work in a forest where the operations consist so largely of *improvement* fellings, and where so much damage might be done by unskilled workmen to young growth, which must receive specially careful treatment during at least one-fourth of the whole period of the rotation. Without this abundant supply of skilled labour it would be impossible to attain to the highly successful results which one finds in the Black Forest.

On the other hand, if the small-holder does not actually depend on the forest work for his very existence, at anyrate it ameliorates his condition and provides him with a more comfortable living. The two systems have grown up together more or less, and one might say they are inseparable.

The small-holder, or the large farmer, very often also does the carrying of the timber (either with oxen or horses) from the forest to the timber merchant's saw-mills in the towns in the valleys. Many industries in the towns also depend on the forest for their existence.

#### CONCLUDING NOTE.

In putting together the foregoing notes, the writer had no intention of suggesting that the systems of forestry practised in Baden could be adopted wholesale in this country, or that the whole of the Highlands say, or the southern uplands of Scotland, or the North of England fells, might be converted into "one horrid forest." Nor is the preposterous idea put forward that large farms could be successfully broken up in a wholesale fashion into small holdings. The economic conditions of the two countries are in many ways totally different. On the other hand, there are many points of resemblance. There is first the question of the necessary forest labour. Wages in our country are usually high, and it is a good thing they are high, but this does not make the question of planting any simpler. There is a desire for cheapness, and it is a necessary condition of profitable forestry to have the ground stocked at a cheap rate.

Workmen's wages in Baden are also high, and here again it is a good thing that they are high, and probably the position of a workman in South Germany is much better than that of a workman in North Germany.

In Baden the labour question is settled by making nature do a large proportion of the stocking.

Artificial planting is certainly resorted to, and now more promptly, and to a much greater extent than formerly; and very extensive nursery establishments are carried on in South Germany; but if the percentage of trees planted over the whole vast area of forests in Baden were reckoned up, it would be found very small indeed. It is the large amount of natural seeding of the forest which makes it possible to carry on the very necessary artificial cultures with profit.

A large amount of labour is provided in the forest, but it is largely labour which gives a good immediate return. For example, thinnings proper (there may be cleanings before) are not commenced until a net surplus is obtainable.

The systems of forestry which obtain in Baden have taken a century and more to build up, and they are still being improved upon. It will probably take little less than a century to perfect any similar system in this country.

It is not suggested that any system built up exactly on the Baden pattern could be established here. We could not, for example, grow the silver fir, for it seems perfectly certain that we have got beyond the northern limit for the profitable growth of this tree. But there are other species which, no doubt, will be found suitable to take the place of the silver fir.

The silvicultural characters of the few forest species chiefly cultivated in Germany have been thoroughly studied and are well understood, so far as they apply to German climatic conditions. It is by no means the case that we are so thoroughly conversant with the silvicultural characters even of common suitable species, as applied to our conditions and climate, and these ought to be the subject of further investigation and study. The principles involved are, however, the same.

It seems to the writer, therefore, that when and wherever forests are to be established in this country on anything like an extensive scale, the system should be built on such a foundation as to provide first for the permanency of the forest. Species should be selected which (always assuming they are suitable timber species) could reasonably be expected to reproduce their kind from seed, naturally, to a more or less perfect extent, so as not in the future to have to depend entirely for their renewal on artificial planting. This of course could only be accomplished in

the future, and it is to the work of the public or private nurseryman alone which we must look in the first instance. Second, a sufficient supply of skilled labour is necessary. In building up the forest, permanent provision should be made, by providing holdings or otherwise, for keeping skilled forest workers on the land.

With such objects in view, the combination of small farms and forest, as one finds it in Baden, appears worthy, to some extent at any rate, of imitation.

During a century the price of timber in Germany has risen more or less steadily at the rate of 1 per cent. per annum. That is to say, it has doubled itself in one hundred years.

The steadily rising price of timber, and its increasing scarcity all over the world, is a matter of great moment in an industrial country like our own.

So far, anything of consequence which has been done for forestry in this country has been done by private individuals. Under present conditions they could not reasonably be expected to do very much more than they are doing. The position of municipalities, up to the present, with regard to forestry has not been such as to encourage the hope that they could deal effectively with the question. It seems quite obvious, therefore, that any large scheme of forestry to be effective could best be undertaken by Government, or at anyrate should be under its help or guidance.

Will any British Government ever take up seriously the question of reforesting suitable parts of the country on a large scale?

## 24. Notes of Silvicultural Interest.

By THOMAS HALL.

Overthinning of Woods.—The much-discussed method of raising forest crops by natural regeneration or direct sowing can hardly be called practicable in this country under existing circumstances, owing to the fact that most private estates are overrun by game, and more especially by the kinds most injurious to young forest crops, such as rabbits and hares.

It is easy to understand, under such circumstances, why woods are so much thinned and never underplanted with forest trees, as even the undercover usually planted in a game preserve, such as privet, laurel, and rhododendron, will not thrive under a really close canopy, such as would be formed by a crop of timber grown on purely silvicultural lines.

That undercover of this kind could be largely dispensed with in our game preserves has not as yet been realised by the majority of landed proprietors or their agents, who go on from year to year cutting down trees which in all probability would not have reached their highest value for the next fifty years, under the pretence, perhaps, that the timber is required for estate purposes, but in reality to save the undercover from being exterminated. The forester, even though he be of the new school, has to submit to the inevitable, the keeper's advice being generally considered of more value than his where game is preserved on an estate.

Underplanting Game Covers with Forest Trees.—Highwoods are rarely underplanted in this country, owing principally to the expense which would be entailed by the enclosing of woods of large extent with a fence sufficient to protect them until they would be safe from the attacks of ground game. A simple plan whereby this expense may be greatly reduced, may therefore prove of interest to many who contemplate such an undertaking.

We will suppose that a wood of 8 or 10 acres, composed principally of oak, and about seventy years old, has become bare at the bottom and useless as a game cover, and it is only the expense of protecting the whole area which hinders its underplanting.

The underplanting of the whole area may, however, be success-

fully carried out with very little expenditure, by enclosing (with a rabbit-proof fence) say 2 acres of the most open part of the wood, and planting this with 1-2 year seedlings of spruce, silver and Douglas fir, at 21 to 3 feet apart, 13,000 trees or more, sufficient to plant the whole area at 5 to 6 feet apart when the trees are old enough to withstand the attacks of ground game. When the trees have attained a height of 3 to 4 feet, they can be thinned out by transplanting with balls of earth attached to their roots. The pits having been previously made, the trees should be carried on hand-barrows, constructed with a frame (two-thirds the height of the trees) all round them, one end being detachable, so that the plants can be put in and taken out more easily. The frame keeps the plants in an upright position, which is of great importance, as were the plants allowed to fall over sideways, the ball of earth, being much heavier than the tree, would be broken and become detached from the root, taking with it the small fibrous roots on which the success of the operation entirely depends.

The trees should be planted in the open spaces between the old stems at 5 feet apart, the largest and strongest being left standing on the enclosed part at the same distance. It will be found an advantage to have the enclosure on the most exposed side of the plantation, so that when the final transplanting takes place the newly removed trees will have the benefit of the shelter from the firmly established ones remaining.

Woods underplanted in this manner would repay the cost if it were for nothing else than the benefit to the older trees by having their stems cleaned of side branches.<sup>1</sup> It would also form a better game cover, and hold pheasants better than privet, which, from its dampness, is rarely resorted to.

Regeneration of Beech by Natural Seedlings.—In a good seed-year a very simple plan for stocking a nursery break with beech may be carried out in the following manner very successfully. A piece of ground is selected, and enclosed with 1 inch mesh wire netting, under one or two good seed-bearing trees. The ground inside this enclosure is dug over roughly to a depth of several inches in September or October before the seed begins to fall. After the seed has fallen, the ground is lightly prodded on the surface, and levelled with an ordinary garden fork to

<sup>&</sup>lt;sup>1</sup> To secure this object the underplanting should be done earlier, say at the ages of 30 to 50 years.—Hon. Ed.

cover the seed, and finally given a light rolling to imbed the seed more firmly in the ground.

Pigeons and squirrels should be kept off during winter by shooting, else they will devour large quantities of seed which may not have been properly covered. If mice are numerous, poison should be laid in drain pipes so that other animals cannot reach it. Rats will be kept off by the I inch mesh netting.

When the seedlings are two years old they should be lifted with balls of earth by means of an ordinary garden trowel, and carried on hand-barrows (with a raised edge 4 inches deep all round) to the nursery, where they are laid out in lines 15 inches apart, with 4 inches between each plant.

The garden trowel is again used in this operation, the ground having been prepared to the necessary width, and the line set at 15 inches from the last row. Small holes at 4 inches apart are then cut the exact size of the ball attached to the root of the plant, the plant and ball are inserted and the earth firmed round it with the hand. No treading with the foot is allowed, as this would break the ball of earth round the plant and otherwise injure the roots.

The great advantage of this method is that the young seedlings have the shelter of the parent tree for the first two years, which of course would be denied them if the seed were gathered in the usual way and sown in the nursery beds.

Preventing Frost Lifting in Seed-Beds.—Sowing tree seeds in rows instead of broadcast has lately come more into practice in the nursery, and although this in itself is some protection against frost lifting, it may be found necessary, in some localities, to give the young seedlings some artificial protection for the winter months. I discovered the beneficial effects of mulching or bedding between the rows by accident two years ago. The leaves from a beech tree, which were shed over the wall into the nursery, got drifted by the wind into a sheltered corner where four beds of Menzies' spruce were sown. Two of the beds were covered with the leaves, and owing to pressure of other work at the time they were not removed. The result was that the other two beds were lifted by a black frost in February, and they had all to be gone over and pricked in again, and the ground firmed about them, while not a plant was stirred in the two beds covered by the leaves.

I have since then found it much better to bed between the rows with spruce needles, as they are not readily shifted by wind, and do not require to be raked off in the spring. Leaving them on the bed keeps down weeds, and reduces the danger of drought to a minimum.

Mulching to prevent Sunbaking and save Watering.—Mulching seed-beds with moss or cut grass to prevent sunbaking, and to save watering, especially where a large quantity of seed is sown, has been the practice of many foresters for a number of years, but great care must be taken when this material is used in removing it when the young plants come above ground, as much injury may be done to their tender heads, by tearing away the seed casing, before it has dropped off in the natural way.

A much simpler plan, and one that will be found to answer the purpose quite as well, is to cut spruce boughs with healthy green foliage, where they can be spared, and lay them on the beds with their butt ends stuck in the paths between the beds. When the seed germinates, the inner ends of the boughs should be raised and propped up with a forked twig stuck in the bed between the rows of seeds. An occasional watering over the boughs keeps the beds nice and cool, and the ground will never get crusted, as would be the case with continual watering without any protection. Mulching between the rows of transplants will also be found beneficial to their growth, and, what is of more importance, to the formation of fibrous roots. A good dressing of half-rotten leaf mould between the rows will answer this purpose best, and this should be kept continually stirred with the hoe along with a portion of the surface soil. The fine particles of soil and mould will keep the moisture always near the surface.

(To be continued.)

## 25. Continental Notes—Germany.

By BERT. RIBBENTROP, C.I.E.

At present, when the training of foresters in England has become a national and imperial question, it may probably interest your readers to know what is happening in this respect in Germany, where a controversy regarding the education and training of officers for the higher grades of the forest services has, throughout the past year, excited considerable interest in professional circles. The contending parties agree that a prolonged course of practical forest work, in addition to mere excursions, must, at one period or other, form an essential part of the training; but whereas one of the opposing parties advocates an entire university education, the other is in favour of retaining the instruction in sciences and technical subjects at the existing forest academies, to be preceded by a year's lectures at a university in political economy, law, and other subjects not so fully taught at the technical high schools.

In the beginning of 1907 the fight threatened to become a heated one. A number of letters, professedly from Prussia, till now considered the stronghold of the forest-academical party, had appeared in the *Forst und Jagd Zeitung* and in some other of the newer technical publications, criticising the existing departmental education at the forest high schools, and calling for radical changes. The letters were anonymous, and eventually led to a very angry retort in the interest of Eberswalde. However, the heat evaporated, and all further discussions were conducted with the dignity that the importance of the subject demands.

The first official meeting of the rival parties took place in Berlin during the twelfth sitting of the Council of Forest Management (Forst-Wirthschaft-Rath) in February 1907. The meeting was attended by forty-five official members of the committee, drawn from all parts of Germany, and by special delegates deputed by the State forest administrations of Prussia and most of the other important States of the empire, clearly indicating that the question under discussion was considered to be one of vital importance.

The leaders of the rival camps were Professor Dr Enders

(Munich) and Oberforstmeister Riebel (Munden). The theses of the former were:—

- r. The forest academies, in their present condition as isolated technical schools of forestry, can no longer be considered to be suitable educational institutes for probationers of the upper forest services.
- 2. At least half of the practical business of an officer in the upper grades of the forest department consists of purely administrative affairs, which demand a thorough knowledge of law, land revenue, political economy, etc., and this alone would be sufficient reason for an amalgamation of forest education with university teaching. There are, however, other reasons which render this necessary. (a) The scientific and social intercourse, with professors and scholars of other scientific professions, forms both for the teachers and the probationers of the forest service, a rich source of new impressions, stimulates to new exertions, serves to widen their intellectual field of perception, and prevents the growth of professional onesidedness. (b) A university offers the teacher ample and suitable means for original research, and gives the students opportunities of acquiring knowledge beyond and above that strictly required by their profession. (c) A complete social and official equality between the higher forest officials and similar officers of other departments can only be attained if the standard of education and training is equal in every respect.
  - 3. The university course should extend over four years.
- 4. The utility of an initial practical course, preceding the teaching at a university, is out of proportion to the time thus consumed.
- 5. The combination of forest education with agricultural academies is indefensible.
- 6. It is very desirable that the number of universities in which forest science is to be taught should not exceed three to four for the whole empire.

The leader of the forest high school party, Mr Riebel (Munden), late director at Eberswalde, opposed in the following terms:—

1. The necessity for transferring the higher forestry education exclusively to universities cannot be admitted. It is more to the point to teach the auxiliary sciences on which forestry is based, and forest science itself, at technical high schools,

which have been specially constituted for this purpose, and which are, moreover, intimately connected with forests available for purposes of instruction.

- 2. Sufficient means for original scientific research should be placed at the disposal of the professors of such academies, and their grading and pay should be made proportionate to their positions. Special steps should be taken as regards the training of future teachers.
- 3. In the advanced state of science, a minimum of four years' study is required for an education sufficient for the demands of the present time. Three of these four years should be devoted to studies at a technical high school.

The complete course of training, Riebel proposes to regulate in the following manner:—(a) Preliminary—A certificate of having passed the final examination from a classical or modern school of the first class. (b) A winter half year of practical apprenticeship, during which a diary has to be kept. (c) A year at a university-law, land revenue, general administration, political economy, finance, and history of administration to be compulsory subjects. (d) One year military service. (b, c, and d may be arranged in any sequence desired, but must be completed previously to the course at the technical high school.) (e) Three years' study at the high school, including the first or scientific examination. This examination is conducted in two parts: the first, taken at the end of the third or fourth half year, embraces auxiliary science, law, and theoretical and practical administration; the second part, taken at the end of the academical studies, includes surveying, all branches of technical forest science, and forest policy. Comprehensive independent work is to be demanded in this section of the scientific examination, and the examiners are to be the academical professors. (f) Two years practical work in the duties of the executive staff, the administrative staff, and on working-plans. (g) Final examination (Staats-Examen).

The speeches of the two eminent leaders, based on their respective theses, were followed by an animated discussion, and it became at once evident, that even in Prussia opinion—not excluding that of many present and former teachers at high schools—leaned strongly towards a university education. However, no formal resolutions were submitted at the first reading.

At the next sitting of the Council, which took place in Strassburg in September 1907, Dr Enders (Munich) submitted his theses No. 1 and 2 as a resolution. Mr Riebel (Munden) opposed, and recommended that no resolution whatever should be put, because the question of forest education was not a national one. It had no effect beyond the boundaries of each individual State, and was therefore one which each government had to decide for itself; a resolution passed by a general German forest committee could consequently have no practical result. The directors of three other high schools also spoke in favour of the retention of high schools, and desired a declaration to the effect that none of the existing methods of forest education could be considered as unjustifiable. high school party had, however, but few friends beside their directorial champions, and the following amendment to the original proposal was finally accepted:-"The entire higher forest education should be given at a university, and should be arranged for a minimum period of four years."

On the following day the subject was once more brought up before the general German Forest Conference, also assembled at Strassburg. An attempt was made to interest the profession in a proposal to raise the standard of the technical schools, so as to render them entirely independent of university teaching. The proposal, however, collapsed when it was pointed out that this would only mean the creation of new small universities. unable to compete with the existing large scientific centres. In conclusion, the resolution, as accepted by the Forest Council, was approved by a great majority. This is how the question of higher forest education stands at present in Germany. It is evident that professional opinion is, even in Prussia, almost entirely in favour of an exclusive university education. The position the various governments will take in regard to this problem lies, however, on the knees of the gods, and the extremely diplomatic statement made by a high official, delegated by the Prussian Government, sheds but a scanty light on the question.

It is to be noted that all parties agree that instruction forests in the immediate vicinity of centres of instruction, so to say for daily use, are essential, but that they need not be school forests, such as are attached to the Prussian academies.<sup>1</sup>

<sup>&</sup>lt;sup>1</sup> This statement may be noted in connection with practical instruction in Scotland.—Hon. Ed.

Since writing the above we find that the Prussian Government have, by a preliminary resolution, settled the question for the time being, by raising the length of the theoretical course at the academies from two years to three. A year's study at a university follows as before. So something tangible has been gained by the agitation, and the end is not yet.

The Prussian academies are justly proud of their school forests. Germany contains many other forests fully as well managed, and, from a silvicultural point of view, perhaps even more instructive, than the plains forests of Eberswalde; but none have, we venture to think, such a complete and detailed record of their management and of the gradual growth of their working-plans. These records represent a typical example of the working-plan development in Prussia, and are therefore doubly interesting. They were originally compiled for the St Louis Exhibition, and published in the form of a popular pamphlet. They are now re-edited, for professional foresters, in the *Forst und Jagd Zeitung*.

It is not generally known that Frederic the Great took a personal interest in forest management. Even before the Seven Years' War he asked for a survey of the Prussian forests, and a settled policy as regards their treatment. In 1764 he ordered, in a personal resolution, the division of every forest into 70 sections, and the gradual abandonment of selection fellings.

The first survey of the present school forest, at the time known as the Biesenthal Forest, was begun in 1755, but war intervened, and the maps were not finished till 1769. The forest was divided into 70 equal compartments, to be worked in annual sequence. The forest was then in a bad state owing to years of spoliation by rightholders and thieves, and it was evident that a literal adherence to the royal order spelt ruin. To meet the difficulty, each block containing 70 compartments was divided into two parts, each containing 70 sections, half the size of the original ones. This, with the prescription that no forest which had not already attained the age of 70 years was to be worked during the first period of 70 years, would have secured a 140 years' rotation; but during the king's lifetime the subterfuge failed, and till 1786 the forest had to yield 10,000 to 20,000 cubic metres per annum.

However, though the provisions, so cleverly thought out, had no effect till 1786, they saved the situation during the revision

which took place in 1787. An elaborated method, known as Hennert's system, was introduced, but proved to be of no practical value, and deserves no further description. As a matter of fact, it provided in itself no security for continuity, and when the period check was applied, the output became obviously too small. The revision resulted in a compromise, under which the previous output was reduced by 50 per cent.; Hennert's method thus became a system based on volume, pure and simple.

Remarkable progress was made during the next decennium: the maps produced in 1795-96 contained for the first time not only the local distribution of species, but of age-classes as well. Nobody but a practical forester can realise the difficulties and tedious labour involved in the production of this the first analytical map of a forest, till then worked by an irregular selection.

It was a splendid achievement, and marked the change from a general to an individual forest treatment. The special summary of the composition of the existing forest was elaborated with the same care, the estimated cubic contents of the various species being separated, even as regards quality. The rotation was reduced to 120 years, and the annual output was fixed at a still lower figure. Volume continued to be the basis of the working-plan.

The next periodical revision took place in 1818. Both maps and proposals are, at present, considered to have been of a somewhat retrogressive character. Though doubtless the differentiation of soils, species, age-classes, etc., can be too detailed, and become an obstacle rather than a help to a sufficiently broad treatment, the revision of 1818 went too far, and demanded, in order to secure equality within whole compartments, sacrifices in the felling age which were not justifiable. The proposals were at once considerably modified. but the principle of securing such equality at some sacrifice has been maintained till quite recent times. It may be harmless in forests situated like those in Eberswalde, but on more exposed areas other methods must surely prevail. A considerable accumulation of mature and maturing wood was found to exist, thanks to the extremely conservative working since 1786: but, on the other hand, an insect attack of some magnitude had lowered the productive value of the older Scots pine forests. Ever since 1798, all regeneration had been assisted by artificial

cultivation on a large scale, and the younger forests were described as very fine. During the revision of 1818, the first practical foundation was laid to the present financial theory, by reducing the rotation of the Scots pine on bad soil. The income in 1818 amounted to about £1500.

The revision was still based on volume (Hartig's method); the output was raised by nearly 40 per cent., and as gradual growth of the yield was foreseen, it was provided that any surplus above the average estimate might be utilised. These accumulations amounted during the next twelve years to about 20 per cent. of the original estimate, and fears were entertained that the forest might be worked above its constant productiveness. An intermediate revision was therefore ordered in 1831. This was to be based on the summary of average increments, a method which, at that time, had taken the fancy of the authorities, and was employed in all Prussian State forests, under the name "Superficielle." The annual output was again reduced to the original estimate of 1818, and this was maintained till 1838. The next regular revision took place in 1838-39, and was this time based on a combination of volume and area. The annual output was again slightly reduced for a time, because the area of fully ripe forest then in evidence seemed insufficient. next regular revision of 1858-59 moved on the same lines as the last one; the annual outturn was not increased, because it was at that time considered to be the duty of the State to grow timber of large dimensions, even at a sacrifice of money. forest school at Eberswalde was founded in 1830, and the maps produced with the revision of 1850 were based on detail surveys made by the academy.

The next regular revision of the working-plan (1878-79) was conducted by Dr Dankelmann, the then director of the academy, and Oberförster-Candidate Riebel, a future director. This revision was marked by far-reaching changes.

The administrative management of the Biesenthal Forest had, in consequence of the increasing intensity of the treatment of individual areas, outgrown the capacity of one officer, and the forest was therefore split up into two divisions (Eberswalde and Biesenthal). The forest, with the exception of certain areas in the vicinity of the academy, was divided into regular high-forest blocks, each being subdivided into 120 compartments, of, as far as conditions of soil, forest growth, etc., permitted, equal

sizes. The area check, originally introduced by Frederic the Great, was once more accepted as the simplest and safest basis for the forest management of the future, after four other more or less complicated methods had been experimented with for ninety years. The material available in the compartments falling into the first period of twenty years was ascertained, and it was prescribed that the annual exploitation should not exceed one-twentieth of such amount. This, however, was and is subject to the general prescription, that any accumulation of surplus material found to exist at the end of three years may be felled. It was further laid down, that thinnings were to return over the same area every ten years. The excised areas, near Eberswalde, were divided into three sections, to be known as the Park-blocks; they were divided into 10 compartments each, one of which was to be exploited each year under a selection treatment, with a felling age estimated at 120 years. This treatment was adopted partly in order to have a forest area available for independent experiments, trials with exotics, and for educational purposes, partly to beautify the surroundings of the forest school. These Park-blocks, originally a mixed forest of Scots pine and beech, contain now a large variety of different species. The preliminary work in connection with this revision was, for purposes of instruction, carried out in a, for ordinary purposes, unnecessarily detailed and complicated manner.

In 1888 a short control revision took place, but no changes were made. The periodical revision of 1898 showed again that no changes were required in the management of the Biesenthal division. In the Eberswalde division, however, considerable areas of Scots pine, planted on old fields, had been attacked by *Polymorphus annosus*, and had died at an age of from 50 to 60 years. This necessitated a rearrangement. The attacked areas had, for the time at least, to be treated by selection, and were for this purpose formed into four special blocks.

The total outturn from Eberswalde alone now amounts to some 18,500 cubic metres, and the net annual income to nearly  $\mathcal{L}_2$  per hectare. The gross income of the whole area comprised in the old Bisenthal forest has risen from  $\mathcal{L}_{1500}$  in 1818 to  $\mathcal{L}_{18,000}$  in 1906.

Many, and often serious and costly, disappointments have so far attended the attempts to afforest old farmlands, heather areas

and other wastes in the north of Germany, but the Prussian Government have in no way relaxed their efforts to re-establish forests where forests once existed. The question is doubtless surrounded by considerable difficulties, many of which were not recognised when the discussion arose in the middle of last century in regard to the afforestation of low-grade farmlands and inferior pastures, or were under-estimated and not sufficiently studied.

Little by little it is discovered that similar failures in the afforestation with Scots pine were observed here and there soon after the Thirty Years' War, but of course no regular records were kept.

One of the most interesting problems of the present time is the afforestation of the extensive waste lands in the old Polish provinces. The forests which once existed in these parts were devastated under the Polish régime by fire and axe; large areas were burned down to create new pastures, and timber was considered common property. Even the Prussian Government alienated, in time of wars and scarcity, large areas of State forests by sale, and finally sacrificed others, when money was scarce, in order to free the remnant from rights of user.

During the last thirty years, however, efforts were made to reacquire these wastes for afforestation, and some 100,000 acres were bought in West Prussia alone. The soil is chiefly a somewhat poor, fine sand. Up to 1906 nearly 40,000 acres had been cultivated, partly by sowing, partly by planting, but unfortunately almost entirely with pure Scots pine. A large number of young plants were dug up in various localities, with the whole root system, and placed before the Forest Conference at Dantzig in 1906, in order to show the influence of the various methods of culture.

The root development was, in every instance, confined to the surface soil, and was therefore an abnormal one for Scots pine. A root disease was not observed, and any shortcoming was ascribed to severe competition amongst the wide-spreading side-roots. A serious opening out of a thirty years old afforestation with Scots pine on old farmlands was, however, noticed in the same vicinity, a sure sign that some serious disease must have established itself; though its existence was not recognised at the time.

The afforestation of dunes forms another important part of

the general afforestation scheme in the north-east of Prussia; and one of the most interesting of the numerous works carried out in this direction is probably the reclamation of the wind-and sand-swept land-tongue (known as the "Frische Nehrung") which separates the Baltic from the bay to the east of Dantzig.

At one time the whole of this peninsula, about fifty miles long, was covered with a mixed forest, and contained several flourishing villages. Its disforestation began during the Thirty Years' War, and was completed in the beginning of the nineteenth century. Dunes took the place of the forest, and all life was gradually covered by moving sands, which have encroached on the bay itself at the rate of some 12 feet per annum, threatening the very existence of this important waterway. Towards the end of last century the State bought the "Frische Nehrung" from its former owners, the town of Dantzig, who all this time had done practically nothing to mend matters, and in 1890 a beginning was made with a systematic reclamation of the peninsula, both from the sea and bay side. Numerous stone spurs were built on the inner side, and plantations of willows and reeds were established between them. An alluvium is rapidly forming, and was some 20 feet broad in 1906.

The defence on the sea-side was begun with the establishment of an outer dune, a protection wall preventing the waves from reaching the foot of the natural dunes. Several parallel lines of bushy hurdles, with intervals of some 6 feet between them, were firmly planted in a continuous stretch about 100 feet from the foot of the natural dune formation. These intervals soon sanded up, and the sand-wall thus formed was again surmounted by further parallel lines of hurdles, which raised the wall in a very short time to the desired height.

The work was started in early spring and continued to autumn, when the wall was planted with *Ammophila arundinacea* and *Elymus arenarius*. The establishment and fixation of such an outwork takes two years.

When protection was thus secured against any fresh attacks from the rear, the treatment of the moving dunes was started. The head of these dunes was levelled down, and the sand smoothed to a certain extent, and protected against the wind by a network of fir branches stuck into the ground. In autumn plant-holes were made 3 feet apart, and filled with dredgings from the bay, a loamy silt, rich in humus. It is indispensable that

this should be done in autumn, as the silt must be exposed to a winter frost. The actual planting took place in spring following, the intervals between the plants being protected by bushes and reeds.

Naturally an afforestation of this sort is expensive, and hardly to be undertaken where no other interests exist but the production of wood. The estimate for the "Frische Nehrung" alone amounts to nearly  $\pounds$  100,000, spread over thirty years. The planting material used in the afforestation consists almost entirely of one-year-old Scots pine plants. In some places, where old soil cropped out, oak has done well.

Similar reclamation works are going on in many places along the coast, but where less money is available than is required for such intensive working as that on the "Frische Nehrung," cultivation is started with *Pinus uncinata*, a variety of *P. montana*, which covers and protects the ground much earlier and more effectively than Scots pine, but which grows more slowly afterwards and yields less produce.

The amount spent on cultural operations in the Prussian State forests has again been raised by 1,591,500 marks (about £79,000) in the budget for 1908, and now amounts to 6,842,000 marks (about £342,000). In the other German States a considerable increase has also taken place of late years in the amount dedicated to the future in the shape of cultural forest operations. Austria is proceeding vigorously with the afforestation of the Karst, an undertaking of great difficulty owing to the scarcity of water, which rushes down the denuded hill-sides. The regulation of the water supply represents here, as in the French Alps, the main difficulty. It is only the richest country in the world which hesitates to put its hand into its pocket for posterity, though it would have all the advantage of the experience gained by other countries, and often dearly bought.

# 26. The Selection and Training of Probationers for the Imperial Forest Service of India.<sup>1</sup>

By J. NISBET, D. (Ec., formerly Conservator of Forests, Burma.

I am of opinion that with the forestry, mainly Continental or its direct offshoot, now taught at several universities and at most agricultural colleges, the Forest Department could satisfactorily and quite as easily be recruited with fairly wellequipped students of estate (including woodland) management, as is found to be the case for the recruitment of the Public Works, the Educational, and other scientific departments, under a system of selection from among properly qualified candidates. But at the same time I think it is very desirable, from more than one point of view, that Indian Forest probationers should be selected by a competitive examination held by the Civil Service Commissioners in Forestry and the cognate sciences, and then be given one year's specialised training in Indian Forestry, Indian vernacular languages, and one branch of science at Oxford and Cambridge, combined with extensive tours in such European forests as may be specially instructive from the Indian point of view.

Such an examination should supply not only the Indian Forest requirements, but also all the growing Colonial needs. The Malay States, Ceylon, Cape Colony, Natal, Nigeria, the Gold Coast, the East African Protectorate, Egypt, and Cyprus now all require forest officers; and it can only be a question of time before Canada, Australia, and New Zealand must also introduce some rational system of Forest Conservation based on our Indian experience, and will then require a large number of men. And all Colonial systems of forestry must be based on the Indian system, not on European models.

Such a test would, I feel convinced, secure the best men, who are likely to be attracted by the pay and pension offered by the Indian Forest Service, after having gone through a university or other collegiate course with a view to adopting the profession of land agency or estate management. And just as open competitive examinations are now held annually in July for the Home, Indian, and Colonial Civil Services, so, too, should a competitive examination in forestry apply simul-

<sup>1</sup> Extracted from an article in The Calcutta Review.

taneously to the selection of probationers for the Indian and Colonial Forest Services. The examination should be open to all those between 20 and 23 years of age who have obtained either—

- (1) The B.Sc. degree in Forestry from Edinburgh University, the Armstrong College, Newcastle-on-Tyne, or the University of North Wales, Bangor; or
- (2) The Diploma in Forestry at Oxford 1 or Cambridge; or
- (3) The Diploma of one of the Agricultural Colleges at Cirencester, Downton, Aspatria, or Wye; or
- (4) The Diploma of Professional Associate of the Surveyors' Institution, London.

Such competitive examination should take place in the following subjects:—

I. Forestry.	arks. II. Cognate Sciences. Mark
g. Protection,	1. Geology and Mineralogy, 400 2. Chemistry(chiefly Organic), 400 3. Botany, 400 4. Zoology,
Ортю	nal Subjects.

The training of probationers after the competitive examination in forestry and the cognate sciences should therefore not exceed twelve months, as in the case of the Civil Service probationers; and it should be specialised to meet Indian requirements so far as possible. Also it should be given both at Oxford and at

<sup>&</sup>lt;sup>1</sup> To supply qualified students Oxford would then require to provide its own forestry instruction—just as Cambridge, Edinburgh, and the other Universities do—without special India Office support.

Cambridge, as might easily be arranged through the Boards of Indian Studies without further cost to the Government of India than is at present incurred in the "Delegation of Forestry Students" to Oxford, one Professor of Indian Forestry (and Adviser to India Office) being henceforth delegated to Oxford with a salary of £700 a year, and another to Cambridge with a salary of £500 a year. The specialised course should then embrace the following curriculum (the probationers being previously assigned to provinces, as is the case with Civil Service probationers), after which the selection and the seniority of candidates should be determined by an examination in the subjects of study, to be held annually in June, on the completion of the academic year at Oxford and Cambridge:—

	Marks.
<ol> <li>History of Indian Forest Department; Silviculture, Management, Protection, and Utilisation, as practised</li> </ol>	400
2. Indian Forest Code of Procedure, Office Work, and	400
3. Indian Forest Law (India, Madras, and Burma Forest Acts), and the Rules and Regulations issued thereunder,	
Vernacular Languages—	
I. Hindustani (colloquial and elementary, in Persian character only),	400
2. Chief Vernacular Language of the Province to which the Probationer is assigned (including the Nagari character, and also a more advanced study where Hindustani alone is prescribed),	400
Cognate Sciences, not more than one of the following subjects:—	
I. Botany,	400
2. Zoology; Forest Entomology, 3. Chemistry of Soil and Plant, 4. Physical Geography and Meteorology,	400
	Management, Protection, and Utilisation, as practised in the various provinces of India,

Selected candidates who pass this examination and are otherwise favourably reported on should be appointed to the Indian Forest Service, and should receive (like the Civil Service probationers) a grant of  $\pounds_{150}$  for the year of probation, with passage-money of  $\pounds_{37}$ , 10s. to Bombay, Madras,

or Calcutta, and  $\pounds_{43}$  to Rangoon. And seniority in the service should be given according to the results of this final examination.

During the Easter vacation at the University the probationers should be taken, at Government expense, for a tour in the Alpes Maritimes, the Pyrenees, and Gascony; and after the final examination, the selected candidates should, in July and August, be taken to visit the forests of the Vosges, the Black Forest, the forests of the Bavarian plateau and the Bavarian Alps, the Swiss mountain forests, and the spruce, beech, oak, and pine forests of Hanover,—these being undoubtedly the European woodlands that are by far the most instructive to the Indian forester.

If, after their year of probation, selected candidates appointed to the Indian Forest Service could conveniently, immediately on their arrival in India in November, be taken from Dehra for an extensive tour in the lower Tiri-Gharwal, Kamaon (Himalayan) and Siwalik forests and in Oudh, it would certainly be very useful in introducing them to practical work in India, in accustoming them to camp life, and in getting them into touch with their new surroundings under the most favourable circumstances. And even if such a tour only lasted for about four or five weeks, say from about 15th November till near Christmas, it would help to prepare the young officers for entering on their duties in the New Year with a far better knowledge of, and preparation for, them than were ever enjoyed by their predecessors, the men who have, during these last forty years, made the Forest Department a well-organised and efficient branch of our Administration in India.

# 27. The Larch Shoot Moth 1 (Argyresthia (Tinea) laevigatella).

(With Plate.)

By R. Stewart MacDougall, M.A., D.Sc.

Still another enemy of the larch in Britain falls to be recorded in the tiny moth, Argyresthia laevigatella. This moth is not to be found in the British lists. Professor Somerville, in sending me some material showing the work of the caterpillar, in the month of May, wrote: "This is a very serious enemy in the neighbourhood of Oxford, and, I believe, has not hitherto been recorded in Britain." From this material I bred out five moths. I have also received from Colonel Bailey examples of the damage done by the caterpillars in Bagley Woods, Oxford. Professor Somerville records, in the Quarterly Journal of Forestry, that in the district round Oxford larches up to twenty years of age have been much injured during the past autumn and spring; and in the same number of the Quarterly Journal of Forestry, Mr John Bennet records the caterpillars as destructive on young larch near Basingtoke in Hampshire.

Argyresthia laevigatella is one of the Micro-Lepidoptera, some of which, belonging to the genera Retinia, Tortrix, and Coleophora, are already well known as harmful forest insects very troublesome to combat. It belongs to the family Tineida and the genus Argyresthia. Of this genus there are more than twenty recorded species in Britain. Generally it may be said that Argyresthia caterpillars feed in buds, shoots, or fruits. Amongst trees, one or other species of Argyresthia has been found infesting birch, alder, hazel, oak, beech, goat willow, horse-chestnut, apple, cherry, sloe, juniper, and now to these in Britain we must add the species on larch.

A. laevigatella must be considered a very harmful enemy, both because it attacks young larches and because a single caterpillar is able to accomplish the destruction of a whole year's shoot.

<sup>2</sup> Quarterly Journal of Forestry, vol. i., No. 3, July 1907.

 $<sup>^1</sup>$  Reproduced from the *Journal of the Board of Agriculture* for October 1907, by kind permission of the Controller of His Majesty's Stationery Office.

### DESCRIPTION OF INSECT.

Moth.—The moth is very small, measuring only 4 to 5 millimetres (less than one-fifth of an inch) in length and 10 to 12 millimetres in spread of wings. The forewings are silver-grey and silky, with a gloss like lead; the fore-edges are somewhat darker; the fringes of these forewings are grey or brownish-grey.

The hind wings are dark grey and not so glossy. The face is white; the base of the antennæ is white, and the rest of the antennæ dark and light-ringed. There is a tuft of hairs on the head; the colour of the hair is given differently by different Continental authorities, in my own specimens the colour is yellow. The abdomen of the moth is dark grey.

Caterpillar.—The larva is pale yellow when young, but later is pale grey, with a dash of red, and is dark striped towards the hind end of the back. The head and the three front pairs of legs are black. The length is 6 to 7 millimetres.

Pupa.—The pupa is dark brown, with a black head; its hind end is distinctly pointed.

Distribution.—The moth is native to Eastern Germany, the Alps, and Holland.

Life-History.—The moths issue, through an already prepared flight-hole in the twig, at the end of May and the first part of June. The eggs are laid then on the lower part of the shoot of the year, one egg being laid for each shoot chosen. The egg soon hatches. At the time the caterpillar hatches out and starts feeding, by boring below the epidermis, the new larch branch is still developing, and the feeding of the caterpillar at this early stage is not sufficient to prevent the shoot reaching its normal length. As the year goes on, the damage is greater, owing to the increased size of the caterpillar and its more extended feeding. Winter overtakes the caterpillar before it is full grown, and hibernation takes place in the boring it has made. The borings or galleries are partly filled with black excrement and bore-meal.

In late March or in the month of April the caterpillar starts feeding again, destroying right to the wood and ringing the shoot to an extent—in the longitudinal direction—of four-fifths of an inch. The twig dies above this place of ringing.

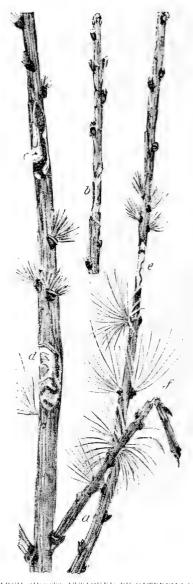
The caterpillar is full-fed in May, and previous to its pupation



Fig. 1.—The Larch Shoot Moth.



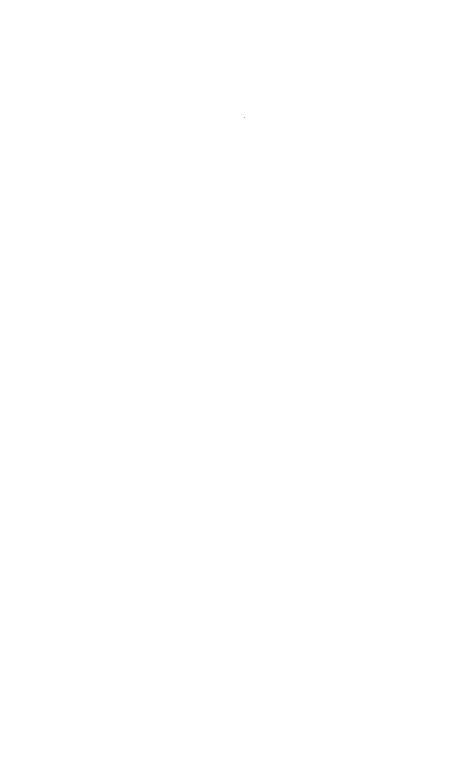
Fig. 2.—Larch Shoot (half natural size), with upper portion dead as result of infestation.



LARCH SHOOTS ATTACKED BY CATERPHLAR.

(a) Place of entry of young Caterpillar; (b) the work of the Caterpillar; (c, d, e) the borings made by the Caterpillar, causing the death of the twig; (f) shoot broken by wind at place of attack (after Eckstein, slightly reduced).

To face page 196.



it bites a hole through the bark that will serve as a place of exit for the adult moth when pupation is over. This flight-hole is very small. After making the hole the larva spins a light web, which covers over the little hole and pupates. The moths issue in May and June—my own specimens issued early in June.

The empty pupal covering does not, as is the case with some moths whose caterpillars are branch-borers, show itself projecting from the flight-hole, but the moth itself when ready works or pushes its way through the web covering the flight-hole, and so to the outside.

Result of Damage and Signs of Attack.—In the spring of the second year the attacked shoot fails to develop its buds, and remains brown and withered and without needles. Occasionally the dwarf shoot just above the flight-hole may produce undersized needles. As the shoot is most markedly eaten in the neighbourhood of the flight-hole, breaking takes place here easily, and these broken, bent-over shoots mark the infestation.

Treatment.—The treatment that follows from a review of the life-history is to break off the shoots and destroy them before the escape of the moths. Unfortunately no outflow of resin or appearance of excrement at the exterior is noticeable at the place of infestation (marks which in other insect enemies of trees serve to call timely attention to the fact that they are at work), and the first sign that anything is wrong may only be observed after the moth has flown. Where the moth has already been at work the damage may be expected to repeat itself, and this suggests special observation.

It will be interesting, now that attention has been directed to this moth, to find to what extent it has obtained a footing in Britain.

## 28. Underplanting.

By Lieut.-Colonel F. BAILEY.

When a young crop of trees of any species has completely closed in over the ground, it will, provided it be of proper density, afford effectual shelter to the soil, conserving moisture, vielding some humus, and keeping down noxious weed growth. But a time comes when the individual trees of such a crop demand more room. The more vigorous of them then begin to crowd out their weaker associates, with the result that the number of healthy stems becomes so much lessened that the density of the canopy formed by the mass of crowns is impaired, and, in the case of light-crowned species, the sun's rays penetrate to the humus layer, while air currents sweep over the soil. Evidence of this is soon afforded by the springing up of grass and other light-loving weeds. Later on, when "thinning out" has proceeded farther, brackens, heather, whins, broom, or other herbs and shrubs appear; and the layer of decaying vegetable matter on the ground, which is essential to the continued prosperity of the crop, becoming too rapidly oxidised, ultimately disappears. But before this advanced stage has been reached, careful observation, supported by accurate periodic measurements, would have demonstrated that the rate of growth of the remaining, and apparently still healthy, trees had begun to fall off; and the deterioration of the stock may be carried to a disastrous extent.

All species do not behave identically in this matter, those which suffer most under the natural process of "thinning out" being the species which carry light, shallow crowns, like the oak, the ash, the larch, and the Scots pine. These species begin to "thin out" earlier than do those having deep, dense crowns, like the spruce, the beech, and the silver fir. The following are the approximate ages at which the process described may be expected to commence:—

One way of dealing with the difficulty is to cut down the crop before serious injury to the soil has resulted; but larch, Scots pine, and oak do not attain the dimensions which are

usually most profitable at the above ages, and consequently the crop cannot, generally speaking, be so dealt with without incurring serious loss.

Fortunately, however, another course may be successfully followed. This consists in establishing, under the gradually lightening canopy, a new crop of young trees which may make good its shelter-giving deficiencies. The "under-crop" must of course consist of "shade-bearing" species, such as beech, hornbeam, silver fir, or spruce, otherwise it could not establish itself under the canopy of the "over-crop"; but even then, if "underplanting" is to be undertaken early enough to do good, some thinning of the over-crop, by the removal of the worst of the trees, is usually needed to afford sufficient light for the development of the new under-crop.

Such underplanting, if done before the over-crop is too old, and before the impoverishment of the soil has gone too far, will enable crops of oak, larch, and other light-crowned species to maintain a satisfactory rate of growth up to a profitable age, and it may even suffice to restore vigour to a crop which has begun to decline from the causes under discussion, provided the evil has not gone too far.

The two crops grow on together; the trees of the over-crop are removed gradually as they attain the desired girth or interfere too much with the due development of the under-crop, and the latter may then be either cleared off or allowed to stand for a further period to increase its dimensions, as may at the time seem best.

From the above it will be seen that underplanting is done entirely in the interest of the over-crop. The under-crop is of quite secondary importance; and it would never, for its own sake, be planted or sown as such, for the simple reason that the over-crop standing among and over it is not only of no use to it, but after a comparatively short number of years becomes a distinct impediment to its development, by depriving it of light and of the benefit of light rainfall. The under-crop will, no doubt, have some value; but the object in view is not the realisation of this value, as the under-crop yields its profit indirectly, through the favourable influence which it exercises on the development of the more valuable over-crop.

A crop of dense-crowned species such as beech, spruce, or silver fir cannot, of course, be underplanted at all, and it is

quite useless to underplant a crop of the light-crowned species unless the following conditions exist:—

- r. The species of which the crop consists must yield timber of high commercial value, which increases with the girth of the trees.
- 2. The trees must be of good shape, so that they may, when felling time arrives, cut up well.
- 3. The trees must be sound, and they must be young enough to be capable of further vigorous development under the treatment applied.

To underplant a crop which does not fulfil these conditions is a mere waste of time and of money. It will not be benefited to a remunerative extent, while the development of the crop established beneath it will be impeded by it. Unpromising crops, even of valuable species, which have no future, should be removed as soon as other circumstances may permit, and the ground should then be restocked.

If a species be susceptible in youth to frost or drought, shelter for it can be provided in other and better ways than by planting it under the shade of a valuable over-crop, which must stand over it, to its detriment, much longer than is necessary for its protection. But a crop which does not fulfil the above conditions may be used as a *temporary* shelterwood for tender species, the old trees being removed as soon as the new crop no longer needs their shelter.

## 29. Experiments on the Relative Value of certain Timber Preservatives.<sup>1</sup>

Professor Henry has recently carried out a series of experiments on the relative value of certain antiseptics recommended by various authors as means of protecting timber from the attacks of fungi, or wood-destroying insects, and from the injurious effect of the soil, and we summarise below his chief results. as set forth in his pamphlet. The object of the experiments was purely practical, for they had as aim the investigation of the question as to the best preservatives to be used by private individuals, or others unable to set up costly plant. Professor Henry points out that a good preservative should fulfil the following conditions:—the substance should be unalterable, and should not only destroy pre-existing germs of destructive organisms, but should prevent—indefinitely if possible—the access of new germs from the exterior; it should not alter the force of resistance, the hardness, elasticity, and other qualities of the wood, but should either leave these in their original state or improve them; it should penetrate easily to all parts of the wood, and fix itself permanently within the elements; it should not be poisonous or dangerous; it should be of constant and definite composition; if possible, it should not have a strong or disagreeable odour, and it should not change the colour of the wood; finally, it should be of a sufficiently low price to make it worth while to use it in preference to replacing the damaged wood.

Eight preservatives were chosen as subjects for experiment, the selection being made from among those which previous experiments seemed to point to as having considerable value. These eight were as follows:—(1) Avenarius' patent carbolineum; (2) carbolineum, Lion brand; (3) gas-tar; (4) microsol; (5) antinonnine; (6) antigermine; (7) lysol; (8) hydrofluoric acid. Carbolineum is a commercial term for an extract of coal-tar containing creosote. The brand invented by Avenarius is distinguished by its high density and viscosity, while the Lion brand is less dense and less viscous. The tar employed was obtained from the gas-works of Nancy. Microsol is a pasty mass soluble in water, formed of copper sulphate united to some organic matter.

<sup>&</sup>lt;sup>1</sup> Preservation des Bois contre la Pourriture par le sol, les Champignons et les Insectes, par E. Henry, Professeur à l'école nationale des eaux et forêts. Berger-Levrault et Cie, Nancy. To be obtained from the author. Price 4 francs. 1907.

Antinonnine is a dinitro-cresylate of potassium, which has been highly praised by some experimenters. It colours the wood a strong yellow. Antigermine is a green mixture, which, like antinonnine and lysol, is a derivative of creosote. Lysol is a solution of cresylol in soap, and is completely soluble in water. The hydrofluoric acid used was the ordinary commercial product. The woods used for the purpose of experiment were silver fir (Abies pectinata), Aleppo pine (Pinus halepensis), oak (Quercus robur), beech (Fagus sylvatica), poplar (Populus). Three specimens were experimented with in each case. The specimens were cut green, were dried first in the air, then in a stove, and were then immersed in the solutions, the conditions being identical in all experiments. The immersion lasted for twenty-four hours, and the solutions were heated over a water-bath to 140° F. Although this uniformity of procedure was adopted to ensure a fair trial, yet in point of fact there are great differences in the rate of impregnation of different woods, and the time can in many cases be much shortened. The author gives full details of a series of subsidiary experiments having for their object the determination of the rate of impregnation of different woods, but for these reference must be made to the original pamphlet.

After treatment with the antiseptics, the samples of timber were placed under two sets of conditions. One set were exposed in the open air in a garden where they were almost buried in leaf-mould or manure, the free end being fully exposed to the influence of snow, rain, and sun. The other series were placed in the galleries of the iron-mines of Lorraine. These galleries run at about 33 feet below the surface, have a constant temperature of 50°-54° F., and are completely protected from rain and sun. Though adequately ventilated, the air in them is only slowly renewed, and all the conditions are thus favourable to the development of wood-destroying fungi, notably dry-rot, which is very prevalent. Some of the specimen cubes were in actual contact with infected planks. The experiments lasted three years, and seem to have been conducted with the greatest care.

The method of immersion practised allowed both the varieties of carbolineum to penetrate to the centre of the poplar, the beech, and the fir, while in the case of the oak and Aleppo pine the whole of the sap-wood was impregnated and parts of the hardwood. This shows that with this preservative it is not necessary to have recourse to vapour or to impregnation under pressure. The degree of impregnation is indicated by the brown colour

produced by the reagent. Microsol has equal penetrative power, but the degree can only be demonstrated by testing for copper. Taking first the specimens exposed in the open, the following results were obtained. Of the "control" specimens left in the open without any preservative, the fir was the best preserved, and after it the Aleppo pine. The specimens of oak, beech, and poplar not treated were at the end of three years so decomposed that their replacement would be necessary in actual use. But the specimens treated with lysol, antinonnine, and hydrofluoric acid were equally or more decomposed. On the other hand, the specimens of oak, Aleppo pine, beech, poplar, and fir treated with either of the brands of carbolineum, with coal-tar, or with microsol, remained unaltered, and were as serviceable as at the outset of the experiment.

The second series, the specimens placed in the mine galleries, showed the following results. First as to the controls; after the poplar the fir was the most altered, whereas in the open the fir is the most resistant; the beech was also much altered, while the heart of the oak remained sound. The specimens impregnated with the two brands of carbolineum, with gas-tar, and with microsol remained intact, and this is true of all the five species experimented with. Thus these four preservatives proved themselves equally valuable in the case of timber in the open and timber under shelter. The least certain of the four is, however, the tar, so that the contest for the first place is limited to the two carbolineums and the microsol. Antinonnine and hydrofluoric acid had a favourable effect on the specimens placed in the mine galleries, which is in marked contrast to their absence of preservative action on timber placed in the open. specimen of fir treated with antinonnine and placed in the mine galleries was perfectly preserved, while, as already mentioned, the control specimen was much altered.

The hydrofluoric acid also had a preservative effect upon the sap-wood of oak. As to the lysol, it had no preservative effect, and is to be rejected alike for timber under shelter and in the open. The experiments with antigermine were less elaborate than with the others, but they showed that this substance does not prevent the development of fungus mycelia in the wood of beech, while it has a preservative effect on fir.

The result of the series of experiments then is to emphasise the value of carbolineum and of microsol. The question as to which should be employed can only be solved by a consideration of the special conditions in each case. The following considerations are important in forming a decision. Carbolineum imparts to the timber treated by it a persistent odour which many find disagreeable, and which might possibly taint food, etc., placed in closed cellars, sheds, etc., whose wood had been treated with it. Again, it soils to a considerable extent both the clothes and the hands of the workmen using it, and precautions have to be taken to protect the skin and eyes against its irritating effects, this being especially true when it is employed hot and within closed spaces. Further, timber treated with carbolineum cannot be painted, for, even after a long period of drying, the preservative diffuses through and alters the paint, producing long brown marks. In the case of skirting-boards and wainscoting, it is, however, sufficient if the side in contact with the wall is painted with carbolineum, and if this is not done until after the front face has been painted, and has thoroughly dried, the paint will not be affected. If, however, it is desired to leave the wood in its natural colour, microsol is indicated. This product has no smell, does not produce irritating vapours, does not prevent the wood being painted, and seems generally to be indicated for wood in the interior of buildings, while carbolineum should be reserved for that to be exposed in the open.

In a final section the author discusses the damage done to wood by various destructive insects, the means of recognising the more important of these, and methods of prevention or of Thus he gives an illustrated account of Hylotrupes bajalus, which attacks all the useful conifers, and is extremely destructive. A characteristic which renders it especially destructive, is that it may go on breeding for many successive generations without the perfect insects ever appearing at the surface, and thus the beams, etc., attacked, may be completely destroyed internally before the presence of the beetle is suspected. A simple and efficient preventive measure is to paint the surface once or twice with hot carbolineum. The same antiseptic can be applied to wood already attacked, and will prevent further damage. Similar treatment will prevent the attacks of Termes lucifugus, which is becoming more and more common in south-west France.

The author also discusses at some length the ravages of the common wood-borers *Anobium*, *Ptilinus*, etc. Here again one of the antiseptics named above, especially carbolineum or microsol; is the remedy indicated.

MARION I. NEWBIGIN.

# 30. The Northern Branch of the Royal Scottish Arboricultural Society.

#### Visit to the Loyat Estates.

The Members of the Northern Branch of the Scottish Arboricultural Society held their first excursion, which was to the Lovat Estates, on Saturday, 13th July 1907. The party, numbering about forty, were met on arrival at Beauly by Mr J. T. Garrioch, on behalf of Lord Lovat, and Mr Gilbert Brown, forester on the Lovat Estates. Maps and notes concerning the origin and future management of the woods to be visited were handed to each of the party.

Balblair Wood was first visited. This wood, extending to about 130 acres, owes its existence entirely to natural regeneration. Within its area 104 acres have trees about 55 years of age, while 26 acres carry trees of about 35 years of age. It was agreed that Balblair Wood was one of the best examples of natural regeneration in this country. From Balblair the party drove to Beaufort Castle, where they were entertained to luncheon by Lord Lovat.

The party then inspected other woods. In Lonbuie Wood, the matured timber was cut in 1902, and the replanted area amounts to about 19 acres. As the condition of the soil differs in certain parts, four different species have been planted, namely, larch, spruce, Scots fir, and some Douglas firs. The nursery contains 4 acres, where the young plants are reared from seeds sown. Great interest was taken in the nursery, the fine condition of the beds and young plants being specially admired. Sawmill Wood extends to 1 acre, one-fourth of which was planted in 1898 with Japanese larch and spruce, alternately, 4 feet apart, the remaining three-fourths being planted in 1900 with Douglas fir. The strip (especially the Japanese larch) was greatly admired, these trees being in most cases about 25 feet high. Alder, extending to 20 acres, is being used for the experimental plots. A great many of these plots are made up of larch planted in different ways, some pure, others mixed with beech and sycamore, the idea being to note exactly if there is any difference in the incidence of disease on the larch planted under different systems. Dunballoch and Cononbank Woods extend to 120 and 130 acres respectively. The former was planted with Scots fir twenty years ago, and the latter with Scots fir twenty-five years ago. In connection with these woods, which are good specimens of closely planted woods, the opinion was generally expressed that it would be unnecessary to do any thinning out, with the exception of the removal of dead and suppressed trees, for a number of years yet.

### MEETING OF 28TH SEPTEMBER 1907.

A meeting of the Society was held in the Town Council Chamber, Inverness, on 28th September. Mr J. Grant Thomson, Grantownon-Spey, President of the Branch, occupied the chair.

Mr I. Grant Thomson then addressed the meeting, his subject being "Forestry, Past and Present." Mr Thomson said: "Brodie of Brodie and Gentlemen, you have conferred an honour upon me that I never coveted, never expected, and I fear never merited; but since you have elected me as the first President of this Branch of the Royal Scottish Arboricultural Society, I will hope for your sympathy and kindly support. I can only assure you of my high appreciation of so signal a mark of your good opinion. No doubt there may be some difficulties to overcome, but with prudence, patience, and hearty co-operation, I trust this Branch may be a benefit, not only locally, but to the country at large, and especially to the Highlands. You are all aware of the object we have in view, namely, to assist and encourage afforestation. I need not dwell on that subject. Gentlemen, I can now look back over nearly sixty years of active work, and can remember many changes that have taken place. Few can say that their connection with forestry is so lengthened as mine has been, and I daresay fewer still can say that they have served for the length of time that I have done under the same family. And here I cannot but pay the grateful tribute of saying that there never were more considerate proprietors than the noble family of Seafield, or any that I know of so much interested in arboriculture and everything connected therewith. By their generous consideration and indulgence, I have been permitted to visit other estates, and you will pardon me for mentioning that there is scarcely a county in Scotland, from Berwick to Sutherland and from the island of Mull to Aberdeen, where I have not been employed; and while I hope I was of some benefit to those who asked my advice, I also was benefited myself, and saw some things that could not be seen in one locality. In these wanderings I have come across

some plantations that have been exceedingly well managed, some that have been fairly well cared for, and others on which I would rather not make remark. Sometimes I have been asked as to the best method of managing woods, but more frequently my advice has been sought about how to get money out of woods, or how to use them for game cover. But, gentlemen, I am not going to give a history of myself or of what I have seen or done. I will confine the few remarks I am to make to the extent and cost of forest operations fifty years ago as compared with the present time, and to the prospects of forestry in the Highlands in present circumstances.

### A RETROSPECT AND COMPARISON.

"Notwithstanding all the Arboricultural Society has done to increase an interest in forestry since it was inaugurated in 1854 (and that is not little), my belief is that there is not nearly the same extent of ground being put under trees at the present day as was the case fifty years ago. It is impossible to find out the areas exactly; nurserymen naturally enough hesitate to state what number of forest trees are grown now as compared with the date I refer to, but nearly all of them say that there is now less ground under trees in nurseries than formerly, and, as a consequence, there must be fewer trees grown in plantations. This is no fault of the nurserymen: given a market for the plants, nurserymen will grow them to supply any demand. I would like to mention some reasons for this shortage of planting. Now, gentlemen, bear with me; I am not a politician, and I hope nothing of that nature will ever enter into this Society; but if there is a shortage in planting now, there must be a cause or causes for it, and to my mind some of the following are the reasons. Fifty or sixty years ago there was a heavy tax on all timber imported from foreign countries, and prices of home timber were high in proportion. Besides, proprietors now are handicapped very much by death-duties and other taxation that did not exist in my younger days. Many a proprietor, when he comes into possession, finds heavy burdens on his estate that must be wiped off, and by the time this is done little may be left to expend on planting. It must always be borne in mind that, unless under exceptional circumstances, very few who plant can get much return for their outlay in their own lifetime. Still another reason for less planting being done is the value of game, which brings in ready money, and many proprietors, however willing to make improvements, are glad of a quick return. The last reason which I will mention is the increased expense of planting. I have got information from a very reliable source of the cost of fencing, draining, and planting a plantation of very nearly 1000 acres, now nearly 50 years old. The plants used consisted of Scots fir, larch, and a few spruce, all three years old, in the proportion of two Scots firs to one larch. The total cost (including everything save superintendence) was as nearly as possible thirty shillings per acre. This sounds to me, and I am sure to you, a very low figure, but I am confident my information is quite correct. Another plantation I have heard of, now about 80 years old, was planted at ten shillings the acre. I am certain this could not be done now for anything like the same price. The price of labour has increased, the price of plants has also risen enormously. About the year 1860 one-year seedling Scots firs could be purchased at £4 per hundred thousand, two-year seedlings at £5, and one-year one-year transplants at £12 per hundred thousand. A catalogue of a most respectable firm of nurserymen for the year 1906-1907 is before me. The prices given in it are—one-year seedlings, 4s. per thousand; twoyear seedlings, 10s. to 12s.; and one-year one-year transplants, 14s. to 16s. per thousand—at least five times the previous prices. This is an exceptional year, but I am quite convinced that it will be a long time before we see the abovequoted low figures again. Then as to the price of labour. I remember in the year 1843 that in the South of Scotland men's wages were 7s. a week in summer and 6s. in winter. We all know what has to be paid nowadays. On the other hand, almost the only circumstances I can mention as having tended to increase the value of woodlands are the improvements in the manufacture of timber from the old sawpits to machinery of the finest possible kind, and the improvements in inland transport, from horse-haulage and river-floating to traction-engines, steam lorries, and railways. But though this has certainly tended to make woods more valuable, and in remote districts more saleable, it can hardly lead to increased planting in the case of proprietors who are in lack of ready money, and anxious for a speedy interest on their outlays. I remember that at one of the early meetings of the Society in Edinburgh, a very worthy forester, one held in estimation all over the country, rose and said: 'I have a letter

from a friend in America, assuring me that the forests there are being cleared with such rapidity that they will soon be all cut down, and home-grown timber will rise in price by leaps and bounds.' This was fifty years ago; and I must say I have not yet seen such a tendency to the extent that was foretold. But that a rise in price will come some day there can be no doubt. Foreign supplies are getting farther inland, and I hear of little being done to reproduce. In Ireland, whence great supplies have come in the past, especially to the West Coast, little or no planting is being made. And in this country, if more ground is being cleared than is being put under young crop, the end will come.

"Now, what is to be done? Is our country to become more and more denuded of trees? Can nothing be done to secure to the Highlands of Scotland some of that increased outlay of money that will be spent in purchasing timber in future years? That there is plenty of waste land in the Highlands capable of growing timber to profit, I think no one will call in question. It would be a source of revenue to the country if even a portion of the money paid for foreign supplies could be spent at home; and I see no reason why it should not, if proper measures be adopted for this end. I do not see how individual proprietors (unless in exceptional cases) can accomplish much, though I know there are some proprietors in the country who have forethought and capital enough to go on planting. In the case of most proprietors the loss of grazing and shooting rents would be a serious consideration to begin with, and the capital needed would be difficult to provide; but much could be done if Government gave assistance, either by advancing capital at a low rate of interest, or by getting possession of large tracts suitable for planting, paying full compensation to the present owners. to the actual extent of suitable ground, I have no accurate conception. I have heard it estimated at ten million acres, even twenty million acres. I fear that many who pass through the Highlands by train or steamboat, looking at the hill-sides, frequently say, 'What suitable ground for planting that is,' yet if it were walked over, and closely examined, large tracts might be found unsuitable, where it would be a waste of money to plant a single tree. I am convinced, however, that there are large tracts in the Highlands well adapted for the remunerative growth of timber. Let me here say that the larger the area

enclosed, the less the outlay per acre for fencing, and if huts or tents have to be built for workmen, it is better to do this for 10,000 or more acres than for smaller areas.

"But the first question to be considered is, what is the actual extent of ground available and suitable for the purpose aimed at? Perhaps the best way to obtain this information would be to get a Government Commission appointed, as was done in the case of deer forests, and let them ascertain and schedule the different areas in the various Highland counties. I said before, let full justice be given to the proprietors. Let them sustain no injury or loss. If Government were willing in this way to purchase and plant the suitable areas, it is possible, and I think highly probable, that terms might be arranged in such a fashion, that while proprietors would be benefited, there would be no loss but a gain to the country and the Government. Apart from the ultimate money value of the woods (and, I may add, their artistic value in imparting an attractive character to the landscape), the employment created by afforestation on an adequate scale would be enormous. Hundreds of thousands of pounds would be spent in planting, fencing, etc.; and one can hardly imagine the amount of money that would be circulated when the crop came to be manufactured. It takes on an average as much money to manufacture a lot of timber as it costs to purchase it. In conclusion, I would say that I hope someone here—yes, many a one—will live to see the day when vast tracts of our Highland hill-sides will be clothed with thriving timber. Then there would be employment for a large population resident in the country, whose incomes would be secure, and whose contentment, because of comfortable homes and steady wages, would keep them at home in the Northern Counties, and prevent emigration to overcrowded cities or to distant countries. I thank you for the honour you have done me, and for the patient hearing you have given to these remarks. I trust that this Inverness Branch of the Society will be prosperous and useful. I was born in Inverness-shire, and though my home for the past forty-nine years has been chiefly in a neighbouring county, a large part of my work has been in Inverness-shire. If my advice or assistance can benefit this Branch in any way whatever, it is freely at your service."

A discussion followed, in which Brodie of Brodie, Mr Scott, Darnaway, Mr Alexander Fraser, and others took part.

### VISIT TO INVERNESS NURSERIES.

On the invitation of Bailie Gossip, the Members of the Club and their friends visited Messrs Howden & Co.'s nurseries, through which they were conducted by the Bailie. He showed them a large quantity of first-rate plants of various ages, some grown from seed here, others purchased. The home-grown plants had the best appearance of any. Interesting experiments of transplanting at unusual periods were also viewed. One lot shown was transplanted in July 1906, and it looked quite healthy. The deduction was that these young plants made no rootgrowth until they had ceased their branch- and bud-growth. The Members also visited one of the numerous annexes of the nurseries, and saw several acres of seedling coniferous plants, of which a large proportion looked remarkably well, considering the extremely backward season. Bailie Gossip gave some interesting figures as to the quantities of seeds used in the various beds, each of which should produce 105,000 plants. There was some talk as to the testing of the seeds for germination purposes, and the view was expressed by practical men that there was little to be gained from such tests. The true test was the weight of the seed per bushel. Scots fir averaged 34 lbs. per bushel. The best results were always got from heavy seeds. Large seeds produced large plants, and small seeds small plants. The visitors were hospitably entertained by Bailie and Mrs Gossip, who, on the motion of Brodie of Brodie, were warmly thanked for their kindness.

### Visit to Novar Woods.

On Saturday, 19th October, the Members of the Branch paid a visit to the Novar Woodlands. There was a large party.

The whole forest area here is practically immune from rabbits, but the result of their former depredations was seen in the scraggy appearance of many otherwise well-developed trees. Black game is now the great scourge. The damage they do to young plantations is extensive. The scheme of management is high-forest, and a rotation of crop of from 80 or 100 years; but owing to storms, the indiscriminate cutting down of wood in former years, and other causes, it will not come into full operation for many years to come. As soon as the last of the older woods have been felled, there will be a cessation of

felling till the oldest of the younger woods reach maturity, which will be in a period of from 36 to 40 years after the final fellings. During the interval there will be plenty of work in the thinning and in the tending of the younger plantations.

Arriving at Novar railway station, the visitors proceeded to Evanton Wood, and made a rapid survey of the mixed crop of Scots fir, larch, spruce, Douglas fir, and beech of various ages. The larch and Scots fir were largely of spontaneous growth, the other varieties having been planted to fill up blanks, and to suit different conditions of soil and exposure. Douglas fir is largely used to fill up blanks, as it makes rapid headway in the shade. Both the natural and the planted crops gave indications of healthy and vigorous growth. On the hill, which extends from the village for about two miles, is planted a mixed crop of larch, Scots fir, Douglas fir, with mountain pine at the summit, all of which are making excellent growth A crop of Douglas fir on the edge of the Black Rock was greatly admired. The outstanding features of the plants were their healthy appearance and their remarkable development. Natural regeneration is encouraged, because, barring accidents, a carefully trained natural crop usually gives excellent results. To produce a natural crop, the method employed all over the estate is that, when an old wood is being felled, "standards"—that is, solitary trees which are scattered over the whole area of the wood—are left standing to restock the ground by natural means. When the young plantations reach a certain height, the "standards" are cut down. The blanks are then filled up with shade-bearing plants, chiefly Douglas fir. No material damage is done to the surrounding plantation by the felling.

Crossing the Black Rock, the lower belt at Assynt was next visited. The age of this plantation is about 19 or 20 years, and it is composed of Scots fir, larch, and spruce, with a few hardwoods. Chief interest centred in the Scots fir, which appeared to want thinning. Here the scheme seemed to be the survival of the fittest, and, in comparison with the whole, the badly-developed and dead trees were in a very small minority. A brief inspection was made of the Assynt west belt, which was composed of larch, Scots fir, and spruce planted pure, the age of which was 19 years. The spruce plot was greatly admired, and, it was thought, would give better results than the preceding one. The Black Rock Wood, with its stock of Scots

fir and larch, aged 100 years, was visited next. Not only here, but throughout the whole route, magnificent specimens of old timber were inspected. Assynt Hill was rapidly gone over. The crop here was larch, Scots fir, and Douglas fir, from 20 to 23 years old. Some few years ago larch disease was rampant in the larch plantations, but the cutting out of diseased stems, and underplanting with such valuable conifers as Douglas fir, Sitka spruce, Lawson's cypress, Hemlock spruce, Thuja gigantea, Abies grandis and silver fir, seem to be putting a stop to the ravages of the disease. When the crop had been thinned and underplanted, it presented a magnificent appearance. The Grandis seemed to be in a more flourishing condition than the Sitka, but the Hemlocks were the best of the lot. The Sitka, however, were planted later than the others, and they do not get on well in a damp soil. A break of silver fir which was planted in among the larch seemed to be doing well, but in the open silver fir makes no great headway. The ages of the young underplanted plots ranged from 1 to 4 years.

Several patches of the larch plantation were left unthinned they will be thinned in time—and they presented a very scraggy appearance. The diseased stems were seen at a glance, and the ground was rank with coarse grass, whins and brackens. Plots of spruce were forging ahead, and were much better in every way than the larch. A plot of Thuja gigantea, which was planted last spring, appeared to be doing very well in the shade. The larch in the centre of the plantation was not nearly so good as that on the outskirts. This was perhaps due to the quality of the seeds. The following will give an indication of the revenue derived from the thinnings. The smaller posts or stakes are sold at 2s. a dozen, the middle-sized ones at 3s. 6d. a dozen, and the large ones at 4s. a dozen, or 4d. each. The cost of dressing them is 2d., 3d., and 1s. per dozen respectively. Much damage is being done to the young larch and Scots fir plantations on the Meannchnoc by black game. About two years ago a plot was planted with strong, healthy firs, and another with smaller ones. The first got away beyond the reach of the black game all right, but the latter plot was attacked, and the plants are stunted and bushy. This was merely tried as an experiment, but the expense was rather heavy. On the Broomhill and the Old Nursery the Douglas firs were making great headway; so, too, were the other conifers.

#### THE NOVAR NURSERIES.

The party then visited the nurseries, which are from 8 to 9 acres in extent. Here they saw a vast array of all kinds of plants in various stages of development. The nurseries were in excellent condition, and were kept remarkably clean. Plants of all descriptions and of all ages were in the healthiest condition. Seed-beds planted in the shade of the apple-trees in the garden were also visited, but there seemed to be no difference in their growth from the beds in the nurseries. The curiosities in the museum having been inspected, the visitors had a walk through the experimental plots in the Dalzheal. Here have been carried on experiments in planting certain crops, some pure and others mixed, by notching and by pitting. There seemed to be not much difference between the results of the notching and the pitting, as all the plots appeared to be in a flourishing condition. The notching, however, is done at half the cost of pitting, while dibbling, again, is done at half the cost of notching. The Crosshills was the last of the plantations visited. The crop was composed of larch and spruce, the age of the larch being 21 years and the older spruce 16 years. Part of the larch crop was thinned and underplanted in 1899 with spruce, silver fir, and Sitka spruce. The remainder was thinned in 1903, and underplanted with Hemlock spruce, Thuja gigantea and Douglas fir. Here, as in Assynt Hill, larch disease was at one time very prevalent. The plantation is now an excellent one all round, and, as regards underplanting and the combating of the larch disease, the best results have been obtained in this section. The Sitkas, which were planted some nine years ago, ranged from 10 to 16 feet in height, but the Hemlocks made the best show. They were planted five years ago, made rapid headway, till now their height is from 6 to 8 feet. The objection to this underplanting that many put forth—and it was the only one—was the difficulty that would be experienced in thinning and hauling out the trees without doing extensive damage. The chief difficulty, it was contended, would be in hauling the trees out from the centre of the plantation. There is not much in this objection. The plantations are intersected by "rides," and the distance from the centre of a plot to a "ride" is not great.

An instructive and enjoyable day terminated with a visit to the creosoting plant. The visitors were entertained to luncheon by Mr, Mrs and Miss Meiklejohn at the Dalzheal.

## 31. The Aberdeen Branch.

#### Excursion to Durris.

The third excursion of the Aberdeen Branch of the Society took place on Saturday, 29th June 1907, when, by the kind permission of H. R. Baird, Esq., a visit was paid to his beautiful estate of Durris.

The party were received on arrival by Mr Braid, the factor on the estate, and Mr Crozier, head forester. They first passed along the main road to inspect a number of young Douglas firs planted in the form of a road-side belt among a sprinkling of old trees, larches, Scots firs, etc.; these demonstrated how well the Douglas fir thrives under partial shade.

Passing the old historic mansion, the company found its way to the estate nursery, which, without question, is among the best laid out and cultivated place of the kind to be met with on any private estate. Here were to be seen large brakes of plants comprising samples of all the imported trees which abound on the estate, particularly Douglas fir, Menzies (Sitka) spruce, varieties of the silver fir, Albert (Hemlock) spruce, etc. All these are from the north-western parts of America, and have proved themselves to be the trees best adapted to succeed in this country. These imported species have now been so long on Durris, that nearly all the seed used can be gathered off carefully selected trees on the estate.

The party's next move was to visit the experiment with Menzies spruce at Strathgyle. Strathgyle is a plantation of some 80 to 90 acres, planted twenty-nine years ago. The altitude is 900 feet, and the exposure north-easterly. Here, on a peaty soil resting on boulder clay, are to be seen Menzies (Sitka) spruces grouped alternately with other spruces, Scots fir and larch. The Menzies spruce is, however, at least three times bigger than its ally the Norway spruce of the same age, while the Scots fir and larch are comparative failures; even a sprinkling of Douglas fir, planted by way of experiment, seems to hold its own better than the two last named, notwithstanding the altitude and exposure.

Afterwards a business meeting of the Society was held, when, on the motion of Mr Hart, Cowie Mains, Mr Braid was called to the chair.

After the meeting the company broke up into groups and visited many parts of the extensive policies, especially the den where are to be found many of the fine old oaks and larches said to have been planted during the Duke of Gordon's proprietorship. Some of the larches measure over 100 feet high and from 8 to 10½ feet

in circumference at 5 feet up. Here also, as in other parts of the grounds, were to be seen growing in forest form many imported trees, such as Douglas firs, silvers, Menzies spruce, and even Albert spruces, Cypresses, Wellingtonias, all making fine clean shapely stems like any ordinary forest-tree.

The west avenue, the *Nobilis* avenue, and many other noteworthy objects in this home of rare trees, were also inspected. Among the trees specially noted were the following—a fine old "Douglas" now about 70 years of age, 112 feet high, 12 ft. 6 ins. circumference at 5 feet up; the pendulous branchletted spruce, a rare and beautiful variety of the Norway spruce; an *Abies magnifica* 85 feet high, and 7 feet in circumference at 5 feet up, said to be the largest of its kind in the United Kingdom.

At the saw-mill several large planks of Douglas fir and Menzies spruce were shown partly planed. The Douglas had a fine reddish appearance, and ex-Provost Fleming, whose opinion, from his extensive connection with the timber-trade, must be respected, expressed himself to the effect that the Douglas fir lent itself to a high polish and finish, and was therefore well adapted for house construction, etc. The Menzies spruce was whiter, and otherwise not so suitable for highly finished work.

When all this had been seen, a re-union was again effected at Durris Cottage, the beautiful home of Mr and Mrs Braid, where a sumptuous tea and other refreshments were set out on the lawn by Mrs Braid. Before mounting the conveyances, Mr Gammell of Drumtochty proposed thanks to Mr and Mrs Braid for their substantial remembrance of the Society's human needs. If anything could attain to pleasure and profit alike, it was this visit of the Arboricultural Society to Durris. The former is unquestioned, while, at the same time, many practical lessons were to be learned by the student of forestry.

I am sure that those of us who have some practical knowledge of forestry can, from our observations at Durris, added to former experience, unhesitatingly assure even the most cautious of our landed proprietors and others interested, that a profitable investment can be obtained by planting as forest-trees some of the newer conifers, such as Douglas fir, Menzies spruce, etc.

Durris, by its nearness to the city and the many object-lessons it affords, will no doubt be highly appreciated by Mr Dawson, the recently appointed lecturer at Aberdeen University, and his students.

John Rule, Forester, Huntly.

32. Forestry Section in the Scottish National Exhibition, Edinburgh, 1908, organised by the Royal Scottish Arboricultural Society, 1st May to 31st October.

As soon as it was definitely known that a Scottish National Exhibition was to be held in Saughton Park, Edinburgh, the Council of the Society arranged that an Exhibit of Forestry should be included in it. A suitable space in the North Garden, facing the main avenue, was allotted free of charge to the Society, on part of which a Pavilion, hired for the occasion from Mr John M'Manus, London, was erected to receive such of the Exhibits as required to be kept under lock and key; on another part a shed has been put up to protect the timber boards from the weather, and the remainder of the space is occupied by Exhibits which do not require special protection.

It is intended that a detailed report of the Society's Exhibit be published in a future issue. Meanwhile we give a list of the names of those who have been good enough to respond to the Society's invitation to enter Exhibits under the headings given below, viz.:—

# Specimens illustrating the Rate of Growth of Trees.

W. Steuart Fothringham, Esq. of Murthly.
The Right Hon. The Earl of Mansfield.
The Right Hon. The Earl of Strathmore.
R. C. Munro Ferguson, Esq. of Raith and Novar, M.P.
His Grace The Duke of Atholl, K.T.
Cameron of Lochiel.

## Specimens of different Kinds of Timber.

W. Steuart Fothringham, Esq. of Murthly. The Most Hon. The Marquis of Zetland, K.T. The Right Hon. The Earl of Mansfield.

A. W. Inglis, Esq. of Glencorse, Midlothian. The Right Hon. The Earl of Strathmore.

R. C. Munro Ferguson, Esq., M.P. His Grace The Duke of Atholl, K.T.

The Most Hon. The Marquis of Breadalbane.

Henry R. Baird, Esq. of Durris, Drumoak, Aberdeenshire.

His Grace The Duke of Wellington, Heckfield, Winchfield, Hants, per Mr W. R. Brown, Forester.

The Right Hon. The Earl of Carnarvon, Highclere Castle, Newbury, Berks, per Mr W. Storie, Forester.

The Right Hon. Viscount Powerscourt, Ireland.

David W. Thomson, Esq., Nurseryman, Edinburgh.

Messrs A. & R. Brownlie, Timber Merchants, Earlston.

Mr Alex. Pollock, Royal Rustic Builder, Tarbolton.

Adam Spiers, Esq., Timber Merchant, Edinburgh.

James Whitton, Esq., City Chambers, Glasgow.

George Cadell, Esq. (late Indian Forest Department), 20 Murrayfield Avenue, Edinburgh.

Messrs James Jones & Sons, Ltd., Larbert Saw-Mills.

H. J. Younger, Esq. of Benmore, Argyllshire.

The Right Hon. The Earl of Rosse, Birr Castle, King's County.

Sir Duncan E. Hay, Bart. of Smithfield and Haystoun, Peebles.

Messrs Alex. Jack & Co., Ltd., Maybole.

F. R. S. Balfour, Esq., Dawyck, Peebles.

Messrs J. & M. Smith, Peebles.

Specimens showing the Comparative Quality of Timber grown on different Soils and Situations, and the respective Ages at which each reaches Marketable Size and Maturity.

His Grace The Duke of Roxburghe, K.T.

His Grace The Duke of Northumberland, K.G., Alnwick Castle.

## Gates, Fencing Material, Railway Timber.

W. Steuart Fothringham, Esq. of Murthly.

The Right Hon. The Earl of Mansfield.

His Grace The Duke of Roxburghe, K.T.

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

The Economic Fencing Co., Ltd., Billiter House, London, E.C.

Mr James Kay, Barone, Rothesay.

Colonel F. Bailey, Lecturer on Forestry, Edinburgh University.

H. J. Younger, Esq. of Benmore, Argyllshire.

Specimens of Stems illustrating the effects of Dense and Thin Crops in Branch Suppression and Quality of Timber.

His Grace The Duke of Northumberland, K.G.

Specimens of Timber Preserved by various Methods.

The Right Hon. The Earl of Mansfield.
His Grace The Duke of Roxburghe, K.T.
R. C. Munro Ferguson, Esq., M.P.
Messrs Major & Co., Ltd., Hull.
The Economic Fencing Co., Ltd.
Mr George Leven, The Cottage, St Quivox, Ayr.

Specimens showing the Beneficial Effects of Pruning when well done, and Injurious Effects when badly done.

His Grace The Duke of Northumberland, K.G.

Specimens of Abnormal Growth.

The Right Hon. The Earl of Mansfield. The Right Hon. The Earl of Strathmore. R. C. Munro Ferguson, Esq., M.P. The Right Hon. Lord Leith of Fyvie. Mr James Kay, Barone, Rothesay.

Plants, Trees, and Timber damaged by Storms, Frosts, Insects, Animals, Birds, or other Causes, and Specimens of the Insects, Animals, Birds, or Fungi which caused the damage.

Dr Stewart MacDougall, Hon. Entomologist to the Society. Dr A. W. Borthwick, Hon. Cryptogamist to the Society. W. Steuart Fothringham, Esq. of Murthly. Mr George Anderson, Braehead, Cumbernauld. The Right Hon. The Earl of Mansfield. Captain W. B. Rankin of Cleddans, etc.

Young Trees showing various Methods of Transplanting.

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

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

## Specimens illustrating Forest Botany.

Dr A. W. Borthwick, Hon. Cryptogamist to the Society.

W. Steuart Fothringham, Esq. of Murthly.

The Right Hon. The Earl of Mansfield.

F. R. S. Balfour, Esq., Dawyck.

# Tools, Instruments, and Implements—Home and Foreign—used in various Operations connected with Forestry.

Messrs Robert Sorby & Sons, Ltd., Sheffield.

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

Mr James Kay, Barone, Rothesay.

Colonel F. Bailey.

The Right Hon. The Earl of Mansfield.

## Working-Plans, Maps, etc.

R. Campbell, Esq., B.Sc., Hon. Geologist to the Society.

Dr Schlich, C.I.E., F.R.S., Professor of Forestry, Oxford University.

Colonel F. Bailey.

Sydney J. Gammell, Esq. of Drumtochty.

J. G. Bartholomew, Esq., The Geographical Institute, Edinburgh.

# Specimens of Rustic Work.

Mr Alex. Pollock, Royal Rustic Builder, Tarbolton.

## Pictures and Photographs in connection with Forestry.

Royal Scottish Arboricultural Society.

The Right Hon. The Earl of Mansfield.

His Grace The Duke of Roxburghe, K.T.

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

# Instruments for Measuring Height and Diameter of Trees, etc.

Messrs J. & M. Smith, Peebles.

Colonel F. Bailey.

Mr James Kay, Barone, Rothesay.

# Tanning and Dyeing Substances derived from Forest Produce.

The British Dyewood & Chemical Co., Ltd., 53 Bothwell Street, Glasgow.

Wood Pulp and other Materials for Paper Manufacture.

Messrs Thomas Tait & Sons, Ltd., Inverurie Mills, Inverurie.

Other Objects of Interest relating to Forestry.

W. Steuart Fothringham, Esq. of Murthly.

A. W. Inglis, Esq. of Glencorse.

The Right Hon. The Earl of Mansfield.

His Grace The Duke of Atholl, K.T.

Mr James Rodger, Estate Office, Leinster Street, Athy, Co. Kildare.

Mr John Thomson, Gormaddie, Balmoral, Ballater.

Messrs J. & M. Smith, Cabinetmakers, Peebles.

Royal Scottish Arboricultural Society.

H. J. Younger, Esq. of Benmore.

F. R. S. Balfour, Esq., Dawyck.

Mr Adam Spiers, Timber Merchant, Edinburgh, has supplied the flagstaff, and Messrs Dicksons & Co. and Mr David W. Thomson, Nurserymen, Edinburgh, have sent the decorative plants and shrubs.

The Society's attendant is Mr Alexander M'Rae, lately Forester at Castlecomer, Co. Kilkenny, who has made and fitted up the benches in the Pavilion, erected the shed for the timber, laid out the ground, and staged the Exhibits.

# NOTES AND QUERIES.

### ARBORICULTURE AND ARABLE LAND.

If it be true that nothing is more beautiful than the hedgerow timber and the scattered oaks and elms of the English Midlands, it is equally true that nothing is more destructive to agriculture than much of our "ornamental" timber in Scotland. A great deal could be done both to increase the value of arable land and to beautify the landscape, through a gradual process of change in the allocation of trees and in the varieties used. A really good tree, wherever situated, is worth some sacrifice to keep, and the general effect of the whole landscape should always be held in view. Subject to these considerations, much might be done in Scotland both for the adornment of the countryside and to increase the value and utility of our timber.

Trees planted round farm and other houses for shelter frequently exclude light, and spoil the gardens or roofs—whereas vacant spaces could be utilised, and real shelter provided in lieu of the original plantations, which, in many cases, serve only to create a draught instead of a "bield."

The "scrunty" elm, often an eyesore, at the roadside should disappear, along with the obnoxious weeds which flourish beneath its fostering shade; so also with the battered beech which lingers on to spoil the hedge or ruin the neighbouring crop. No tree should be left in an arable field that is not a fine tree and a feature of the landscape. Such trees are rarely necessary, as in the south of England, to shelter stock on the pasture lands.

Shelter-strips should always run north and south to protect the crops from prevailing winds, and to give every field its fair share of the sunshine. Hedgerow timber should consist mainly of oak, Lombardy poplar, birch, Scots fir, etc., and other varieties which throw least shade and therefore do the minimum of harm to hedge and crop. Probably the ideal border for a road is a beech hedge with oak standards, but a thorn hedge with Lombardy poplar and similar combinations is not to be

despised. For house and garden shelter, the gean, mountain ash, laburnum, and oval-leaved privet are among the species insufficiently employed. Chestnuts, black Italian poplars and Acers will soon make a show on unutilised spots of bare land—and much of arable Scotland remains very bare—and will serve for shelter or for ornament. Beech, elm and ash should be clumped or grown in two or three close lines for avenues, else they will rarely become ornamental timber.

Corners where fields meet can often be planted with a clump of trees to the great advantage of the landscape. The willow, and especially its scarlet variety, too rarely gives colour to the margin of our streams and pools. Nor is the toom or ashpit often enough secluded by a diadem of *Retinospora* or other ornamental species. Apart altogether from large plantations, were landowners to take a more active interest in the disposition of ornamental timber, outside their policies, this would have a considerable effect upon the comfort and welfare of their tenants and their employees—whilst by removing the eyesores of stunted, hidebound, ill-grown standards, and by covering bare and ugly pieces of ground with shelter clumps for man and beast, the splendid natural scenery of Scotland would be further enhanced.

R. M. FERGUSON.

#### THE ARDGOIL ESTATE.

The development and utilisation of the above estate, lately presented to the city of Glasgow by Mr Cameron Corbett, M.P., is of considerable interest from a forestry point of view.

The estate is situated in the parishes of Lochgoilhead and Kilmorich, and consists of 14,650 acres, the majority of the area being rough hill pasture land. The greatest elevation is found on the summit of Ben Ime, which attains a height of 3318 feet, while five other hills of over 2000 feet in height occur on the estate. Very few estates present such a minimum proportion of level arable ground.

The purpose for which the gift was made was to provide a place of resort for the citizens of Glasgow; and all revenues from the estate are to be devoted to the upkeep of the estate, and to rendering it more accessible to the inhabitants of

the city. A large proportion of the area is probably suitable for growing coniferous timber, and that this would be a profitable course to adopt seems to be indicated by the fact that at present probably only twenty families gain a livelihood from the land. It is the firm conviction of Mr James Whitton, Superintendent of Parks, Glasgow (on whose report this article is largely based), that crofting, except to a very limited extent, would be a failure. The problem is therefore the same as that which exists over a large proportion of Scotland, that is, by what method can land of this description be utilised so that an increased number of persons may obtain a reasonable living wage from the soil?

The land in the Eberswalde district of Germany may be compared, in some respects, to the Ardgoil Estate, inasmuch as only small areas here and there are of agricultural value. The main distinction between the two is that the rainfall on the Ardgoil Estate is sufficient to produce a soil-covering of rough hill pasture even on the more barren portions, whereas at Eberswalde the soil is porous and the rainfall small. The woods on the Eberswalde district may be described as analogous to the rough hill pasture in Scotland.

It is a significant fact that while in Scotland the annual rental of land capable of growing grass is, in the case of hill pasture, often not more than a few pence per acre, in Germany an annual sum of about ten shillings per acre is realised for a planted area, most of which could not produce pasture. There is some doubt as to the effect of a possible influx of visitors on the farms of the Ardgoil Estate, with the consequent disturbance of stock. The official report draws attention to the fact that "the afforestation . . . of a considerable area of the estate, merely to afford shelter, would enhance the value of the farms as grazing subjects, and would be an advantage. There is, however, the larger question of creating a source of revenue for the future . . . by the planting of trees."

That the estate is capable of growing most of the common timber-trees, both hardwoods and conifers, is without question, and there is reason to believe that in former times woods covered a large portion of this estate. It is encouraging to find that a considerable amount of planting is likely to be undertaken, and that it will be done in a systematic manner.

### Afforestation of Surplus Lands.

The following letter from Dr Schlich appeared in the *Times* of 10th April 1908:—

Twenty-two years ago I urged extended afforestation of surplus or waste lands in these islands. These suggestions I have repeated on many occasions since, and I particularly pointed out that such afforestation might be found an auxiliary in solving the Irish land question and the great problem of the unemployed. The reasons for my action were, in the first place, the desirability of increased afforestation, so as to increase home production; and secondly, my conviction that the operations would ultimately pay a fair interest on the outlay, provided they were conducted in an economic and business-like manner. The study of the forest conditions in various parts of the earth had shown me that a scarcity, or at any rate a considerable rise in the price, of timber must come within a limited period of time, so that woods planted in this country would benefit by that increase. My proposals remained unheeded for a considerable period of time; indeed, they were even characterised as "wild gambling in futures." Of late, however, the matter has been more seriously considered, and I have read with great interest the four articles on "British Forestry" published by you during the last two months. A Committee on Irish Afforestation is just completing its labours, and I have reason to believe that proposals made by me in January 1886 have been seriously considered. I also see that the Royal Commission on Coast Erosion has been enlarged, and is now considering "whether it is desirable to make an experiment in afforestation as a means of increasing employment during periods of depression in the labour market."

These are all hopeful signs towards the inauguration of extended action, especially as recent experience has shown the correctness of my forecast as regards the financial aspect of the undertaking. Our supplies of timber come chiefly from the countries around the Baltic and from North America, in the proportion of about five and a half to three million tons. It stands to reason, therefore, that any rise in price in North America must affect prices in these islands. This morning I received a statement issued by the United States Department of Agriculture, Forest Service, entitled "Wholesale Lumber Prices, 1886-1908," on the markets of New

York, Baltimore, Buffalo and San Francisco, from which I trust you will permit my giving the following extract:—

The increase in prices during the last ten years has been as follows, in dollars per 1000 feet board measure:

Species.			1899.	1908.	Per cent. of Increase in 10 Years.
New York—White Ash,			34	60	77
,, Birch, .			35	54	54
,, White Oak,		.	55	82	
,, Yellow Poplar,		- 1	25	46	49 84
" Hemlock, .			11.20	22	91
,, Spruce, .			21	39*50	88
Buffalo-Hickory,			48	59.20	24
,, White Pine, .		.	44	79	80
San Francisco-Redwood,		.	17	35	106
Yellow Pine generally, .		-	16	24	50

These increases must have produced a rise in prices in the United Kingdom. As a matter of fact, as I showed at a conference held last year at the invitation of Lord Carrington, the average increase all round since 1895 amounts to about 20 per cent., the increase not coming suddenly, but quite steadily year by year. As the United States must call more and more upon the timber resources of Canada, and as the population of the latter country is rapidly increasing, there cannot be a shadow of a doubt that the export of timber from North America to these islands must decrease, leading to a further increase in prices. In how far the countries round the Baltic can counteract that effect may be considered as problematic; at any rate, until now they have not been able to do so. These countries have also to meet the everincreasing requirements of many other countries, such as Germany, Belgium, France, Holland, and many others.

These things prove that we have a fair field before us for increased afforestation of surplus lands, even if looked at from a financial point of view. I hope that the Commission on Land Erosion and the Committee on Irish Forestry will see their way to formulate practical proposals dealing with the subject on broad lines.

I am, Sir, your obedient Servant,

#### FOREST PRESERVATION IN THE UNITED STATES.

A despatch in the Times of 12th May gives some account of the work which has been done by Mr Roosevelt's Administration in connection with the preservation of the timber resources of the United States. In the first place, experts have been for some time drawing attention to the effects produced by the reckless destruction of the forests. Thousands of acres of arable land, stretching from hill-sides and river banks, have been deprived of the protecting trees which regulate the periodic floods of the rivers. In consequence, the lands are being swamped by the overflowing streams, the courses of the rivers being in turn clogged with the rich soil stripped and washed from the land. This effect of deforestation demands costly dredging of the streams, and endangers the efficiency of works designed to facilitate navigation. The storage of flood waters also becomes a necessity, and reclamation schemes, in addition to being directed to arid lands, have also to be applied to once useful fertile areas over which the flood waters have ruinously spread through ruthless tree felling. One instance among several is the reduction of the amount of forest cover on the White Mountain Thereby the water-power in the New England watershed. streams has become insufficient to run the mills, and 95 per cent. of the water-power factories have had to use steam at certain periods of the year or else stop running.

Mr Roosevelt's crusade for the preservation of the remaining portions of the public domain not at the mercy of the squandering methods of private owners, has taken a form that will be enduring as far as it goes with the means at hand. In the West an over-abundance of land and a meagre population once encouraged a lavish distribution of the public domain for agriculture, timber, water, fuel, and minerals. Now it is recognised that these resources are not inexhaustible, and that their abuse must be stopped. A brilliant lieutenant of the President's, Mr Gilbert Pinchot, chief of the forestry service, has for some time been conducting a vigorous campaign against the further monopoly of the public lands, the benefit of which has accrued to a few individuals, who have ousted the bona fide home-steader. Considerable forest reserves have now been established in the West, and portions of the coal supplies and mineral fields have been conserved.

The conservation of water-power, upon which in turn depend the forests, is quite as grave a question as that of the coal, to which considerable attention is now being devoted. It is said that water-power is becoming exhausted at the rate of millions of tons annually through the absence of forest control by the State. The snows and water in the great mountain ranges of the West, Mr Garfield says, contain enough power to turn millions of wheels, to irrigate millions of acres, and to furnish water supply to hundreds of cities. To this unused power commercial interests are naturally turning. But mindful of the spendthrift and monopolistic policy which has marked the control of the forest and mineral areas by the "interests," the Administration has sternly set its face against the granting of further franchises for the use of a natural agent that it conceives to be a public utility, not a private privilege.

The President has warned Congress that he will veto Bills which grant such privileges to private monopolies. As a part of the Administration's policies, this determination to thwart the creation of vested interests in water-power, to check further forest exploitation, and weaken the grip of illegitimate ownership of the forest and mineral areas, is certain to meet with bitter opposition in Congress, when in due time it takes the form of proposed legislation. But the whole situation calls for laws prescribing some intelligent system of national conservation, similar to that followed in European countries, aided by uniform laws in all the States.

Linked with Mr Roosevelt's plans for this conservation is his scheme for the improvement of inland waterways—a vital question daily becoming of more urgency. Far-reaching measures have been proposed by the Commission he appointed. In a weighty report submitted to Congress, the Commission recommended that hereafter plans for the commercial development of inland waterways should "take account of the purification of the waters, the development of power, the control of floods, the reclamation of lands by irrigation and drainage, and all other use of the waters or benefits to be derived from their control." Here is indicated the wonderful network of public interests bound up with the Administration's concern for the conservation and control of the national estate of the Republic.



## Plate XVI.



To face page 220.

#### Afforestation of Reclaimed Lands.

In connection with the subject of afforestation, the following official notice is of interest:—

"The King has been pleased to enlarge the terms of reference to the Royal Commission on Coast Erosion, and to direct them to inquire whether, in connection with reclaimed lands or otherwise, it is desirable to make an experiment in afforestation as a means of increasing employment during periods of depression in the labour market, and if so, by what authority, and under what conditions, such experiment should be conducted; and to add to the Commission the following new members:—Mr John Galvin, Mr E. Stafford Howard, C.B., Mr H. C. Monro, C.B., Dr W. Somerville, F.L.S., F.R.S.E., Mr Fraser Story, and Mr John Ward, M.P."

# Basic Slag on Seed-Beds.

(With Plate.)

The value of basic slag as a fertiliser has been demonstrated and proved in many ways; but as I am not aware of its having been tested on seed-beds—in this country at least—I am sending the accompanying photograph, along with table of measurements and explanation.

Reference to Plate.	Age in Years.	Circumference at Ground.	Total Height.	Length of last Year's Growth.
No. 1—A,	3 3 4 4	Inches. $I_{\frac{1}{10}}$ $I$ $I_{\frac{7}{8}}$ $I_{\frac{1}{8}}$	Inches.  13 $\frac{1}{2}$ 12 $\frac{1}{4}$ 11 $\frac{1}{2}$ 12 $\frac{1}{2}$	Inches. 10 9 63 6

These measurements illustrate the rate of growth of two lots of Scots pine, the specimens measured and photographed being average sized plants of their respective lots.

Those illustrated by No. 1 were raised at Pollok, the seed having been sown in beds prepared in the usual way, and a light dressing of well-matured farmyard manure dug in; but, before covering the seed, basic slag was sown on the beds at the rate of about 12 cwts. per acre. This was the only special attention they received, except that during a spell of

very dry weather they were watered several times. The following spring a number of the seedlings were lined out on the Corrour estate nursery at Fersit, and, at the same time, those illustrated by No. 2 were bought as two-years' seedlings, and lined out alongside of them, both lots receiving identical treatment then and since. The specimens in both cases were taken from a plot of selected seedlings.

Both lots of plants are very regular in size all over, but, if anything, there is less variation in the three-year-old plants than in the others. The No. 1 seedlings, however, have all along had a much better colour—quite noticeable even at a considerable distance—than the No. 2 lot; but it has yet to be seen which lot of plants will succeed better when planted out. Nevertheless, it is very apparent that the application of slag on the seedbeds has had a marked effect on the constitution of the young plants. Even allowing that the seedlings were raised in different localities, there could scarcely have been such a difference in health and vigour had not the slag been used.

J. Boyd.

## Working-Plan for the Ardross Woods.1

A working-plan for the above woods, which are the property of Mr C. W. Dyson Perrins, has just been drawn up by Dr Schlich and Mr R. S. Pearson. It contains valuable suggestions, most of which are applicable to other Highland estates; and it should be studied by all Scottish landowners, factors, and foresters. Special attention may be directed to what the authors say regarding the treatment of larch, in view of the prevalence of the destructive Larch Blister, and regarding the exotic species which they suggest for trial as forest-trees in this country. Among other matters may be mentioned their recommendation of the vertical notching-spade for the planting out of young seedling trees.

F. B.

# FORESTRY AT THE WEST OF SCOTLAND AGRICULTURAL COLLEGE.

A scheme calculated to afford a complete course of theoretical and practical instruction in Forestry has recently been devised

<sup>&</sup>lt;sup>1</sup> London: Bradbury, Agnew & Co., 1907. Price 6d.

by the West of Scotland Agricultural College, and owing to the kindness of certain proprietors, and the efforts of the Lorn District Committee of the County Council of Argyll, a most promising start has already been made.

The Lorn District Committee has promised to pay the class fees of six Forestry students, who are in the first instance to be apprenticed for eighteen months on certain estates, and are subsequently to attend a winter session at the Agricultural College in Glasgow.

The scheme includes the further advantage, that the methods of Forestry practised upon the properties where the students are engaged are made available to the College for the purposes of experiment and research.

Lord Strathcona, Mr Macalpine Downie, Mr Nelson and Mr Macdonald have all consented to a working arrangement of this kind with the College.

The conditions under which the students are appointed may be summarised as follows:—

The course is for working men and youths only. It will extend over a period of two years, during which time the students will be required to spend six months in Glasgow, taking classes of forestry, botany, chemistry, soils and manures, zoology, book-keeping, and surveying at the West of Scotland Agricultural College. The Forestry Experimental Station of the College at Kilmarnock will also be visited. Students will further be required to spend eighteen months on an estate where they will (1) perform the duties of a working forester; (2) keep a journal recording full details and costs of the work done each day (these journals will be taken into account in all examinations); and (3) attend such lectures and examinations as the College may decide to hold. The intention is to give weekly lectures at the local centres for a certain period of the year. For the present, the number of students to be admitted in any one year is limited to ten. Wages will be paid to the students during their work on the estates, their College fees will also be paid during their work in Glasgow, and assistance given towards their other expenses in Glasgow. It is also hoped that special bursaries may be established. Periodical examinations will be held in Oban and other centres, and at the end of the course certificates will be given to those who suceeed in satisfying the examiners. Applications for admission should be sent to Mr John D. Sutherland, Royal Bank of Scotland, Oban, and should be received before 30th September in any year.

W. F. A. H.

## FORESTRY AT THE UNIVERSITY OF EDINBURGH.

The University Court has established three additional lectureships in connection with the degree of B.Sc. in Forestry. Dr R. S. MacDougall will lecture on Forest Entomology, and Dr A. W. Borthwick on Forest Botany, while Mr Hudson Beare, Professor of Engineering, has consented to conduct the course in Forest Engineering, pending the appointment of a lecturer in that subject.

#### CHAIR OF FORESTRY AT CAMBRIDGE.

Mr Augustine Henry, M.A., F.L.S., a native of Derry, in Ireland, has been appointed Reader in Forestry at Cambridge. Mr Henry studied for two years at the Forestry School at Nancy, and has travelled extensively, having visited the forests of China, Japan, North America, France, Spain, Corsica, as well as those of Great Britain. He has also been associated with Mr H. J. Elwes, F.R.S., in the authorship of *The Trees of Great Britain and Ireland*.

## FORESTRY APPOINTMENT AT INVERLIEVER.

The Commissioners of Woods and Forests have selected Mr John Boyd, Head Forester to Sir John Stirling-Maxwell on the Pollok Estate, as Resident Forester in the newly-acquired Government Forest of Inverliever. Mr Boyd is to be congratulated on his appointment to this important office, for which he is well qualified.

On Friday, 19th June, a presentation was made to Mr Boyd on the occasion of his leaving the Pollok Estate. The presentation took place at the Agricultural College in Glasgow, Principal Wright being in the chair. An Exhibition in connection with Forestry was held at the same time.

## WOOD: ITS BOTANICAL AND TECHNICAL ASPECT.

A lecture with the above title was delivered by Professor Wm. Somerville, M.A., D.Sc., at the Royal Institution, London, on 20th February. The lecture was illustrated by a series of diagrams of wood and of tables showing comparative growths of different species of timber-trees.

## THE COST OF FENCING.

In connection with the subject of outlay on afforestation, one often reads or hears that planting costs so much per acre, and that some additional named sum, or some proportion of the planting charge, must be added to provide for fencing. Persons who give such rates doubtless quote from their own experience in fencing particular tracts, where the cost was actually as stated. But it is evident that such figures, however accurate they may be, cannot be generally applied, all fencing estimates given in the form of a constant rate per acre, or in that of a constant proportion to the planting charge, being fallacious.

The cost per acre of planting is not much affected by an increase or a decrease of the area stocked. If a contractor be employed, he charges a rate per acre which does not greatly vary with the area. But the cost of fencing works out very differently, as may be seen from what follows. Assuming the side of a square plot of ground covering one acre to be 70 yards, the length of a fence enclosing it will be  $(4 \times 70)$  280 yards, and the cost at 1s. a yard will be £14—that is, £14 per acre. Take a second square plot covering 4 acres, and it is clear that while the area has been increased four-fold, the length of the fence has only been doubled. And if the calculation be carried a little further, we arrive at the following results:—

Square Area Enclosed.		Cost.		
	Length of Fence.	Total.	Per Acre.	
Acres.	Yards.	£	£ s. d.	
I	$4 \times 70 = 280$	14	14 0 0	
4	$8 \times 70 = 560$	28	7 0 0	
16	16×70=1120	56	3 10 0	
64	$32 \times 70 = 2240$	112	1 15 0	
256	64 × 70 = 4480	224	0 17 6	
1024	$128 \times 70 = 8960$	448	0 8 9	

and so on. A pretty wide range! Even at the rates found near the bottom of the table the burden of providing fences is heavy enough; but if the blocks of forest are large ones, it is not so heavy as it is often represented to be. If, however, the blocks are of irregular outline, or are elongated into the form of strips or shelter-belts, the cost of fencing will be much higher than that stated above, which has reference to square blocks only. Indeed, if the blocks be sufficiently irregular or elongated, the cost may be almost infinitely expanded.

It may therefore be assumed that, having regard to the bill for fencing, large, regularly shaped, and approximately square blocks are much to be preferred. And large blocks have the further great advantage that, as indicated by the proportionally shorter length of the fence required to enclose them, they carry a smaller proportion of ill-shapen, branchy, marginal trees; while the larger the area, the more do the conditions of moisture, temperature, and air-stillness in the interior approach those of a natural forest, and thus promote the healthy development of the crop. Again, in the case of large areas, work, being more concentrated, can be more efficiently supervised and more economically done; fewer roads for the removal of timber have to be kept up, while labour-saving mechanical means of transport may be more successfully employed; and, finally, the market can be better served, to the enhancement of sale prices.

On most estates woods are required for game coverts; and they answer this purpose better if they are not too large, and if they are more or less elongated rather than compact in shape. But on some estates, at least, it may be possible, after duly providing for sporting requirements, to devote considerable areas to the practice of systematic forestry, with profit as the object of management; and such areas should, as far as practicable, be laid out in large and compact blocks.

F. B.

## EXPERIMENTAL STUDY OF LARCH CANKER.

Mr E. R. Burdon, of the Botany School, Cambridge, proposes to organise an experiment on a large scale to test the theory that the *Chermes* bug is responsible for the majority of cases of Larch canker. In outline the experiment is as follows:—It is proposed to start in different parts of England and Scotland

about a dozen plantations, each consisting of fifty Larix europæa and fifty Larix leptolepis. The plantations are to be established in the vicinity of other larch plantations already infected with canker, but are to be formed of young larches free alike from canker and from Chermes. Each plantation is to be divided into three parts: of these one will be kept free from Chermes by spraying, one will be artificially infected with Chermes, the third will be left without interference. The plantations are then to be carefully studied, and it is hoped that the results in ten years' time will yield some valuable information on the connection between Chermes and canker. A number of proprietors have already favourably received the suggestion that plantations should be started on their lands for the purposes of the experiment, but the constant periodical inspection which the experiment necessitates will involve a heavy outlay. Members of the Society who are interested in the subject are requested to communicate with Mr Burdon,

## THE FORESTERS' AND GARDENERS' SOCIETY OF ARGYLL.

This Society has been established to stimulate and encourage the study and practice of Forestry and Gardening by regular meetings for discussion, and by such other means as may from time to time suggest themselves, and to assist members and their families as occasion may arise. It is composed of Honorary Members and Ordinary Members, consisting of (a) Proprietors, Factors, and others, (b) Foresters and Gardeners. A meeting of members is held once a month during six months of the year, a syllabus of subjects for discussion and lectures being drawn up by the committee. At least two outside excursions are also arranged during the year to woods and gardens in the district or elsewhere.

## Some recent Forestry Books.1

Annesley, Earl, Beautiful and Rare Trees and Plants. 70 Illustrations from Photographs taken at Castlewellan. Net 42s. Newnes, 1903.

<sup>&</sup>lt;sup>1</sup> See "Note on Modern Works on Forestry" in the *Transactions*, Vol. XV. The books in this additional list are also obtainable from Messrs Douglas and Foulis, 9 Castle Street, Edinburgh.

- Brandis, Dietrich, Indian Trees: An Account of Trees, Shrubs, Climbers, Bamboos, etc., indigenous or commonly cultivated in the British Indian Empire. Net 16s. Constable, 1906.
- Brown, J. Pinkney, Practical Arboriculture: How to Plant and Grow Forest Trees which may be Grown in our Generation to a Profit. Text-Book for Railway Engineers. 100 Illustrations (Connersville Arboriculture). Net 12s. 6d. Dawson, 1906.
- CHARPENTIER, P., Timber: Comprehensive Study of Wood in all its Aspects, Commercial and Botanical. Translation from French by J. Kennell. Illustrated. Net 12s. 6d. Scott and Greenwood, 1902.
- Cole, Vicat, British Trees Drawn and Described. 2 Vols. Net 34s. Hutchinson, 1907.
- COOK, E. T., Trees and Shrubs for English Gardens. Illustrated. Net 12s. 6d. Newnes, 1902.
- Cox, G. C., Royal Forests of England. Illustrated. Net 7s. 6d. Methuen, 1905.
- Curtis, C. E., Practical Forestry and its Bearing on the Improvement of Estates. Third Edition. Net 3s. 6d. Lockwood, 1907.
- Dame, L. L., and Brooks, H., Handbook of Trees of New England, with ranges through the U.S. and Canada. Plates. Net 7s. 6d. (Boston), 1902.
- ELWES, H. J., and HENRY, A., The Trees of Great Britain and Ireland. 5 Vols. Illustrated. Net £15, 15s. Quaritch, 1907.
- FORBES, A. C., English Estate Forestry. Net 12s. 6d. Arnold, 1904.
- Gant, A., Seaside Planting of Trees and Shrubs. Illustrated. Net 5s. Newnes, 1907.
- GILLANDERS, A. T., Forest Entomology. Illustrated. Net 15s. Blackwood, 1908.
- GREEN, S. B., Professor of Forestry, University of Minnesota.

  Principles of American Forestry. Net 6s. 6d. Chapman and Hall.
- GROOM, PERCY, Trees and their Life-Histories. Illustrated. Net 25s. Cassells, 1907.
- NISBET, JOHN, The Forester: A Practical Treatise on British Forestry and Arboriculture for Landowners, Land Agents, and Foresters. In 2 volumes. Net 42s. Blackwood, 1905.

- SARGENT, C. S., Manual of Trees of North America (exclusive of Mexico). Net 25s. Constable, 1905.
- Schlich, Professor, Forestry in the United Kingdom. (A Lecture.)
  Net 2s. Bradbury, 1904.
- Schlich, Dr, Manual of Forestry. Vol. I., "Forest Policy in the British Empire." 3rd Edition revised. Net 6s. Bradbury, 1906.
- Vol. II., "Sylviculture." 3rd Edition revised. Net 8s.
- Vol. III., "Forest Management." 3rd Edition revised.

  Net 9s. 1905.
- Vol. IV., "Forest Protection," by W. R. FISHER. 2nd Edition. Net 12s. 1907.
- Schwappach, Dr, *Primer of Forestry*. Translated by Fraser Story. Net is. Dent, 1904.
- SIMPSON, J., Game and Game Coverts. Illustrated. Net 15s. Country Gentlemen's Association, 1906.
- SIMPSON, John, The New Forestry, or the Continental System adapted to British Woodlands and Game Preservation.
  Illustrated. Net 15s. Pawson & Brailsford, 1907.
- Step, E., Wayside and Woodland Trees: Pocket Guide to British Sylva. Illustrated. 6s. Warne, 1904.
- Stone, Herbert, The Timbers of Commerce and their Identification. Illustrated with 186 Photo-Micrographs. Net 7s. 6d. Rider, 1904.
- Trees and Shrubs grown in the Kew Arboretum, excluding Coniferæ. Hand List. Net 1s. 3d. Kew Gardens, 1903.
- UNWIN, A. HAROLD, Future Forest Trees, or the Importance of the German Experiments in the Introduction of North American Trees. Net 7s. 6d. Unwin, 1905.
- Ward, H. Marshall, Trees: Handbook of Forest Botany for Woodlands and Laboratory, Vol. I., "Buds and Twigs." Vol. II., "Leaves." Vol. III., "Flowers and Inflorescences." Each net 4s. 6d. Cambridge University Press, 1904-5.

## REVIEWS AND NOTICES OF BOOKS.

Forest Entomology. By A. T. GILLANDERS, F.E.S., Wood Manager to the Duke of Northumberland. xxii+422 pp., including Index. 351 Illustrations. Blackwood & Sons, Edinburgh, 1908. Price 15s.

Some years ago, at one of the dinners of the Royal Scottish Arboricultural Society, the cover of the menu card, skilfully drawn, showed a German forester driving injurious insects out of his wood at the sword's point, a British forester being depicted lying asleep and unconcerned while the insects attacked his trees. If the artist wished to convey the lesson that more took place in the wood while the forester slept than the "growing of the tree" in the Society's motto, and that it behoved the forester to be on the alert against insects, we can declare, with perfect certainty, that the reproach has lost much of its point, for the importance of the study of Forest Entomology is now widely recognised. That our foresters only need some encouragement to make good use of their opportunities has been well proved true by numerous and useful notes and articles on entomological subjects which have recently appeared in the Transactions of the Society. And now we have, in this book of Mr Gillanders, the latest proof of the advantage of, and interest in, the subject of Forest Entomology.

Chapter I. gives a résumé of the Eriophyidæ or Gall Mites, the various species of importance in Forestry being described in detail. The next two chapters treat of the Beetles, these extending, as the importance of the order warrants, to almost one hundred pages. Chapter IV. treats of Oak Galls, and Chapter V. of other harmful Hymenopterous Insects—the Sawflies and the Wood Wasps. Chapter VI. treats of Scale Insects; Chapter VII. of Moths; Chapter VIII. of Aphididæ; Chapter IX. of Diptera; Chapter X. of Psyllidæ and Cicadidæ; while concluding chapters give hints on collecting, on Insecticides and on Beneficial Insects.

In each case abundant detail is set forth. The student of forest entomology, and especially the working forester, will find in the book a mass of material largely drawn from the eminent authors cited, whose works are not always easily accessible, while he cannot fail to be impressed with the enthusiasm of the author for his subject, and with the assiduity and industry he has displayed in the production of his book. To break ground in Britain with a new text-book on Forest Entomology was no easy task. Mr Gillanders deserves, and will receive, the warmest acknowledgment of his efforts. The book is illustrated with numerous figures, some of them very good. To say that Messrs Blackwood are the publishers is to say that nothing is wanting in the get-up.

Trees and Their Life-Histories. By PERCY GROOM. London: Cassell & Co. Price 25s. net. With 512 Illustrations.

This book forms a most welcome addition to the literature of Forest Botany. The author has been very successful in his endeavour to place before the reader a simple and clear account of the life and growth of the various forest-trees with which he deals. The volume is lavishly illustrated by typical and well-chosen photographs showing the trees as they appear at different seasons of the year, and also the characteristic features of their various parts, such as bud, flower, fruit, leaf, twig, root, and bark.

The trees dealt with are treated under the two classes Gymnospermæ and Dicotyledones. In his Introduction Professor Groom has given a very interesting organographical description of the different parts which compose the tree. He has evidently taken pains to write this Introduction in such a way that the non-botanical reader might have no difficulty in understanding clearly, and appreciating the importance to the tree of its various organs, and thus to profit by what follows. In the other two parts of the volume the individual life-histories of the two great classes of trees are given. In describing the special life-history of each tree, no point of importance has been omitted, and the written account, together with the photographs given to illustrate the various points, present to the student a complete picture of the different phases through which the tree passes in its growth

and development from the embryo to maturity. Of course, in a book of this size it is impossible to include all known species, but the author has made a judicious selection of the trees most likely to be met with in our various forests and parks.

The author has never lost sight of the fact that the living tree is the object upon which the reader's attention must be focussed, and this he has succeeded in doing in a very successful manner.

We can confidently recommend this book to all who are interested in trees.

Webster's Foresters' Pocket Diary (Sixth Edition) for 1908, for the use of Foresters, Estate Agents, Nurserymen. 2s. 6d. net. London: William Rider & Son, Ltd.

The present issue of this little pocket-book, which is of a convenient size and made of good paper, shows the same features as former editions, and has also some new articles in the introductory portion. These include some Tables useful to foresters, a note on the Area of Woodlands in Great Britain and Europe, some statistics in regard to the Average Prices of Home-grown Timber, and so forth. The present issue is likely to prove as useful to foresters as have the former editions.





# Royal Scottish Arboricultural Society.

## Instituted 16th February 1854.

PATRON.

HIS MOST EXCELLENT MAJESTY THE KING.

## PROCEEDINGS IN 1907-Continued.

## THE GENERAL MEETING.

The General Meeting of the Royal Scottish Arboricultural Society was held in the General Meeting Room in the Highland and Agricultural Society's Showyard, Prestonfield, Edinburgh, on Thursday, 11th July 1907, at 11.30 A.M. In the unavoidable absence of Sir Kenneth Mackenzie, Bart., President of the Society, Sir John Stirling-Maxwell, Bart., Vice-President, occupied the Chair. There was a large attendance of Members.

#### MINUTES.

The Minutes of the Annual Meeting, which had been printed and circulated amongst the Members along with the *Transactions*, were held as approved.

#### CHAIRMAN'S REMARKS.

The Chairman said that all the Members would regret to hear that the cause of the President's absence was the illness of his daughter, and that he was sure they would authorise him to write to the President expressing their sympathy with him in the circumstances. He was also confident that the

Members would join with him in thanking the Highland and Agricultural Society for the grant of £20 which they had given for prizes for timber exhibits, for the free space which they had given to the Society, and for the use of the room for the present meeting. The Society's Exhibition was not on a very large scale, but it was a very interesting one, and represented the nucleus of what would be a very large development on the same lines as the years went past. The number of estates in Scotland which cared to compete was small, but was increasing, and as time went on there was no doubt the Exhibition would become one of considerable national importance.

### ELECTION OF HONORARY MEMBERS.

On the motion of the Chairman, the following were elected Honorary Members of the Society, as recommended by the Council, viz.:—(1) Frederick Simmonds, M.V.O., 16 Abingdon Court, Kensington West, late Deputy Surveyor of Windsor Parks and Woods; and (2) The Right Honourable Lord Castletown of Upper Ossery, K.P., C.M.G., Granston Manor, Abbeyleix, Ireland, President of the Irish Forestry Society, and Chancellor of the Royal University of Ireland.

#### INVERNESS BRANCH.

It was reported that, in terms of the requisition referred to in the last Annual Report of the Society, a meeting of the Members residing in Inverness district had been held in Inverness on 4th May 1907, which was attended by the President, the Honorary Secretary, and the Secretary on behalf of the Council, when the Branch was duly constituted, and the following Office-Bearers were elected:—President—Mr J. Grant Thomson, Wood Manager's Office, Seafield Estates, Strathspey. Vice-Presidents—Lord Lovat and Brodie of Brodie. Committee—James Gossip, Nurseryman, Inverness; Donald Robertson, Forester, Dunrobin; Daniel Scott, Forester, Darnaway; James Walker, Wood Merchant, Inverness; Gilbert Brown, Forester, Beaufort; and John J. R. Meiklejohn, Factor, Novar. Hon. Secretary and Treasurer—Alex. Fraser, Solicitor, Inverness.

#### FORESTRY EXHIBITION.

The Secretary then intimated the Judges' Awards in connection with the Forestry Exhibition in terms of the following Report, viz.:—

Report by the Judges on the Forestry Exhibition held within the Highland and Agricultural Society's Show-ground at Edinburgh from 9th to 12th July 1907.

We beg to submit our awards as follows:--

## I. ARTICLES IN COMPETITION.

# Competition No. 1.

For Boards of Scots Pine, Larch, and Norway Spruce.

1st Prize, £2, 10s., The Earl of Mansfield.
2nd Prize, £1, 10s., John A. Stirling of Kippendavie.
3rd Prize, £1, The Duke of Roxburghe.

# Competition No. 11.

For Boards of any three Coniferous Timber Trees other than the above.

1st Prize, £2, 10s., The Earl of Mansfield. 2nd Prize, £1, 10s., H. J. Younger of Benmore.

# Competition No. III.

For Boards of Ash, Oak, and Elm.

1st Prize, £2, 10s., Captain Stirling of Keir.
2nd Prize, £1, 10s.,
3rd Prize, £1,
Sir Duncan E. Hay, Bart. of Smithfield and Haystoun.

# Competition No. IV.

For Boards of any Three Broad-leaved Trees, other than the above.

Ist Prize, £2, 10s., Sir Duncan E. Hay, Bart. 2nd Prize, £1, 10s., The Earl of Mansfield. H. J. Younger of Benmore.

# Competition No. V.

For Specimens of the Fruits of Trees, together with Drawings or Photographs showing the Morphological Structure of Fructification in each particular species.

John Patten, Jun., Hulne Park, No. 1 Silver Medal.

# Competition No. VI.

Damage done by Insect Pests.

The Duke of Roxburghe, . No. 2 Silver Medal.

# Competition No. VII.

Gate for Farm Use manufactured from Home-grown Timber.

The Earl of Mansfield, . No. 1 Silver Medal.

# Competition No. VIII.

Self-closing Wicket-Gate manufactured from Home-grown Timber.

The Earl of Mansfield, . . No. 1 Silver Medal.

# Competition No. X.

Full-sized Section of Rustic Fence made from Larch or other Thinnings.

Alex. Pollock, Tarbolton, Bronze Medal.

# Competitions Nos. XI., XII.

Specimens showing the Comparative Quality of Larch and other Timbers grown on different Soils and Situations, and the respective Ages at which they reach Marketable Size and Maturity.

The Duke of Roxburghe, . No. 1 Silver Medal.

# Competition No. XIII.

Specimens illustrating the Beneficial Effects of Pruning when well done, and the Injurious Effects when badly done.

The Duke of Northumberland, No. 2 Silver Medal.

# Competition No. XIV.

Specimens of Stems illustrating the Effects of Dense and Thin Crops in Branch Suppression, and Quality of Timber.

The Duke of Northumberland, No. 2 Silver Medal.

# Competition No. XV.

Examples showing the Best Methods of Utilising Home-grown Small Wood, to be accompanied by specimens of round wood.

The Earl of Mansfield, . . No. 2 Silver Medal. Alex. Pollock, Tarbolton, . Bronze Medal.

# Competition No. XVI.

Collection of Fungi injurious to Forest Trees and Shrubs.

W. Steuart Fothringham of No. 2 Silver Medal.

# Competition No. XVII.

Examples or Photographs of Damage caused by Squirrels, Voles, etc.

The Duke of Roxburghe, . Bronze Medal.

# Competition No. XVIII.

For any Useful Invention or Marked Improvement on any of the Instruments or Implements used in Forestry.

The Duke of Roxburghe, . No. 1 Silver Medal.

# Competition No. XIX.

For any approved Article either wholly or mainly made of Wood.

William Sinton, Jun., Jedburgh, Bronze Medal. Alex. Pollock, Tarbolton, Bronze Medal.

#### II. ARTICLES FOR EXHIBITION ONLY.

In giving effect to the instructions of the Committee, that in the event of an Exhibit of special merit being brought forward, the Judges may recommend one of the Society's Medals or other Award, we beg to recommend Awards as follows:—

- To Dr A. W. Borthwick, Hon. Cryptogamist to the Society, for his valuable and extensive Exhibit of the Cones and Branchlets of Conifers, dried and mounted in cases; and for his specimens of New and Undetermined Species of Fungi—a Gold Medal.
- To A. T. Gillanders, F.E.S., Alnwick Castle, for his specimens of Plants, Trees, and Timber damaged by Insects, and specimens of the Insects which caused the damage; and for examples of Turf and Soil, illustrating the advantage of pasturing woodland or waste-land by stock, previous to planting—a No. 1 Silver Medal.

- To the Earl of Mansfield, for his specimens illustrating the Rate of Growth of Trees, with statement of Age and Volume per acre; Hunting Wicket-Gate; and a collection of Tools used in Forestry Operations—a No. 1 Silver Medal.
- To Alexander Murray, Forester, Murthly, for his collection of the Seeds and Leaves of 180 varieties of Trees and Shrubs—a No. 2 Silver Medal.
- To Messrs Dicksons & Co., Nurserymen, Edinburgh, for a collection of Tools used in Forestry; collection of Cones; and a collection of Timbers shown as hand specimens—a No. 2 Silver Medal.
- To Adam Spiers, Timber Merchant, Edinburgh, for specimens, in large size and exceptional quality, of Oak, Sycamore, Larch, etc.—a No. 2 Silver Medal.

The Judges have pleasure in reporting that on this occasion the exhibits, both as regards quality and numbers, showed a distinct advancement on most of the Exhibitions preceding it. The quality of the timber in the various Competitions left little to be desired, and the sawing and handling of the boards showed that the Exhibitors had profited by the experience gained at former Exhibitions.

In Competition No. I. the evenness in quality and size of the boards of Scots Pine, Larch, and Norway Spruce had not been excelled at any previous Exhibition, and the Judges had

considerable difficulty in arriving at their decision.

In Competition No. III. the Timber was of excellent quality also, and if a weakness showed at all, it was in the quality of the Ash—a slight tendency towards discoloration

being noticeable in all the specimens.

In Competition No. XVII., although the Photographs of the Forest Tramway and accompanying Report showed no new invention or special improvement on existing appliances of the kind, the Judges, in consideration of the wide applicability of this method of haulage in large forest areas, the value of the Photographs and of the Report, were unanimous in their recommendation of a No. 1 Silver Medal.

In the Classes for Field and Wicket-Gates there was a notable increase in the number of entries, and both as regards design and make up they were of a substantial and serviceable nature. As there is always considerable diversity in the weight of mountings and timbers used in construction, the Judges beg to recommend that in future a detailed account should accompany each exhibit, showing the weight and cost of iron mountings, and of the timber forming the gate and the gateposts, so as to admit of a closer comparison of the cost stated by Exhibitors.

It is to be regretted that landowners and their foresters resident within the Show area should not have taken a greater practical interest in the Exhibition. Every estate cannot possibly be possessed of timber of size and quality sufficient to ensure a high place in the Prize List, but the list of Competitions has been so arranged that all possessed of a desire to help may be enabled to do so. The national aspect of the Exhibition must of course be preserved, but it is especially desirable that each locality should be strongly represented by its own products.

The general arrangement and staging of the exhibits reflected the greatest credit upon the Exhibition Committee, who, ably directed by Mr MacHattie, their Convener, had the exhibits so

placed that the work of the Judges was greatly simplified.

JOHN D. CROZIER.
JOHN BROOM.
S. MACBEAN.

The Secretary reported that the Council had unanimously approved of the Judges' recommendations, and the awards and recommendations were accordingly approved by the Meeting. Mr Johnstone moved the adoption of the Report, and expressed the indebtedness of the Society to the Judges, and also to the Exhibition Committee, to whom, on his motion, a hearty vote of thanks was accorded. The Secretary then moved a vote of thanks to Mr Pollock for so kindly granting the use of one of his rustic houses for an office during the Exhibition. He also mentioned all those who had sent articles for exhibition, but had obtained no award, and particularly referred to Mr Weale, whose collection of Photo-Micrographs had carried off the Society's Gold Medal last year, and to Mr David W. Thomson, Nurseryman, Edinburgh, who so kindly sent the ornamental trees and shrubs.

# JUDGES' REPORT ON ESSAYS.

The Report of the Judges on the Essays received in Competition was given by the Secretary as follows, viz.:—

#### CLASS I.

(1) The Best Method of Disposing of Refuse Wood after Felling.

Award—Bronze Medal, to WILLIAM HALL, The Terrace, Tockwith, near York.

(2) Hedge Laying.

Award—Bronze Medal, to William Hall, The Terrace, Tockwith, near York.

(3) The Laying Out of a Mixed Plantation, and its Management for the next Twenty-five Years.

Award—No. 1 Silver Medal, to W. H. Whellens, Gregynog, Newton, North Wales.

(4) Collection of Ten Notes of Silvicultural Interest.

Award—No. 2 Silver Medal, to Thomas Hall, Moore Abbey, Monasterevan, Co. Kildare.

#### Class II.

(1) The Nursery Treatment of the Western or Californian Hemlock Spruce (*Tsuga Mertensiana*), with Notes on its Suitability for use as a Forest Tree.

Award—No. 2 Silver Medal, to J. M. Murray, Assistant Forester, 26 Colville Place, Edinburgh.

The Report was approved. Mr Massie moved a hearty vote of thanks to the Judges for their trouble in connection with the Essays, which was duly responded to.

# Excursion 1907.

Mr Buchanan, Convener of the Excursion Committee, reported that a considerable number of names had already been entered for the forthcoming Excursion, and that he hoped a good representation of all classes of Members would visit Strathspey next month. He said that three places had been mentioned for the Excursion next year, viz.—Germany, Lochiel's country, and the Edinburgh district, and that the Council had unanimously agreed to recommend the Edinburgh district, in view of the fact that the Scottish National Exhibition is to be held in Edinburgh next year. He moved that they decide on the Edinburgh district, and this was unanimously agreed to. The date of the Excursion was then considered. Mr Whitton pointed out that the date usually fixed on interfered with the work of foresters and gardeners immediately previous to the 12th of August, while, again, the middle of July was unsuitable owing to the Highland Show. It was ultimately agreed that each Member should send his views on the subject to the Secretary.

# SCOTTISH NATIONAL EXHIBITION, 1908.

Mr W. H. Massie, Convener of the Committee on this Exhibition, which is to be held in Edinburgh next year, said that the Council of the Society thought it advisable to take advantage of the opportunity of bringing the interests of forestry before the public at the Exhibition. The Committee had had a meeting with the Manager, who led them to understand that the Exhibition authorities would be only too pleased to give the Society a place. The Council had asked all the Members in their recent circular to intimate what exhibits they were likely to send, and after the replies had been received, they would know what course to pursue.

#### NEWLY DISCOVERED FUNGI.

The CHAIRMAN mentioned that Dr Borthwick's exhibit included three newly-discovered fungi, and, at his request, Dr Borthwick explained these to the meeting. The President thanked Dr Borthwick for his interesting statement.

#### DR Somerville's Address.

The Secretary explained that, owing to an unavoidable cause, Dr Somerville was prevented from attending the meeting and delivering his address on "Heredity and Forestry," but that he had sent his MS., which would be read by Dr Borthwick. Dr Borthwick then read the address, which it was agreed should be printed in the *Transactions*.

Mr Charles Buchanan said the Members were sorry to know that Professor Somerville had been unable to attend the meeting, but they hoped to have him with them in the course of the forthcoming Excursion, when doubtless there would be an opportunity of talking over the various points raised. He moved that they record their obligation to Dr Somerville for sending his valuable paper, and that the Secretary be instructed to thank him for it. He also moved a hearty vote of thanks to Dr Borthwick for reading the paper to them.

A vote of thanks to the Chairman, proposed by Mr Whitton, closed the proceedings.

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# Royal Scottish Arboricultural Society.

#### SYLLABUS OF COMPETITIONS-1908.

[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 15th May 1908. Each such Essay, Report, Model, or Article must bear a Motto, and be accompanied by a sealed envelope bearing outside the SAME Motto, with the Class to which the Competitor belongs, and containing a CARD with the NAME and Address of the Competitor.

Essays should be written on one side of the paper only; the left-hand quarter of each page should be left as a blank margin. The lines should not be crowded together.

Judges cannot compete during their term of office.

Successful Competitors may have either the medals or their converted values, which are as follows:—Gold, £5; No. 1 Silver, £3; No. 2 Silver, £2; Bronze, 10s.]

The following subjects are named for competition in 1908:—

#### CLASS I .- FOR OPEN COMPETITION.

- I. An account of the Broad-leaved and Coniferous Trees, especially of the more recently introduced Species, which the writer has found from experience to be most suitable as Forest Crops on high and exposed situations. The method under which such a Crop has been raised to be fully described. (Five Guineas offered by W. H. Massie, Esq., of Messrs Dicksons & Co., Nurserymen, Edinburgh.)
- II. Suitability of any exotic Conifer for cultivation as a Forest Crop, and nature of the locality found, in the experience of the writer, to be most suitable for it. (*Five Guineas* offered by DAVID W. THOMSON, Esq., Nurseryman, Edinburgh.)

- III. The relative powers to bear shade of some or all of the following species:—Douglas Fir, Menzies Spruce (Picea sitchensis), White American Spruce, Sequoia Sempervirens, Lawson's Cypress, Abies grandis, Giant Hemlock (Tsuga Mertensiana), Thuya gigantea; and the order in which the above Species should be placed in a list of shade-bearing trees comprising also Silver Fir, Beech, Spruce, Hornbeam. The Report to be based on personal experience only. (Five Guineas offered by John Methven, Esq., of Messrs Thomas Methven & Sons, Nurserymen, Edinburgh.)
- IV. Successful raising, by the writer, or on the Estate with which he is connected, of a Young Forest Crop by the method of "Direct" Sowing. The conditions of Soil and Soil Covering to be fully stated. (A Medal.)
- V. Comparative results obtained by various methods of Planting, with various Species and Sizes of Plants, up to the time at which the Young Plantation has become thoroughly established. (A Medal.)
  - The Report to be based on actual experience; soil and other local conditions to be fully described.
- VI. The use, on an Estate with which the writer is, or has been, connected, of Timber of any British-grown exotic Conifer, for House Carpentry and other Estate purposes. (A Medal.)
  - Besides giving information as to the specific uses to which the timber has been put, the writer should give details, such as the age of the trees from which it was taken, the soil on which they were grown, and whether the trees were raised in the open, or in woods of ordinary density. Statistics to be given, as far as available, of the comparative durability of this timber and the timber of British coniferous trees.
- VII. Details of Measures successfully adopted, on an Estate with which the writer is, or has been, connected, to prevent or mitigate the destructive effects of Gales. (A Medal.)
  - VIII. Successful raising, by the writer, or on the Estate with which he is connected, of a Young Forest Crop in a frosty locality, with details as to Soil Covering, Species, and Measures of Protection adopted. (A Medal.)

- IX. An approved Report on the Woods of which the competitor is Forester. Reporter to state the extent of the woods, the species of trees grown, soil, situation, age, management, etc. (A Medal.)
- X. Successful Under Planting of Larch or other Lightcrowned Species, on an Estate with which the writer is, or has been, connected. (A Medal.)
  - The Report to be based on experience, the cases referred to being cited.
- XI. Details of Measures successfully practised by the writer to exterminate any important Parasitic Fungus, or to mitigate the Damage done by it. (A Medal.)
- XII. Details of Mechanical means employed by the writer, or on the Estate with which he is connected, for moving Timber from the interior of Woods to their margins, or to roads. (A Medal.)
- XIII. The erection and maintenance of a Saw-mill, or any Wood-working Machinery, used by the writer, or on the Estate with which he is connected, for the Manufacture of Timber, with details of outturn and cost. (A Medal.)
- XIV. Details of Measures successfully adopted for the natural regeneration of a timber crop of Scots Pine, Larch, or other species. (A Medal.)
- XV. For an approved Essay on the Botanical characteristics of typical Conifera. The Essay to be accompanied by Illustrations, and to be of an educational character. (A Medal.)
- XVI. For an approved Essay on Soils:—(a) preparation prior to planting; (b) the advantages of soil-protection accruing from density of crop; (c) the improvement to the soil arising from mixing the main crop with various classes of shade bearing trees. (A Medal.)
- XVII. The best collection of ten short Notes of silvicultural interest based on personal observation. (A Medal.)
- XVIII. An approved Essay or Report on any other subject connected with Forestry. (A Medal.)

#### CLASS II .- FOR ASSISTANT FORESTERS ONLY.

- I. Details of the Measures successfully practised by the writer to exterminate any important Insect Pest, or to mitigate the Damage done by it. (A Medal.)
- II. The best collection of five Notes of silvicultural interest based on personal observation. (A Medal.)
- III. An approved Essay or Report, based on personal experience, on any practical work connected with Forestry. (A Medal.)

ROBERT GALLOWAY,

Secretary.

5 St Andrew Square, Edinburgh, October 1907.

# Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

Patron-HIS MOST GRACIOUS MAJESTY THE KING.

# LAWS OF THE SOCIETY.

#### 1. FUNDAMENTAL LAWS.

- I. The name of the Society shall be the "ROYAL SCOTTISH ARBORICULTURAL SOCIETY."
- II. The objects of the Society are,—the advancement of Forestry in all its branches; including the institution of Schools of Forestry and Demonstration Areas, and the dissemination of a knowledge of such branches of Science and Arts as are connected with Forestry. These objects are proposed to be attained—
- r. By holding meetings for discussion and the interchange of information; also for the reading of papers and abstracts or reviews of works bearing upon the objects of the Society.
- 2. By publishing annually, or oftener, *Transactions* and *Proceedings*, and an Abstract of the Accounts and Funds of the Society; also by publishing or circulating periodical or other literature containing information regarding Forestry.
- 3. By contributing to the formation, in Edinburgh or elsewhere in Scotland, of a Museum of British and Foreign Woods, of Forest Produce, and of objects relating to the science and practice of Forestry; also of a Forest Library.

- 4. By encouraging the cultivation of all trees and shrubs which are suitable for the climate of Britain, with the view of facilitating the study of their uses and habits, and their climatic and other requirements.
- 5. By authorising, directing, assisting, and encouraging excursions, exhibitions, experiments, and investigations connected with Forestry or kindred sciences, to be undertaken in any part of Britain or abroad.
- 6. By appointing Correspondents residing abroad; and by appointing Local Secretaries in suitable home districts from amongst the Members of the Society, to co-operate with the Secretary and Officials in Edinburgh in the interests of the Society.
- 7. By advising and consulting with, or assisting financially or otherwise, any organised body giving instruction in Forestry on an approved method; by taking an active interest in examinations in Forestry, and by offering in competition bursaries to Forestry Students.
- 8. By establishing, in such centres as the Council may approve, Local Branches for the purpose of promoting the objects of the Society, upon such conditions as to Membership and otherwise as the Council may from time to time determine.
- 9. By keeping a Register of men qualified in Forestry, or in forest and estate Management, and by introducing such to employers.
- 10. By any other means that the Council may deem necessary or expedient from time to time.
- III. The Society shall consist of three Orders, viz.: Honorary Members, Ordinary Members, and Honorary Associate Members. 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:—

- Proprietors the valuation of whose land exceeds £500 per annum, and others, subscribing annually . One Guinea.
   Proprietors the valuation of whose land does not exceed
- £500 per annum, Factors, Nurserymen, Timber Merchants, and others, subscribing annually . Half-a-Guinea.
- Foresters, Gardeners, Land-Stewards, Tenant-Farmers, and others, subscribing annually . . . Six Shillings.
- 4. Assistant-Foresters, Assistant-Gardeners, and others, subscribing annually . . . . . Four Shillings.
- IV. Subscriptions are due on the 1st of January in each year, and shall be payable in advance. A new Member's subscription is due on the day of election, unless otherwise provided, and he shall not be enrolled until he has paid his first subscription.
- V. Members in arrear shall not receive the *Transactions*, and shall not be entitled to vote at any of the Meetings of the Society. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.
- VI. Any eligible person may become a *Life* Member of the Society, on payment, according to Class, of the following sums:—
- VII. Any *Ordinary* Member of Classes 1, 2, and 3, who has paid *Five* Annual Subscriptions, may become a *Life* Member on payment of *Two-thirds* of the sum payable by a *new* Life Member.
- VIII. All Annual Subscriptions and payments for Life Membership shall be paid direct to the Treasurer.

IX. The Society may, on the recommendation of the Council, elect Twelve British Honorary Members (including Indian and Colonial) and Twenty Foreign Honorary Members,—persons who have acquired eminence in Forestry at home or abroad, or who are otherwise deemed worthy. The Society may also, on the recommendation of the Council, elect Honorary Associate Members; but an Honorary Member or an Honorary Associate Member, who has not been elected from the list of Life or Ordinary Members of the Society, shall not be eligible for election as an Office-Bearer in the Society, and shall not vote at any of its meetings.

X. The Society may accept, from time to time, donations to its Property and Funds, Library and Museum, also Premiums to be awarded for the furtherance of any of its objects.

XI. The Funds of the Society shall, with the concurrence of the Council for the time being, be invested in such Trust security or securities as they shall approve, and shall be held in the names of three Trustees for behoof of the Society.

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

XIII. The Council, by a two-thirds majority, and with the approval of the President, shall have power to expel any Member for any cause which shall appear to a meeting of the Council to require such action; it shall not be necessary for the Council to assign any reason for such expulsion, and all persons so expelled shall thereupon cease to be Members, and to have any interest in the Society or its concerns.

XIV. The affairs of the Society shall be conducted by a President, six Vice-Presidents and twenty-one Councillors, with Secretary, Treasurer, and Auditor; provided always that nothing herein contained shall prevent the same person being appointed both Secretary and Treasurer. The President, Two Senior Vice-Presidents, Seven Senior Councillors, Secretary, Treasurer, and Auditor shall retire annually; but the President, one of the retiring Vice-Presidents, and four of the retiring Councillors, the Secretary, Treasurer, and Auditor shall be eligible for re-election. The other vacancies shall be filled by the election of eligible Members of the Society. Every member who has filled the office of President shall be eligible for election by the Council as an Honorary Life Member of the Council.

XV. The Annual Business Meeting of the Society shall be held at such time and place as the Council may determine, for the election of Office-Bearers, the hearing of the Secretary's, Treasurer's, and Auditor's Reports, and the transaction of other appropriate business. At this Meeting the following Honorary officials may be elected, viz., Honorary Secretary, Honorary Editor, Honorary Consulting Botanist, Honorary Consulting Chemist, Honorary Consulting Cryptogamist, Honorary Consulting Entomologist, Honorary Consulting Geologist, and Honorary Consulting Meteorologist. The Honorary Secretary and the Honorary Editor shall be members of the Council *ex officio*.

XVI. A General Meeting of the Society shall also be held in the course of each year—the time and place to be fixed by the Council—at which necessary business shall be transacted, and Subjects approved by the Council may be discussed. It shall be in the power of the President, or in his absence of the Senior Vice-President, to convene a Special General Meeting of the Society at any time, and the Council shall have power to call other General Meetings from time to time as occasion may require.

XVII. An Extraordinary General Meeting of the Society may be called at any time, upon ten days' notice, by authority of the Council, on the requisition of Forty Members of the Society, who shall state precisely the objects for which they wish such Meeting to be summoned. The Special Business to be brought up shall be stated in the billet calling the Meeting, and it shall not be competent to introduce or discuss any other subject or business at such Meeting. Such Special Business shall not be considered as approved by the Society until the same shall have been confirmed by a two-thirds majority of the Members present and voting at the next Annual Business or General Meeting.

XVIII. The Council shall have the right at any time to claim a vote of the entire Membership of the Society on any subject brought before any Meeting of the Society.

XIX. At Meetings of the Society, no Motion or Proposal (except of mere form or courtesy) shall be entertained for immediate consideration, unless notice thereof has been given fourteen days previously to the Council; without prejudice, however, to the competency of proposing to remit such Motion or Proposal to the Council for consideration, with a view to its being disposed of at a future Meeting.

XX. The Council may appoint Correspondents residing abroad, and Local Secretaries in suitable home districts, but such appointments must be confirmed at the first General Meeting of the Society held thereafter. These appointments shall not confer a right to vote at any Meeting of the Society or Council.

XXI. Any proposal or motion for the alteration or amendment of the existing Fundamental Laws, or for the enactment of new Laws, shall be intimated in writing at the Annual Business Meeting, or at the General Meeting, but shall lie over for discussion till the next Meeting, which may be held not less than three months after such notice has been given as aforesaid. It shall then be decided on by a

majority of at least two-thirds of the votes of *Life* and *Ordinary* Members present, provided at least thirty Members are present and vote. Such motion shall be clearly stated in the billet calling the Meeting at which it is to be discussed.

XXII. The Council shall have power to make such Rules, Regulations, or By-Laws as they may deem necessary or useful for the regulation of the affairs of the Society; and, from time to time, to vary, alter, or revoke such By-Laws; provided that no By-Law hereafter to be made, and no alteration or repeal of any By-Law, shall be considered to have passed and be binding on the Society until it has been adopted or confirmed, with or without modification, at a Meeting of the Society.

#### 2. BY-LAWS.

- I. At any Meeting of the Society the Chair shall be taken by the President, but in his absence one of the Vice-Presidents or the Senior Member of Council present shall preside. Thirty Members shall form a quorum.
- II. The Chairman shall have a deliberative and a casting vote.
- III. The voting, upon all occasions, except as specially provided for in Laws XVII. and XXI., shall be, in the option of the Chairman, either by a show of hands or numeratim, i.e., the Chairman shall ascertain the majority of the votes of Life and Ordinary Members present.
- IV. In electing Office-Bearers, the Council shall recommend to the Annual Business Meeting the names of Members eligible to fill the vacancies. Such names shall be intimated to each Member in the billet calling the Meeting. It shall, however, be in the option of any Member present, to propose to substitute

any other name or names, in lieu of any of those recommended. In the event of this being done, and a seconder to the new proposal being found, the vote shall be taken, as between the name or names thus proposed, and those proposed by the Council.

V. Any casual vacancy occurring in the list of Office-Bearers may be filled up by the Council, and the Office-Bearer thus elected shall take the place in the list, of the Office-Bearer whose vacancy he fills, and shall retire at the time that the latter would have done. An Office-Bearer who shall not have attended a Meeting of the Council for one year—unless prevented by ill-health—shall be held to have vacated office. Office-Bearers may obtain, on request, repayment of third class railway fares paid by them in attending Council Meetings.

VI. The Council shall have power to make conditions and regulations in connection with Competitions, Exhibitions, Experiments, Investigations, and all other matters undertaken with the view of promoting the objects of the Society; and also power to appoint Committees, Judges, or other Officials in connection therewith, except where otherwise specially provided.

VII. The Council, by a two-thirds majority of its Members present at the Meeting, and with the approval of the President, shall have power to limit the numbers who may attend the Excursions, and to reject any application for admission to these Excursions, without assigning any reason therefor.

VIII. The Judges of essays and other subjects proposed for competition are, during their term of Office, debarred from themselves competing.

IX. Intimation of all papers intended to be brought before the Meetings of the Society must be given to the Secretary, for the approval of the Council, at least one month previous to the Meeting at which they are to be read. Essays and Reports intended for competition, and Specimens, Implements, or other Articles intended for Competition, Exhibition, or Approval, must be submitted to the Society, in such manner and within such time as the Council may from time to time determine.

X. Any Member may transmit to the Secretary papers and communications, which, if approved of by the Council, may be read by the author, or, in his absence, by the President, Secretary, or other official at any Ordinary Meeting of the Society.

XI. Any Member who may be awarded a Medal or Premium by the Society shall have it in his option to receive the value in money or plate; and in the event of his selecting any other article than a Medal, it shall be competent for him to adopt and use upon it the inscription which would have been engraved on the Medal.

XII. The converted values of the Society's Premiums shall be—Gold Medal, Five Pounds; No. 1 Silver Medal, Three Pounds; No. 2 Silver Medal, Two Pounds; No. 3 Silver Medal, One Pound; Bronze Medal, Ten Shillings.

XIII. Local Secretaries shall act in the interests of the Society in their respective districts in securing new Members, and in disseminating information regarding the Society, for which purposes they shall correspond with the Secretary and Officials in Edinburgh; but they shall not be called on to collect the Subscriptions of Members.

XIV. Every Member of the Society shall have the privilege of bringing with him to the Annual Business Meeting of the Society two friends, as Visitors, who shall, however, not be entitled to take any part in the business of the Meeting.

EDINBURGH, 5th February 1908.

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# Royal Scottish Arboricultural Society.

#### Instituted 16th February 1854.

PATRON.

HIS MOST EXCELLENT MAJESTY THE KING.

#### PROCEEDINGS IN 1908.

#### THE ANNUAL MEETING.

The Fifty-fifth Annual General Meeting of the Royal Scottish Arboricultural Society was held in the Goold Hall, 5 St Andrew Square, Edinburgh, on Wednesday, 5th February 1908, at 3 P.M. Sir Kenneth J. Mackenzie, Bart. of Gairloch, President, presided over a large attendance of Members.

#### A POLOGIES.

Apologies for absence were intimated from Sir John Stirling-Maxwell, Bart., Vice-President; Colonel Bailey, Hon. Editor; Mr Sydney J. Gammell of Drumtochty, Vice-President of the Aberdeen Branch; Messrs Robert Allan, James Whitton, John Boyd, J. D. Crozier, Members of Council; and Messrs John D. Sutherland, Oban; J. H. Milne-Home, Irvine House, Canonbie; and Alex. Milne, Nurseryman, Edinburgh.

#### MINUTES.

The CHAIRMAN mentioned that the Minutes of the last Meeting had already been printed and issued to the Members, along with

the *Transactions*, and on his suggestion they were held as read and approved of.

#### LAWS.

The Chairman said that a proof of the revised Laws had been before the Members for a year. One or two suggestions had been submitted to the Council regarding them, and had been carefully considered. He now moved, on behalf of the Council, that the revised Laws and By-Laws, as sent in proof to all Members of the Society, be approved and adopted in place of the existing Laws and By-Laws, subject to the following alterations, viz:—That Clause 7 on page 2, which refers to the acquisition of lands and buildings, should be deleted; that the words "including lands and buildings," in Law XI. page 4, be deleted; and that the word "Trust" be inserted in Law XI. page 4, between "such" and "security," so as to put it beyond doubt that the Society must invest its funds in Trust securities only. Mr M'Hattie seconded the motion, which was unanimously adopted.

# REPORT BY THE COUNCIL.

The Secretary then read the following Report by the Council, viz.:—

# Membership.

The Membership of the Society has been well maintained during the year, although considerable loss has been sustained, as usual, through deaths, resignations, and lapses. Four Honorary Members have died, viz.:—Sir Dietrich Brandis, Professor Gayer, Sir Charles B. Logan, and General Michael. Amongst other Members who have died during the year the following may be mentioned:—Sir George Macpherson Grant, Bart.; Lieutenant-Colonel Innes of Learney; Captain Brodie of Lethen; Mr William Leigh, of Woodchester Park; Mr William Allaway, Edinburgh; Mr Walter Haddon, Hawick; Mr John Horne, Mauritius; Mr W. P. Edwards, S.S.C.; Mr Archibald Lockhart, Huntly; and Dr Buchan, Edinburgh. The total Membership reported at last Annual Meeting was 1159. Since then 132 new Members have been elected (including two Honorary Members), but 79 names have been deleted

from the list owing to the causes mentioned above. The Membership at this time is therefore 1212, made up as follows:—

Honorary Members,			19
Honorary Associate M	lem	bers,	7
Life Members, .			323
Ordinary Members,			863
			1212

## Syllabus and Prizes.

The Syllabus of Competitions for 1907 was issued along with the *Transactions* at the end of December 1906. It included 20 subjects for Essays, for several of which valuable money prizes were offered. Five Essays were received, all of which obtained awards; but it is to be regretted that none of the valuable prizes were competed for. The prizes awarded were—One No. 1 Silver Medal, two No. 2 Silver Medals, and two Bronze Medals. The Syllabus for 1908 was issued along with the *Transactions* at the end of the year.

#### Donors.

The thanks of the Society are again due to Mr W. H. Massie, Mr David W. Thomson, and Mr John Methven, for renewing their offers of prizes for subjects in the present year's Syllabus, and to the Directors of the Highland and Agricultural Society for renewing their grant of £20 for home-grown timber to be exhibited in the Forestry Exhibition in their Showyard at Aberdeen.

#### Editorial Work.

A misunderstanding having arisen between the Honorary Editor and the Assistant Editor regarding the method of carrying on the Editorial work, a special Committee of the Council was appointed to inquire into and report on the matter. The Committee found it necessary to define the duties of the Honorary Editor, the Assistant Editor, and the Secretary, with regard to the *Transactions*, and copies of their allocation of the work was sent to the officials mentioned. Unfortunately the Assistant Editor found himself unable to carry on the duties under the conditions laid down by the Committee, and his resignation was accepted with much regret. A temporary arrangement was then made, under which the allowance, at the rate of £25 per annum, previously paid to the Assistant

Editor, was continued to the Honorary Editor, to enable him to receive assistance, and as this arrangement has worked

satisfactorily, the Council propose to maintain it.

An annual grant of £10 has also been placed at the disposal of the Honorary Editor, to be used, when necessary, to obtain the "Continental Notes," formerly contributed gratuitously by Dr Nisbet, who, the Council regret to report, has found it impossible to continue this work for the Society.

#### Local Branches.

The Aberdeen Branch, recently established, continues to carry on its work in an efficient manner, and it will this year have to undertake most of the responsibility connected with the Society's Exhibition at Aberdeen. A Report from the Branch will be

submitted in the course of these proceedings.

As was reported at the General Meeting in July, a Branch of the Society was established at Inverness on 4th May last. This Branch is to be known as the Northern Branch, and its laws have been submitted to and approved by the Council. A Report from this Branch will also be submitted later, from which it will be seen that it is in a very active and flourishing condition.

The question of the representation of these Branches upon the Council of the Society was raised at last Annual Meeting, and the Council, after carefully considering the matter, decided that at the close of each year the Branches should be asked to send in names to the Secretary, which, with the names submitted by individual members of the Council, would be considered by the Council in making their recommendations of eligible Members to fill the vacancies for the ensuing year. This procedure was followed on the present occasion, and it is hoped that it will work satisfactorily.

# Forestry Exhibition.

The Annual Forestry Exhibition was last year held in Edinburgh, and was visited by His Royal Highness the Prince of Wales, and by a large number of the general public. The Judges' Report, as usual, was printed in full in the proceedings of the General Meeting held at Edinburgh in the course of the Show week, and a Report of the Exhibition will be found on page 90 of Vol. XXI. of the *Transactions*. All the money prizes offered by the Highland Society were awarded, with the exception of the third prize of £1 in Competition No. II. In addition to the money prizes, the following Medals were awarded, viz.:—one Gold Medal, seven No. 1 Silver Medals, eight No. 2 Silver

Medals, and four Bronze Medals. A few of those to whom Medals were awarded exercised their option of claiming their converted value in money. The Exhibition is to be held in Aberdeen this year. The revised Schedules have been issued to the Members, and from these it will be seen that Competitions I., II., III., and IV. for Timber Exhibits have been divided into Open and Local Sections. The Local Section is confined to timber grown within the area of the Show, viz.,—Aberdeen, Banff, and Kincardine. The prizes, amounting to £20, in the Open Section are provided by the Highland and Agricultural Society; and those, amounting to £,9, in the Local Section are offered by this Society. The Members of the Committee are-Mr GAMMELL of Drumtochty: Mr John D. Crozier, Durris; Mr John Clark, Haddo House; Mr Charles France, Aberdeen: Mr G. U. MACDONALD, Peebles: and Mr ADAM SPIERS, Edinburgh.

# General Meeting.

The General Meeting was held in the Highland and Agricultural Society's Showyard at Prestonfield, Edinburgh, in the course of the Exhibition week, when the Judges' Reports on the Exhibition and Essays were submitted, and other business transacted. An address on "Heredity and Forestry" by Dr Somerville, was, in his unavoidable absence, read by Dr Borthwick. A full report of the proceedings was, as usual, printed and bound up with the last part of the *Transactions*.

#### Annual Excursion.

The Annual Excursion, which was well attended, was held in the Strathspey district on the 6th of August and three succeeding days, Elgin being the headquarters. The estates visited were the Seafield Estates (Castle Grant and Abernethy districts), Ballindalloch, Aberlour, Orton, and Gordon Castle. Mr Wiseman's Nurseries at Elgin were also visited. A report of the proceedings was published in the last part of the Transactions. A photograph of the party was taken at Gordon Castle, of which a copy was presented to each Member who contributed to the common purse. On the return of the party, the thanks of the Society were formally conveyed to the proprietors for the privilege of visiting their estates, and for their generous hospitality to the Members. The intimation of the death of Sir George Macpherson Grant was heard with great regret by all the Members of the Society, but especially by those who had taken part in the Excursion, and who had been so kindly received and entertained by him at Ballindalloch. A message

of condolence was sent to his family, and a wreath was forwarded

to be laid on his grave.

At the General Meeting in July, it was decided that next Excursion should be confined to the Edinburgh district, in view of the fact that the Scottish National Exhibition is to be held in Edinburgh this year. No arrangements have yet been made as to the estates to be visited, but an invitation has been received from Messrs Dickson & Co. to visit their nurseries at Craigmillar. A discussion took place with regard to the date usually fixed for the Excursion, and it was decided that Members should send their suggestions on the subject to the Secretary.

#### Scottish National Exhibition.

The Council has arranged that the Society shall have an exhibit of Forestry in this Exhibition, which is to be held in Saughton Park, Edinburgh, from May to October. A suitable space in the North Garden has been allotted to the Society free of charge. On part of it a small pavilion will be erected to receive such of the exhibits as require to be under cover, and the remainder of the space will be available for outside exhibits. An invitation was sent to the Members on 22nd June last asking offers of exhibits, and this invitation has been repeated in the circular calling this Meeting. A number of offers have already been received by the Committee, and they hope that Members will now heartily respond to their appeal. Entry forms may be obtained at this meeting, or on application to the Secretary.

# The Society's Flag.

In connection with the Annual Exhibition, the Council considered it advisable that a flag should be secured for the Society. Designs were submitted by Mr William Calder, Leith, and a red flag with the Society's emblem in the centre was ultimately fixed on, and was used at the Edinburgh Exhibition for the first time. It was also used at the Headquarters in Elgin during the Society's Excursion.

# Library and Museum.

A list of additions to the Library since last Annual Meeting is appended to this Report. (See Appendix H.)

An interesting addition to the Museum has been made by Mr James N. B. M'Donald, formerly of Powerscourt and now

of Point Grey, Vancouver, B.C., consisting of a Siwash or Indian hammer or mallet, axe and chisel and spear point, found

near Fraser River, Vancouver.

The question of a room for the accommodation of the Society's books, papers, etc., is still under the consideration of the Council, and it is hoped that before another year a satisfactory arrangement will have been made with regard to this matter.

# Register of Foresters.

Members are reminded that this Register is now in operation. It is hoped that greater use may be made of the Register by both proprietors and estate men.

#### The Laws.

The revised Laws, which were sent in proof to Members previous to last Annual Meeting, have been passed by the Society at this Meeting, and are therefore in operation. It is proposed that a copy of these Laws shall be included in next part of the *Transactions*, and be thus available to all the Members.

#### Resolution.

The Resolution which was passed at last Annual Meeting, with the reasons adduced in support of it, were duly forwarded by the President to the Secretary for Scotland, and acknowledged

by him.

Since then the Government has purchased the estate of Inverliever in Argyllshire, and on receiving official information regarding this purchase, the Council forwarded the Resolution mentioned below to the Prime Minister, the Secretary for Scotland, the Chancellor of the Exchequer, the President of the Board of Agriculture, and Mr Stafford Howard, Commissioner of Woods, etc., who all sent the usual formal acknowledgments. The Council now begs to submit, for the approval of the Society, the following Resolution passed at their Meeting held to-day, namely:—"The Royal Scottish Arboricultural Society, in Annual Meeting assembled, hereby homologates the Resolution passed by the Council of the Society on 15th October 1907, as follows: 'The Council, while feeling gratified that a beginning in State Afforestation in the Highlands had been made, a policy which they think should be rapidly developed, would reassert their views as to the

pressing need for a Demonstration Forest, and would earnestly repeat their request that the Government should purchase a suitable area, with sufficient timber on it, as indicated in the Departmental Committee's Report, and that this, together with Example Plots in connection with the various centres of forestry instruction, and other educational facilities, should be provided without further delay.' The Society further recommends that a Board of Forestry for Scotland, or a Commission under the Board of Agriculture, should be established to foster and promote State and private afforestation in the country, with special power to survey and indicate all land suitable for afforestation, and should be provided with sufficent funds to carry on its work efficiently."

#### Luncheon.

As in recent years the attendance at the Annual Dinner has considerably decreased, the Council this year decided to arrange for a luncheon instead of a dinner. The attendance at the luncheon to-day would seem to indicate that the change has been a welcome one, and the Council propose, with the approval of the Members, that it should be continued.

#### ACCOUNTS.

The Abstract of Accounts was submitted by Mr METHVEN, Convener of the Finance Committee, who read the Auditor's docquet, and mentioned that the finances of the Society were in a very healthy condition. (See Appendix A.)

#### DUNN MEMORIAL FUND.

Mr METHVEN also submitted the Account of the Dunn Memorial Fund, which showed a balance of £15, 15s. 6d. in hand. (See Appendix B.)

#### Excursion Fund Account.

The Secretary submitted the Account in connection with this Fund for the past year, which, according to the Auditor's docquet, showed a balance in hand of  $\pm 32$ , 6s. 4d. (See Appendix C.)

#### REPORTS FROM LOCAL BRANCHES.

The Reports received from the Aberdeen and Northern Branches were afterwards read by the Secretary. (See Appendices D, E, and F.)

#### CHAIRMAN'S REMARKS.

The Chairman said he had great pleasure indeed in moving the adoption of the various Reports, from which it was evident that the Society was in a prosperous condition. They had increased their Membership by 54, and their income had also been increased by about  $\pounds_{50}$ . He thought that was a very satisfactory state of affairs; he hoped that this progress would be maintained, and that the Society would become a still more powerful body than it was at present. The Reports were adopted.

The President further moved that the Resolution embodied in the Council's Report should be sent in the usual way to the Ministers mentioned above, and this was unanimously agreed to.

#### Office-Bearers.

On the motion of Mr Munro Ferguson, Sir Kenneth Mackenzie was re-elected President for another year.

Sir John Stirling-Maxwell was re-elected a Vice-President; and Mr John Methven, Nurseryman, Edinburgh, and Mr James Johnstone, Alloway Cottage, Ayr, were elected new Vice-Presidents.

Dr Borthwick, Mr Leven, and Mr Annand were re-elected to the Council, and the new Councillors elected were:—Lord Mansfield, Mr Sydney J. Gammell of Drumtochty, Mr Broom, Wood Merchant, Bathgate, and Mr J. W. M'Hattie. The following were re-elected:—Mr Munro Ferguson, Honorary Secretary; Mr R. Galloway, S.S.C., Secretary and Treasurer; Colonel Bailey, Honorary Editor; and Mr John T. Watson, Auditor. Mr Andrew Watt, M.A., F.R.S.E., Secretary of the Scottish Meteorological Society, was elected Honorary Consulting Meteorologist in succession to Mr R. C. Mossman, resigned; and the other Honorary Consulting Officials and

the Local Secretaries were re-elected. (For detailed list of Office-Bearers and others see Appendix G.)

#### ANNUAL EXCURSION.

Mr Charles Buchanan, Convener of the Excursion Committee, said that as the Headquarters this year would be Edinburgh, there were a number of places in the neighbourhood which might be visited, such as Dalkeith, Newbattle, Arniston, Rosebery, Hopetoun, Dundas, Hawthornden, Roslin, and Penicuik, while Whittinghame and Gosford were also within easy reach. A day might also be spent in the public parks and nurseries, and another in the Scottish National Exhibition. The Chairman said he had no doubt that the meeting would be very pleased to leave the matter in the capable hands of Mr Buchanan and his Committee.

#### FORESTRY EXHIBITION IN ABERDEEN.

Mr Adam Spiers reminded the Meeting that Schedules in connection with the Society's usual Exhibition in the Highland and Agricultural Society's Show, which was this year to be held in Aberdeen, had been issued to the Members along with the notice calling the Meeting. He had no doubt the Aberdeen Branch would take the matter up very heartily, and, considering the additional inducements offered this year by providing prizes confined to local competitors, he believed the Exhibition would prove as attractive as any that had yet been held.

#### SCOTTISH NATIONAL EXHIBITION.

Mr Massie, Convener of the Committee in charge of the Society's arrangements for an exhibit of Forestry in this Exhibition, said that very good progress was being made with the arrangements. They had an enthusiastic Committee who were doing excellent work, and he hoped the Members would also give an enthusiastic response to the appeal which had been made for offers of exhibits. They were, however, short of funds, but he was sure he had only to mention that

they had opened a Guarantee Fund, to which they might all be subscribers, to ensure a speedy end to their financial troubles.

This concluded the business part of the proceedings, and on the motion of Mr John Methven, a hearty vote of thanks was accorded to Sir Kenneth Mackenzie for presiding.

#### MR BALFOUR'S ADDRESS.

An address was then delivered by Mr F. R. S. Balfour, Dawyck, Peeblesshire, on the "Trees of Western America," with lantern illustrations, in the course of which he described and showed views of a large number of trees seen by him during an expedition to Alberta and the States of Washington and Oregon last year.

At the close of the lecture, the President said that they had listened to an exceedingly interesting and valuable address, which he had no doubt would be reported in the *Transactions*. On his motion a hearty vote of thanks was accorded Mr Balfour.

# APPENDIX A.—Abstract of Accounts for Year ending 31st December 1907. I.—CAPITAL.

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101 18 9  18 12 4  2 6 0  2 7 4 2  18 12 4  2 6 0	of S			۲.					÷ %				တိ
3. Proportion of Life Members' Subscriptions transferred from Capital, 5. Transactions, etc., sold, 6. Income Tax Recovered, 7	Sum in Deposit Receipt of National Bank of Scotland, Jimited, Sun at credit of Account Current of National Bank of Scotland, Limited, Sum in hands of Treasurer,	Note.—Balance of Revenue as above, Less Balance at debit of Capital as above, Consisting of—	53 16									101 18	3. Proportion of Life Members' Subscriptions transferred from

EDINBURGH, 20th January 1908.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1907, of which the above is an Abstract, and have found them correct. The Securities, representing the Society's Funds as above, have also been exhibited to me. JOHN T. WATSON, Auditor.

#### APPENDIX B.

#### ABSTRACT OF ACCOUNTS

IN CONNECTION WITH

THE MALCOLM DUNN MEMORIAL FUND, 1907.

#### RECEIPTS.

Balance in Bank at close of last Account,	£12	18	6
Dividend on $\pounds$ 100 3 per cent. Redeemable Stock			
of Edinburgh Corporation, payable at Whit-			
sunday and Martinmas 1907, £3, less Tax 3s.,	2	17	0
	£15	15	6

#### PAYMENTS.

Nil.

Balance	carried	forwar	d, be	ing	sum	in			
Nation	al Bank	of Sco	otland	on	Acco	unt			
Curren	t, .	•		•			£15	15	6

Note.—The Capital belonging to the Fund consists of £100 3 per cent. Redeemable Stock of Edinburgh Corporation.

EDINBURGH, 20th January 1908.—Examined and found correct. The Certificate by the Bank of above balance, and Edinburgh Corporation Stock Certificate, have been exhibited.

JOHN T. WATSON,

Auditor.

### APPENDIX C.

### EXCURSION ACCOUNT.

### Abstract of Accounts-January 1907.

Balance brought from last Account,	£30 4	9 16	5
Deduct— Paid to Mr A. D. Richardson sum collected for Photographs, £4 16 0 Auditor's Fee (John T. Watson) 1906, 2 2 0	£35	5	5
	6	18	0
	£,28		_
	£ 20	7	5
Excursion to Strathspey.			
RECEIPTS.			
Contributions to Common Purse, £206, 18., less repayments of 5 deposits of 10s., £203 11 0			
PAYMENTS.			
Grand Hotel, etc., Elgin, and driving			
to Orton, £107 2 3			
Driving— Ballindalloch and Aber-			
lour, 10 0 0			
Grantown and Abernethy			
(two days), 24 10 0			
Railways: Local Journeys-			
Highland, 13 10 0			
Great North of Scotland, 14 17 2			
Photographs— Gordon Castle Group, . 14 2 0			
D'			

3 18 11 Balance carried forward to next Account, being sum in National Bank of Scotland, Ltd., on Account Current, . .

199 12 I

Printing, .

lays, .

Gratuities and Sundry Out-

Edinburgh, 24th January 1908.—Examined with Vouchers and Memorandum Book and found correct. Bank Certificate of above balance of £32, 6s. 4d. also exhibited. John T. Watson, Auditor.

### APPENDIX D.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY (ABERDEEN BRANCH).

Report by the Committee of the Proceedings of the Branch to the Second Annual General Meeting, held at Aberdeen on Saturday, 7th December 1907.

The Membership of the Branch has been slightly increased during the past year, but the Committee wishes to impress on all Members of the parent Society resident in the district, their duty to join the Local Branch of the Society.

One Excursion was held during the summer, on 29th June, to Durris, a report of which will be submitted by Mr Rule. It was considered advisable to hold only this one Excursion, in respect that the Annual Excursion of the Society was this year held partly in the area of the Branch.

The Committee offered prizes to assistant foresters for Essays on forestry subjects, but no advantage has been taken of the offer.

In view of the forthcoming Highland Society's Show at Aberdeen in 1908, the Committee has had under consideration how it could best assist the Forestry Department, and encourage Members to put forward exhibits. With this object the Committee has asked the Council of the parent Society to allocate prizes for exhibits, such as timber, to be confined to specimens from the area of the Show.

The Branch was invited to nominate Members to serve on the Council of the parent Society, and the Committee unanimously recommended Mr Sydney J. Gammell of Drumtochty.

The Committee has decided by ballot that the order of retiral from the Committee should be as follows:—

Those who retire this year—Messrs Crozier, Braid, France, and Michie. These gentlemen are eligible for re-election.

Those who retire next year—Messrs Rule, Bell, Robson, and Duthie.

Those who retire the following year—Messrs Clark, Greig, Hart, and Allan.

The newly-elected Members to be placed at the foot of the list. Since the last Annual Meeting some of the Members have been removed by death, and it is with feelings of deep regret that the Committee have to record the death of Lieut.-Colonel F. N. Innes of Learney, one of the Vice-Presidents, whose great interest in the affairs of the Branch and Forestry in general will not soon be forgotten. Mr Archibald Lockhart, Huntly, has also passed away, and those Members who took part in the Excursion to Huntly last year, must have many happy recollections of his kindness when visiting his firm's saw-mills. Although not so well known to some of the Members, but still a prominent member of his profession in Aberdeen, the name of Mr George Philip, superintendent of Stewart Park, must be added to the death roll of the Branch; and only this week the newspapers have recorded the death of Sir George Macpherson Grant, Bart, of Ballindalloch.

The financial statement of the Branch shows an income of £12, 10s. 9d., including the grant of £5 from the parent Society, and an expenditure of £3, 12s. 7d., leaving a credit balance of £7, 14s. 2d. on the General Account, and a balance of 4d. at the credit of the Excursion to Durris, which, with a balance of £1, 4s. at the credit of the Excursion Fund, makes the total credit balance of the Branch £8, 18s. 6d., and this sum is placed with the Aberdeen Savings Bank.

### APPENDIX E.

# ROVAL SCOTTISH ARBORICULTURAL SOCIETY—ABERDEEN BRANCH.

### STATEMENT OF ACCOUNTS, 1907.

EXPENDITURE.	To Cash paid Wm. Walker & Son,	" Cash paid W. O. Webster & Co., o 11 9	" Cash paid Wm. Mutch, Printer, 0 14 9	" Cash paid postages for the year, 112 7	", Cash paid charge on Mr Galloway's cheque, o o 6	Balance at credit carried to Abstract.					£12 10 9
ui	. 63 0 2	. I 4 0	64 4 2		0 6 23.	0 01 0 .	0	08, . 0 2 0	2 0 0 2	unk Book, . 0 I 7	£12 10 9
INCOME	Balance at credit of General Account,	Balance at credit of Excursion Fund,	Balance at credit at close of last Account, $. \cancel{L}4 + 4 + 2$	By Cash Subscriptions from 49 Members at	Is. each,	" Cash Donation from President,	" Cash Arrears of Subscriptions, 1906, . o 4	" Cash Subscriptions received for 1908, . o	" Cash Grant from parent Society, .	", Cash Savings Bank Interest per Bank Book,	

## EXCURSION TO DURRIS ON 29th JUNE 1907.

	£1 15 9 0 6 2 2 10 0 0 0 9 0 0 4	£4 13 0		£8 18 2 0 0 4	£8 18 6	£7 14 2 1 4 4
EXPENDITURE.	To Cash paid T. N. Clapperton for 39 Lunches at 11d. each,  "Cash paid Craighead & Co., Grocers, , Cash paid Aberdeen Riding Academy, , Cash paid Toll at Park Bridge, , Balance at credit carried to Abstract,		ABSTRACT.	Balance at credit of General Account, Balance at credit of Durris Excursion,	Balance at credit of Branch, (as per Aberdeen Savings Bank Pass Book, No. F 648.)	Being Balance at credit of General Account, , Balance at credit of Excursion Fund,
	£3 8 0 3 0	64 13 0		£I 4 0 0 0 4	£1 4 4	
INCOME.	By Cash from 17 Members for Lunch and Driving at 48. each,		EXCURSION FUND,	Balance at credit for 1906,		

COWIE MAINS, STONEHAVEN, 5th December 1907.—I have examined the foregoing Statement of Accounts for year 1907 of the Aberdeen Branch of the Royal Scottish Arboricultural Society, and have found the same correctly stated and fully vouched. The balance at the credit of the Society at the end of the year, amounting to Eight pounds eighteen shillings and sixpence, JOHN HART, Auditor. is deposited in the Aberdeen Savings Bank,

### APPENDIX F.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY (NORTHERN BRANCH).

Report by the Committee of the Proceedings of the Branch to 31st December 1907.

The Branch was inaugurated on the 4th day of May 1907, at a meeting of the Society held in the Station Hotel, Inverness, presided over by the President, Sir Kenneth J. Mackenzie, Bart. of Gairloch.

Since its inauguration the Branch has held three meetings, consisting of an Excursion to Beaufort on 13th July, an Ordinary Meeting on 28th September, when the President delivered an address, after which the Members visited the Nurseries of Messrs Howden & Co., and an Excursion to Novar on 19th October

Both Excursions were well attended by the Members, and Reports upon them are appended to this minute for the information of the Council of the Society.

The Branch was fortunate enough to receive the permission of the Magistrates and Town Council of Inverness for the use of a room in the Town Hall Building for its meetings, and the thanks of the Branch are due to the Corporation of Inverness for this privilege.

In the District comprising the Branch, consisting of the Counties of Inverness, Elgin, Nairn, Ross and Cromarty, Sutherland and Caithness, there are 76 Members of the Society, and of these 44 have affiliated themselves to the Branch, and several new Members have been elected for the Society, the total Membership of the Branch at the date of the Report being 68. The Committee hopes that all Members of the parent body resident in the district will become Members before the next Annual Meeting.

The income of the Branch to date is £8, 8s., including a grant of £5 from the parent Society, but as by the Constitution and By-Laws of the Branch the first Election of Office-Bearers

under the Rules will not take place till December 1908, a full year's working cannot at the present moment be reported.

With reference to the costs of the Excursions, the Committee desire to record their appreciation of the kindness of the Right Hon. Lord Lovat and of Mr Munro Ferguson of Novar, who so kindly entertained the Members at Beaufort and Novar on their visit to the woods on these estates.

On behalf of the Committee of the Northern Branch of the Society.

ALEX. FRASER, Secretary and Treasurer.

### APPENDIX G.

Office-Bearers for 1908:-

### PRESIDENT.

Sir Kenneth J. Mackenzie, Bart. of Gairloch, 10 Moray Place, Edinburgh.

### VICE-PRESIDENTS.

D. F. MACKENZIE, F.S.I., Estate Office, Mortonhall, Midlothian.

Sir Thomas Gieson Carmichael, Bart. of Castle Craig, Malleny House, Balerno.

W. STEUART FOTHRINGHAM of Murthly, Perthshire.

Sir John Stirling-Maxwell, Bart. of Pollok, Pollokshaws.

JOHN METHVEN, Nurseryman, 15 Princes Street, Edinburgh.

JAMES JOHNSTONE, F.S.I., Factor, Alloway Cottage, Ayr.

### COUNCIL.

JOHN BOYD, Forester, Inverliever, Ford, Lochgilphead.

A. T. GILLANDERS, F.E.S., Forester, Alnwick Castle, Northumberland.

W. H. Massie, Nurseryman, 1 Waterloo Place, Edinburgh.

CHARLES BUCHANAN, Overseer, Penicuik Estate, Penicuik.

JOHN D. CROZIER, Forester, Durris Estate, Drumoak, Aberdeenshire.

W. A. RAE, Factor, Murthly, Perthshire.

James Whitton, Superintendent of City Parks, City Chambers, Glasgow.

ROBERT ALLAN, Factor, Polkemmet, Whitburn.

JAMES COOK, Land Steward, Arniston, Gorebridge.

ROBERT FORBES, Overseer, Kennet Estate Office, Alloa.

SIMON MACBEAN, Overseer, Erskine, Glasgow.

G. U. MACDONALD, Overseer, Haystoun Estate, Woodbine Cottage, Peebles.

GEORGE MACKINNON, Overseer, Melville, Lasswade.

ADAM SPIERS, Timber Merchant, Warriston Saw-Mills, Edinburgh.

Dr A. W. BORTHWICK, Royal Botanic Garden, Edinburgh.

GEORGE LEVEN, Forester, Auchineruive, St Quivox, Ayr.

JOHN BROOM, Wood Merchant, Bathgate.

Sydney J. Gammell of Drumtochty, Countesswells House, Bieldside, Aberdeen.

JOHN W. M'HATTIE, Superintendent of City Parks, City Chambers, Edinburgh.

EARL OF MANSFIELD, Scone Palace, Perth.

JOHN ANNAND, Lecturer on Forestry, Armstrong College, Newcastle-on-Tyne.

### HON. SECRETARY.

R. C. Munko Ferguson, M.P., of Raith and Novar, Raith House, Kirkcaldy.

### SECRETARY AND TREASURER.

ROBERT GALLOWAY, S.S.C., 19 Castle Street, Edinburgh.

### HON. EDITOR.

Colonel F. Bailey, R.E., University Lecturer on Forestry, 7 Drummond Place, Edinburgh.

### AUDITOR.

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

### TRUSTEES.

R. C. Munro Ferguson, M.P., W. Steuart Fothringham of Murthly, and Sir John Stirling-Maxwell, Bart. of Pollok.

### HONORARY CONSULTING OFFICIALS.

- 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, D.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., 13 Archibald Place, Edinburgh.
- Consulting Geologist.—R. CAMPBELL, M.A., B.Sc., Geological Laboratory, University of Edinburgh.
- Consulting Meteorologist.—Andrew Watt, M.A., F.R.S.E., Secretary, Scottish Meteorological Society, 122 George Street, Edinburgh.

### JUDGES AND TRANSACTIONS COMMITTEE.

- Colonel F. Bailey, Lecturer on Forestry, University of Edinburgh (Convener).
- D. F. MACKENZIE, F.S.I., Estate Office, Mortonhall, Midlothian.
- JOHN ANNAND, Lecturer on Forestry, Armstrong College, Newcastleon-Tyne.
- A. T. GILLANDERS, F.E.S., Forester, Alnwick Castle, Northumberland. Dr A. W. Borthwick, Royal Botanic Garden, Edinburgh; and
- The SECRETARY.

### PHOTOGRAPHIC ARTIST.

A. D. RICHARDSON, 6 Dalkeith Street, Joppa.

### LOCAL SECRETARIES.

### Scotland.

Counties.

Counties.	
Aberdeen, .	JOHN CLARK, Forester, Haddo House, Aberdeen.
	JOHN MICHIE, M.V.O., Factor, Balmoral, Ballater.
Argyle,	JOHN D. SUTHERLAND, Estate Agent, Oban.
Ayr,	Andrew D. Page, Overseer, Culzean Home Farm, Ayr.
	A. B. ROBERTSON, Forester, The Dean, Kilmarnock.
Berwick, .	WM. MILNE, Foulden Newton, Berwick-on-Tweed.
Bute,	WM. INGLIS, Forester, Cladoch, Brodick.
	JAMES KAY, Forester, Bute Estate, Rothesay.
Clackmannan,.	ROBERT FORBES, Estate Office, Kennet, Alloa.
Dumbarton, .	ROBERT BROWN, Forester, Boiden, Luss.
Dumfries, .	D. CRABBE, Forester, Byreburnfoot, Canonbie.
,	JOHN HAYES, Dormont Grange, Lockerbie.
East Lothian, .	W. S. CURR, Factor, Ninewar, Prestonkirk.
Fife,	WM. GILCHRIST, Forester, Nursery Cottage, Mount Melville
	St Andrews.
	EDMUND SANG, Nurseryman, Kirkcaldy.
Forfar	T 0 T 01
, ,	JAMES ROBERTSON, Forester, Panmure, Carnoustie.
Inverness, .	JAMES A. GOSSIP, Nurseryman, Inverness.
Kincardine, .	
,	JAMES TERRIS, Factor, Dullomuir, Blairadam.
Lanark,	7 7 7 1 11 75 11
	,,

Moray, . . . . John Brydon, Forester, Rothes, Elgin.
D. Scott, Forester, Darnaway Castle, Fores.

Glasgow.

Perth, . W. HARROWER, Forester, Tomnacroich, Garth, Aberfeldy.

John Scrimgeour, Doune Lodge, Doune.

JAMES WHITTON, Superintendent of Parks, City Chambers,

Renfrew, . S. MacBean, Overseer, Erskine, Glasgow.
Ross, . John J. R. Meiklejohn, Factor, Novar, Evanton.

Miss AMY FRANCES YULE, Tarradale House, Muir of Ord.

Roxburgh, . John Leishman, Manager, Cavers Estate, Hawick.

R. V. MATHER, Nurseryman, Kelso.

Sutherland, . Donald Robertson, Forester, Dunrobin, Golspie.

Wigtown, . James Hogarth, Forester, Culhorn, Stranraer.

H. H. Walker, Monreith Estate Office, Whauphill.

### England.

Counties.

Beds, . . Francis Mitchell, Forester, Woburn.

Berks, . . W. Storie, Whitway House, Newbury.

Cheshire,
 WM. A. FORSTER, Belgrave Lodge, Pulford, Wrexham.
 Devon,
 JAMES BARRIE, Forester, Stevenstone Estate, Torrington.
 Durham,
 JOHN F. ANNAND, Lecturer on Forestry, Armstrong College, Newcastle-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, . John Alexander, 24 Lawn Crescent, Kew Gardens, Surrey.

Professor Boulger, 11 Onslow Road, Richmond Hill, London, S.W.

Notts, . . Wm. Elder, Thoresby, Allerton, Newark.

W. Michie, Forester, Welbeck, Worksop.
Wilson Tomlinson, Forester, Clumber Park, Worksop.

Salop, . Frank Hull, Forester, Lillieshall, Newport.
Suffolk, . Andrew Boa, Agent, Skates Hill, Glemsford

ANDKEW BOA, Agent, Skates Hill, Glemsford. GEORGE HANNAH, The Folly, Ampton Park, Bury St

Surrey, . . Andrew Peebles, Estate Office, Albury, Guildford.

Warwick, A. D. Christie, 16 Oak Tree Lane, Selly Oak, Birmingham.

York, . D. Tait, Estate Bailiff, Owston Park, Doncaster.

### Ireland.

Dublin, . A. C. Forbes, Department of Forestry, Board of Agriculture.

James Wilson, B.Sc., Royal College of Science, Dublin.

Galway, . . Arch. E. Moeran, Palmerston House, Portumna.

Thomas Robertson, Forester and Bailiff, Woodlawu.

King's County, WM. HENDERSON, Forester, Clonad Cottage, Tullamore.

Tipperary, . DAVID G. CROSS, Forester, Kylisk, Nenagh.

### APPENDIX H.

Presentations to the Society's Library since the publication of last List in Volume XX. Part 2.

### Books.

- 1. Trees and their Life-History. By Percy Groom, D.Sc.
- 2. Wald und Forstwirtschaft. By Dr Adam Schwappach.
- 3. Kew Gardens. Bulletin 1907.
- 4. Country Gentlemen's Estate Book, 1907.
- 5. The New Zealand Official Year-Book, 1906 and 1907.

### Societies' Reports, Transactions, Etc.

- 6. Annual Report of the Smithsonian Institution, 1905-1906.
- 7. Transactions of the Highland and Agricultural Society, vol. xix., 1907.
- 8. Journal of the Royal Agricultural Society of England, vol. lxvii.
- The 85th Report of Commissioners of Woods and Forests, London, June 1907.
- 10. Report of the Superintendent of Forestry of Canada, 1906.
- Report of the Chief Conservator of Forests, Cape of Good Hope, September 1906.
- 12. Report of State Forest Administration, South Australia, 1906-07.
- 13. Report of the Pennsylvania Department of Forestry for 1905 and 1906.
- Transactions of the Royal English Arboricultural Society, vol. vii., part 1, 1907.
- 15. Report of the Survey Department, New Zealand, 1906-07.
- 16. Report of the Department of Lands, New Zealand, 1906-07.
- 17. Reports of Experimental Farms for 1906, Canada.
- Transactions and Proceedings of the Perthshire Society of Natural Science, vol. iv., parts 3 and 4, 1905-7.
- Transactions of the Natural History Society of Glasgow, vol. vii., parts 2 and 3, 1903-5.
- 20. Scientific Transactions of the Royal Dublin Society, vol. ix.
  - Economic Proceedings of the Royal Dublin Society, vol. i., parts 9, 10, and 11.
  - Scientific Proceedings of the Royal Dublin Society, vol. xi., Nos. 13-20, 1907.
- Transactions of Massachusetts Horticultural Society, 1906, part 2, and 1907, part 1.
- 22. Journal of Royal Horticultural Society, vol. xxxii.
- Calendar for 1907-08 of Edinburgh and East of Scotland College of Agriculture,

### REPRINTS, ETC.

- Working-Plan for Ardross Woods. By Dr Schlich and R. S. Pearson.
- 25. Forest Garden Guide, Circnehester, 1906. By F. C. M'Clellan.
- A Note on the Duki Fig Tree Borer of Baluchistan. By E. P. Stebbing, F.L.S.
- 27. Bush Fruits. Bulletin No. 56 Department of Agriculture, Canada.
- Bulletin No. 9. Reproduction Series No. 5 of the Lloyd Library, Cincinnati.
- 29. Mycological Notes, Nos. 24, 25, and 26. By C. G. Lloyd.
- 30. The Nidulariaceae or Birds' Nest Fungi. By C. G. Lloyd.
- 31. The Phalloids of Australasia. By C. G. Lloyd.
- 32. Quarterly Journal of the Institute of Commercial Research in the Tropics, 1907.
- 33. The Commercial Possibilities of West Africa. By Viscount Mountmorres.
- 34. Catalogue, Ohio State University, 1907.
- 35. Prospectus of Department of Forestry, Yale University, 1907-08.
- 36. Board of Agriculture Returns and Leaflets.
- 37. Cratægus of Southern Michigan. By C. S. Sargent, 1907.
- 38. Quarterly Journal of Forestry. London.
- 39. Forestry Quarterly. New York.
- 40. Forestry and Irrigation. Washington.
- 41. Journal of the Board of Agriculture of Ireland.
- 42. Journal of the Board of Agriculture. London.
- 43. Skogsvårdsföreningens Tidskrift. Stockholm.
- 44. Tidskrift for Skogbrug.
- 45. Timber Trades Journal. London.
- 46. Journal da Commerce des Bois. Paris.
- 47. Timber News. London.
- 48. Estate Magazine.
- 49. Tropical Life. Monthly.
- 50. Agricultural Economist. London.
- 51. The Indian Forester. Allahabad.
- 52. Revue des Eaux et Forêts. Paris. (By purchase.)
- 53. Allgemeine Forst- und Jagd-Zeitung. ( ,,
- 54. Zeitschrift für Forst- und Jagdwesen. (

### Museum.

- 55. Siwash or Coast Indian Hammer or Mallet.
- 56. Axe and Chisel.
- 57. Spear Point.

All found near Frazer River, Point Grey. Presented by Mr J. N. B. M'Donald.

)



### Royal Scottish Arboricultural Society.

(INSTITUTED 16th FEBRUARY 1854.

### LIST OF MEMBERS, &c.

As at 20th June 1908.

### PATRON.

HIS MOST EXCELLENT MAJESTY THE KING.

### PRESIDENT.

Sir Kenneth J. Mackenzie, Bart. of Gairloch.

### FORMER PRESIDENTS.

Υ	ĸ	A	R	

- 1854-56. James Brown, Deputy-Surveyor of the Royal Forest of Dean. Wood Commissioner to the Earl of Seafield.
- 1857. The Right Hon. THE EARL OF DUCIE.
- 1858. The Right Hon. THE EARL OF STAIR.
- 1859. Sir John Hall, Bart. of Dunglass.
- 1860. His Grace THE DUKE of ATHOLL.
- 1861. JOHN I. CHALMERS of Aldbar.
- 1862. The Right Hon. THE EARL OF AIRLIE.
- 1863. The Right Hon. T. F. KENNEDY.
- 1864-71. ROBERT HUTCHISON of Carlowrie, F.R.S.E.
- 1872-73. Hugh Cleghorn, M.D., LL.D., F.R.S.E., of Stravithie.
- 1874-75. JOHN HUTTON BALFOUR, M.D., M.A., F.R.SS. L. & E., Professor of Botany in the University of Edinburgh.
- 1876-78. The Right Hon. W. P. ADAM of Blairadam, M.P.
- 1879-81. The Most Hon. THE MARQUESS OF LOTHIAN, K.T.
- 1882. ALEXANDER DICKSON, M.D., F.R.S.E., of Hartree, Regius Professor of Botany in the University of Edinburgh.
- 1883-85. Hugh Cleghorn, M.D., LL.D., F.R.S.E., of Stravithie.
- 1886-87. The Right Hon. Sir Herbert Eustace Maxwell, Bart. of Monreith.
- 1888-89. The Right Hon. THE MARQUESS OF LINLITHGOW, Hopetoun House, South Queensferry.
- 1890-93. ISAAC BAYLEY BALFOUR, M.D., Sc.D., F.R.S., Professor of Botany in the University of Edinburgh.
- 1894-97. R. C. Munro Ferguson, M.P.
- 1898. Colonel F. BAILEY, R.E.
- 1899-02. The Right Hon. THE EARL OF MANSFIELD.
- 1903-06. W. STEUART FOTHRINGHAM of Murthly.

Date of HONORARY MEMBERS:

Election.
1886. AVEBURY, The Right Hon. Baron, D.C.L., High Elms, Down, Kent.

1904. BAILEY, Colonel F., R.E., F.R.S.E., Lecturer on Forestry, Edinburgh University, 7 Drummond Place, Edinburgh. (Also Life Member by Subscription, 1887.)

1907. Castletown, Right Hon. Lord, of Upper Ossory, K.P., C.M.G., Granston Manor, Abbeyleix, Ireland.

1901. Gamble, J. Sykes, C.I.E., F.R.S., M.A., ex-Director of the Indian Forest School, Highfield, East Liss, Hants.

1905. Henry, Auguste Edmond, Professor of Natural Science, etc., National Forest School, Nancy, France.

1886. HOOKER, Sir Joseph D., O.M., M.D., K.C.S.I., The Camp, Sunning-dale, Berks.

1886. Johore, The Maharajah of, Johore, Malay Peninsula.

1904. KAY, James, Wood Manager, Bute Estate, Rothesay, Bute. (Elected Ordinary Member in 1867.)

1907. Kumé, Kinya, Chief of the Bureau of Forestry, Department of Agriculture and Commerce, Tokio, Japan.

1904. Mackenzie, Donald F., F.S.I., Estate Office, Mortonhall, Edinburgh.
(Also Life Member by Subscription, 1872.)

1907. MAYR, Heinrich, Dr. Philos. et D. Ec., Professor of Forestry, Munich.

1903. Nilson, Jägmästare Elis, Föreständare 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, Oxford University.

1895. Schwappach, Dr Adam, Professor of Forestry, Eberswalde, Prussia.

1907. SIMMONDS, Frederick, M.V.O., 16 Abingdon Court, Kensington West.

1904. Somerville, Dr William, M.A., D.Sc., D.Ec., F.R.S.E., Professor of Rural Economy, Oxford. (Also Life Member by Subscription, 1889.)

1886. TAKEI, Morimasa, 58 Mikumicho, Ushima, Tokio, Japan.

1904. Thomson, John Grant, Wood Manager, Grantown, Strathspey. (Also Life Member by Subscription, 1855.)

### Date of HONORARY ASSOCIATE MEMBERS.

Election.
1903. Battiscombe, Edward, Assistant Conservator of Forests, Nigeri via
Naivasha, East Africa Protectorate.

1901. BRUCE, William, College of Agriculture, 13 George Square, Edinburgh.

1901. CROMBIE, T. Alexander, Forester, Estate Office, Longhirst, Morpeth. 1902. GILBERT, W. Matthews, The Scotsman Office, Edinburgh.

1902. GILBERT, W. Matthews, The Scotsman Olinee, Edinburgh. 1902. Smith, Fred., Highfield Mount, Brook Street, Macclesfield.

1901. STORY, Fraser, Lecturer on Forestry, University of North Wales, Bangor.

1901. USHER, Thomas, Courthill, Hawick.

### LIFE AND ORDINARY MEMBERS.

\* Indicates Life Member. Italics indicates that present Address is unknown.

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

- 1895. Abbor, Thomas, Forester, Neidpath Castle, Peebles.
- \*1906. ABERGROMBY, Sir George William, Forglen, Turriff.
- 1904. Abernethy, Thomas, Assistant Forester, White Deer Lodge, Welbeck Park, Worksop.
- 1902. ACLAND, Sir Charles Thomas Dyke, Bart., M.A., D.L., etc., Killerton, Exeter.
- \*1900. ADAIR, David Rattray, S.S.C., 19 Castle Street, Edinburgh.
- \*1907. Adair, John Downie, Nurseryman, 75 Shandwick Place, Edinburgh.
- \*1883. Adam, Sir Charles Elphinstone, Bart. of Blairadam, 5 New Square, Lincoln's Inn, London, W.C.
- \*1904. Adams, Joseph Wm. Atkin, Resident Agent, Mill Hill, Middlesex.
- 1906. Adamson, John, Assistant Forester, Chatsworth, Pilsley, Bakewell.
- \*1874. Addington, The Right Hon. Lord, Addington Manor, Winslow, Bucks.
- \*1904. AGNEW, Sir Andrew, Bart., Lochnaw Castle, Strangaer.
- 1903. AILSA, The Marquess of, Culzean Castle, Maybole.
- 1906. AINSLIE, John, Factor, Stobo, Peeblesshire.
- 1902. AINSLIE, Thomas, Glenesk, Penicuik.
- 1902. AITCHISON, William, Assistant Forester, Weirburn Cottage, Grant's House.
- 1907. AITKEN, James, Assistant Forester, Dean Road, Kilmarnock.
- 1907. ALDRIDGE, Arthur, Assistant Forester, No. 1 Arch Grove Villa, Long Ashton, near Bristol.
- 1905. ALEXANDER, Henry, Head Forester, Grimstone Estate, Gilling East, York.
- \*1883. Alexander, John, 24 Lawn Crescent, Kew Gardens, Surrey.
  - 1903: ALLAN, James, Wood Merchant, Bucksburn.
- 1905. ALLAN, James, Forester, Lyde Green, Rotherwick, Winchfield, Hants.
- \*1903. ALLAN, Robert, Factor, Halfway House, Polkemmet, Whitburn.
- 1905. Anderson, Duncan, Assistant Forester, Pierremont Nurseries,
  Darlington.
- 1905. Anderson, George, Forester, Bawdsey Manor, Woodbridge, Suffolk.
- 1907. Anderson, James, Foreman Forester, Woodlawn, Co. Galway, Ireland.
- \*1901. Anderson, Robert, Bailiff, Phenix Park, Dublin.
- 1906. Anderson, Robert, Assistant Forester, Fairnington, Roxburgh.
- 1887. Annand, John F., Lecturer on Forestry, Armstrong College, Newcastle-on-Tyne.

- 1903. ANSTRUTHER, Sir Ralph, Bart. of Balcaskie, Pittenweem.
- 1903. Archibald, John Clark, Head Forester, Eden Hall, Langwathby R.S.O., Cumberland.
- \*1906. ARDWALL, The Hon. Lord, M.A., LL.D., 14 Moray Place, Edinburgh.
- 1898. Armstrong, Thos. J. A., Factor, Glenborrodale, Salen, Fort William.
- 1904. ARNOTT, William, Foreman Forester, Old Scone, Perth.
- \*1883. ATHOLL, His Grace the Duke of, K.T., Blair Castle, Blair Atholl.
  - 1860. Austin & M'Aslan, Nurserymen, 89 Mitchell Street, Glasgow.
- \*1887. BAILEY, Colonel F., R.E., F.R.S.E., Lecturer on Forestry, Edinburgh University, 7 Drummond Place, Edinburgh.
- \*1906. BAIRD, Henry Robert, D.L., J.P., Durris House, Drumoak, Aberdeen.
- \*1896. BAIRD, J. G. A., of Adamton, 89 Eaton Square, London, S.W.
- 1903. BAIRD, William Arthur, of Erskine, Glasgow.
- 1908. BAKER, Guy S., Assistant Conservator of Forests, British East Africa.
- \*1908. BALCARRES, Lord, M.P., Balcarres, Fife.
- \*1884. Balfour of Burleigh, The Right Hon. Lord, K.T., Kennet House, Alloa.
- \*1900. Balfour, Charles B., of Newton Don, Kelso.
- \*1886. Balfour, Edward, of Balbirnie, Markinch, Fife.
- 1906. Balfour, Frederick Robert Stephen, J.P., Dawyck, Stobo, Peeblesshire.
- \*1877. Balfour, Isaac Bayley, LL.D., Sc.D., M.D., F.L.S., Professor of Botany, Royal Botanic Garden, Edinburgh.
- 1892. Ballingall, Niel, Sweet Bank, Markinch, Fife.
- \*1904. BARBOUR, George Freeland, of Bonskeid, Pitlochry.
- 1897. BARCLAY, Robert Leatham, Banker, 54 Lombard Street, London, E.C.
- 1900. BARKER, Arthur, Forester, Limekiln Farm, Coddenham, near Ipswich.
- 1903. BARNES, Nicholas F., Head Gardener, Eaton Hall, Chester.
- 1907. BARR, John, Assistant Factor, Erskine, Bishopton.
- \*1866. BARRIE, James, Forester, Stevenstone, Torrington, North Devon.
- \*1895. BARRIE, James Alexander, Forester, Harlestone, Northampton.
- 1907. Barron, Colin Campbell, Wood and Grain Merchant, Nairn Mills, Nairn.
- \*1889. BARRON, John, Elvaston Nurseries, Borrowash, Derby.
- \*1877. BARRY, John W., of Fyling Hall, Fylingdales, Scarborough, Yorks.
- 1874. BARTON, James, Forester, Hatfield House, Herts.
- 1904. BARTON, James Robert, Factor, 61 Frederick Street, Edinburgh.
- 1908. Banter, James, Gardener, Gorddinog, Llanfairfechan, Carnarvonshire.
- \*1903. BAZLEY, Gardner Sebastian, Hatherof Castle, Fairford, Gloucestershire.
- 1899. Beatson, David J., 68 Southgrove Road, Sheffield.
- 1904. BEAUMONT, Robert, Assistant Forester, c/o Mr Brown, Colliers End, North Ware, Herts.
- \*1897. Begg, James, Rosslyne, Culter, by Aberdeen.
- \*1883. Bell, Andrew, Forester, Forglen, Turiff, Aberdeenshire.

- 1898. Bell, David, Seed Merchant, Coburg Street, Leith.
- 1907. Bell, David, Assistant Forester, Pilsley, Bakewell, Derbyshire.
- 1907. Bell, James, Assistant Forester, Abbeyleix, Queen's County, Ireland.
- 1900. Bell, Robert, Land Steward, Baronscourt, Newtown-Stewart, Ireland.
- 1898. Bell, R. Fitzroy, of Temple Hall, Coldingham.
- 1900. Bell, William, Forester, Balthayock, Perth.
- \*1871. Bell, William, of Gribdae, 181 Queen Victoria Street, London, E.C.
- 1895. BENNETT, J. B., C.E., A.M.I., 42 Frederick Street, Edinburgh.
- 1905. Bennett, John, Forester and Acting Sub-Agent, Town's End, Wolverton, Basingstoke.
- 1903. BENTINCK, Lord Henry, M.P., Underley Hall, Kirkby Lonsdale.
- 1904. BERRY, Charles Walter, B.A., 11 Atholl Crescent, Edinburgh.
- 1889. Berry, Francis, Forester, Minto, Hawick.
- 1903. BEVERIDGE, Erskine, LL.D., of Brucefield, St Leonard's Hill, Dunfermline.
- 1907. BEVERIDGE, James, Assistant Forester, Thoresby Park, Ollerton, Newark, Notts.
- 1903. BINNING, The Lord, Mellerstain, Kelso.
- \*1897. BLACK, Alexander, The Gardens, Carton, Maynooth, Co. Kildare.
- 1908. Black, Florence William, of Kailzie, Peeblesshire.
- 1904. BLACK, John, Factor, Cortachy Castle, Kirriemuir.
- 1908. BLAIR, Charles, Glenfoot, Tillicoultry.
- 1903. BLAIR, Thomas, Farmer, Hoprig Mains, Gladsmuir.
- 1872. Boa, Andrew, Estate Agent, Skates Hill, Glemsford, Suffolk.
- \*1877. Bolckow, C. F. H., of Brackenhoe, Marton Hall, Marton R.S.O., Yorks.
- 1892. Bond, Thomas, Forester, Lambton Park, Fence Houses, Durham.
- \*1895. BOORD, W. Bertram, Land Agent, Bewerley, Pateley Bridge, Yorks.
- \*1898. Borthwick, Albert W., D.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.
- 1906. Bowman, John, Assistant Forester, Kincluny, Durris, Aberdeen.
- 1883. Boyd, John, Forester, Inverliever, Ford, Lochgilphead.
- 1897. Braid, J. B., Forester, Witley Court, Great Witley, Worcester.
- \*1899. Braid, Thomas, Factor, Durris, Drumoak, Aberdeenshire.
- \*1902. Brarb, William Wilson, Tossville, 12 Milton Road, Craigmillar Park, Edinburgh.
  - 1907. BREADALBANE, Marchioness of, Black Mount, Bridge of Orchy, Argyleshire.
- 1907. BRODIE, Ian, of Brodie, Brodie Castle, Forres.
- \*1900. Broom, John, Wood Merchant, Bathgate.
- 1905. Brown, Alexander Shannon, Assistant Forester, 17 Henrietta Street, Kilmarnock.
- \*1900. Brown, Charles, Factor, Kerse, Falkirk.
- 1904. Brown, George, Timber Merchant, Buckhaven Saw-mills, Buckhaven.
- 1905. Brown, George H., Foreman Forester, Liverpool Corporation, Brinscall, Chorley, Lancashire.

1900. Brown, Gilbert, Forester, Kiltarlity, Beauly.

1878. Brown, J. A. Harvie-, of Quarter, Dunipace House, Larbert.

1899. Brown, John, Forester and Ground Officer, Craighall, Rattray, Perthshire.

1893. Brown, Robert, Forester, Boiden, Luss.

\*1896. Brown, Rev. W. Wallace, Minister of Alness, Ross-shire.

1895. Brown, Walter R., Forester, Park Cottage, Heckfield, near Winchfield, Hants.

1900. Brown, William, Forester, Lissadell, Sligo, Ireland.

1905. BRUCE, Alexander, Timber Merchant, 53 Bothwell Street, Glasgow.

1907. BRUCE, Charles, Assistant Forester, Harewood, Leeds.

1901. BRUCE, David, Forester, The Square, Dunnottar, Stonehaven.

\*1895. BRUCE, Peter, Manager, Achnacloich, Culnadalloch, by Connel.

\*1867. BRUCE, Thomas Rae, Old Garroch, New Galloway.

1904. BRUNTON, John, Foreman Forester, Woodville Cottage, Birr.

1907. Bryden, Thomas, Nurseryman, Dennison Nurseries, Ayr.

1897. BRYDON, John, Seed Merchant and Nurseryman, Darlington, Co. Durham.

\*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.

1906. BURNETT, Sir Thomas, Bart., Crathes Castle, Crathes, N.B.

1899. Burn-Murdoch, John, of Gartincaber, Doune.

1904. Butler, Robert, Forester, Chestnut House, Cockerton, near Darlington.

1906. BUTLER, Walter James, Assistant Forester, Mainhouse, Kelso.

1902. CADELL, Henry Moubray, of Grange and Banton, B.Sc., F.R.S.E., F.A.S., J.P., etc., Grange, Bo'ness.

1903. CAIRNS, Thomas, Forester, Lissduff House, Errill, Ballybrophy, Queen's County.

1906. CALDERHEAD, William, Overseer, Eredine, Port Sonachan, Argyleshire.

1905. CALLANDER, Gavin, Wood Merchant, Newton Stewart, Wigtownshire.

1901. CAMERON, Alex., Land Steward, Caledon Demesne, Caledon, Tyrone.

1907. CAMERON, Donald Walter, of Lochiel, Achnacarry, Spean Bridge.

1900. CAMERON, Dr James, The Fountain, Loanhead.

1902. CAMERON, Ewan, of Rutherford, West Linton.

1908. CAMERON, John, Forester, Isel Hall, Cockermouth, Cumberland.

\*1899. Cameron, John J., Norwood, Hamilton.

1904. CAMERON, Robert, Assistant Forester, The Mains, Dundas Castle, South Queensferry.

1907. CAMMACK, John, Hedger, Muirhouse, Falkirk.

1895. CAMPBELL, Alexander, Land Steward, Rosemill Cottage, Strathmartin, by Dundee.

1899. Campbell, Alexander, Tullymully, Dunkeld.

1908. CAMPBELL, A. C. Carter, of Possil, Fascadale, Ardrishaig.

1902. CAMPBELL, Buchanan, W.S., 7 Lansdowne Crescent, Edinburgh.

1904. CAMPBELL, David S., Forester, Wilton Castle, Redcar, Yorks.

- 1905. CAMPBELL, Hugh A., Coachman and Gardener, Cunmont, by Dundee.
- \*1897. Campbell, James Arthur, Arduaine, Lochgilphead, Argyleshire.
  - 1900. CAMPBELL, James S., Forester, Ginsboro Hall, Ginsboro, Yorks.
- 1906. CAMPBELL, John, Land Steward, Forss Estates, Westfield, Thurso.
- 1908. CAMPBELL, Patrick William, of Auchairne, W.S., 25 Moray Place, Edinburgh.
- 1901. CAMPBELL, Peter Purdie, Factor, Lee and Carnwath Estates Office, Cartland, Lanark.
- 1908. CAMPBELL, Robert, B.Sc., Geological Laboratory, Edinburgh University.
- 1903. CANCH, Thomas Richard, B.Sc., P.A.S.I., 15 Riselaw Road, Morningside, Edinburgh.
- \*1903. CAPEL, James Carnegy, 34 Roland Gardens, London, S.W.
- \*1896. CARMICHAEL, Sir Thos. D. Gibson, Bart. of Castlecraig, Malleny House, Balerno.
  - 1906. CARNEGIE, James, of Stronvar. Balquhidder.
- 1907, CARNEGIE, Robert, Assistant Forester, Craigo, by Montrose.
- 1903. CARRUTHERS, Major Francis John, of Dormont, Lockerbie.
- \*1898. Carson, David Simpson, C.A., 209 West George Street, Glasgow.
- 1907. CASSELLS, Andrew, Assistant Forester, Bandon, Balbirnie, Markinch, Fife.
- 1904. CATHCART, Sir Reginald Gordon, Bart., Cluny Castle, Aberdeenshire.
- 1904. CAVERS, A. R. S., Estate Office, Benmore, Kilmun.
- 1904. CHADWICK, Robert, Findhorn House, Forres.
- \*1906. CHALCRAFT, George Barker, C.E., M.Inst.C.E., Swafield House, near North Walsham, Norfolk.
- 1897. CHALMERS, James, Overseer, Gask, Auchterarder, Perthshire.
- 1898. CHALMERS, James, Forester, Estate Office, Killin, Perthshire.
- 1904. CHALMERS, Robert W., Assistant Forester, Auchencrash Cottage, Glenapp Castle, Ballantrae.
- 1892. CHAPMAN, Andrew, Factor, Dinwoodie Lodge, Lockerbie, Dumfriesshire.
- 1892. CHAPMAN, Mungo, Torbrix Nurseries, St Ninians, Stirling.
- 1908. Chernside, Sir Herbert, Newstead Abbey, Nottingham.
- 1906. CHISHOLM, Alexander M'Kenzie, Clerk of Works, Dalkeith Park, Dalkeith.
- 1897. CHISHOLM, Colin, Forester, Lundin and Montrave Estates, Hattonlaw, Lundin Links.
- \*1882. Chowler, Christopher, Gamekeeper, Dalkeith Park, Dalkeith.
  - 1884. Christie, Alex. D., 16 Oak Tree Lane, Selly Oak, Birmingham.
  - 1906. CHRISTIE, Charles, Factor, Estate Office, Strathdon.
- 1906. CHRISTIE, Thomas, Nurseryman, Rosefield Nurseries, Forres.
- \*1883. Christie, William, Nurseryman, Fochabers.
  - 1908. CHRYSTAL, Robert, Assistant Forester, Bowmont Forest, Roxburgh.
  - 1890. CLARK, Charles, Forester, Cawdor Castle, Nairn.
- 1902. CLARK, Francis Ion, Estate Office, Haddo House, Aberdeen.
- 1891. CLARK, John, Forester, Haddo House, Aberdeen.

- 1906. CLARK, John, Forester, Almond Dell, Old Clapperton Hall,
  Midcalder.
- 1892. CLARK, William, 66 Queen Street, Edinburgh.
- 1902. CLARK, William, Assistant Factor, Raith, Kirkcaldy.
- \*1872. CLERK, Sir George D., Bart. of Penicuik, Midlothian.
- \*1902. CLINTON, The Right Hon. Lord, Fettercairn House, Fettercairn.
- 1906. CLYNE, James, Engineer, Knappach, Banchory.
- \*1898. Coats, Sir Thomas Glen, Bart., Ferguslie Park, Paisley.
- 1904. Cobb, Herbert Mansfield, Land Agent, Higham, Rochester, Kent.
- 1896. Cockburn, Alex. K., Assistant Forester, 51 High Street, Peebles.
- 1906. Cocker, Alexander Morrison, Nurseryman, Sunnypark Nursery, Aberdeen.
- \*1904. COKE, Hon. Richard, Holkham, Norfolk.
  - 1906. COLEBROOKE, Lord, Glengonnar, Abington, Lanarkshire.
  - 1906. Coles, Walter G., Engineer, 122 George Street, Edinburgh.
- 1900. Collie, Alexander, Head Forester, Cholmondeley, Malpas, Cheshire.
- 1907. COLLIER, James, Assistant Forester, Estate Yard, Woodlawn, Co. Galway.
- \*1879. Colquhoun, Andrew, 75 Buchanan Street, Glasgow.
  - 1908. Colston, William G., Estate Clerk, Rossie Estate Office, Inchture.
  - 1908. COLTMAN, William Hew, J.P., B.A., Barrister, Blelack, Dinnet, Aberdeenshire.
  - 1907. COMRIE, Patrick, Land Agent, Waterside, Dalry, Ayrshire.
  - 1905. COMRIE, William Lewis, Factor, Cally Estates Office, Gatehouse.
- 1895. Connor, George A., Factor, Craigielaw, Longniddry.
- \*1887. Cook, James, Land Steward, Arniston, Gorebridge, Midlothian.
  - 1906. Cook, Melville Anderson, Assistant Forester, Glamis, Forfarshire.
- 1904. COUPAR, Charles, Assistant Forester, Rose Cottage, Achnacarry, Spean Bridge.
- \*1897. COUPAR, Wm., Overseer, Balgowan, Perthshire.
- 1908. COUTTS, Wm., Forester, Gardener, and Ground Officer, Learney, Torphins, Aberdeen.
- \*1908. Cowan, Alexander, Valleyfield, Penicuik.
- \*1876. Cowan, Charles W., of Logan House, Valleyfield, Penicuik.
- \*1892. Cowan, George, 1 Gillsland Road, Edinburgh.
- 1858. Cowan, James, Forester, Bridgend, Islay, Argyleshire.
- 1899. Cowan, Robert, Chisholm Estates Office, Erchless, Strathglass.
- \*1901. Cowan, Robert Craig, Craigiebield, Penicuik.
- \*1874. COWPER, R. W., Gortanore, Sittingbourne, Kent.
- \*1904. Cox, Albert E., of Dungarthill, Dunkeld.
- \*1904. Cox, William Henry, of Snaigow, Murthly.
- 1900. CRABBE, Alfred, Forester, 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.
- \*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.

- 1903. CRANSTOUN, Charles Joseph Edmondstoune, of Corehouse, Lanark.
- 1899. CRERAR, David, Land Steward, Methven Castle, Perth.
- 1898. CRICHTON, William, Manager, Castle Ward, Downpatrick.
- 1907. CRITCHLEY, Edgar Godsell, Solicitor, 29 High Street, Inverness.
- 1903. CROLL, John, of D. & W. Croll, Nurseryman, Dundee.
- 1898. CROMBIE, James, Forester, c/o Mrs Goulder, Fawley, near Henley-on-Thames,
- \*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.
- 1907. CRUICKSHANK, James, Farmer and Hotelkeeper, Port Erroll, Aberdeenshire.
- 1906. Cumming, James, Manager, Glen Grant, Rothes.
- 1900. Cumming, John H., Overseer, Royal Dublin Society, Ball's Bridge, Dublin.
- 1906. CUMMING, William, Nursery Foreman, Burnside Nurseries, Aberdeen.
- \*1901. Cunningham, Captain John, Leithen Lodge, Innerleithen.
- 1898. CUNNINGHAM, George, Advocate, 30 Queen's Gate Terrace, London, S. W.
- \*1893. CURR, W. S., Factor, Ninewar, Prestonkirk.
- \*1884. CURRIE, Sir Donald, K.C.M.G., M.P., of Garth Castle, Aberfeldy;
  4 Hyde Park Place, London, W.
- 1907. CUTHBERTSON, Evan James, W.S., 3 Cumin Place, Edinburgh.
- 1907. Dale, Robert, Assistant Forester, Dean Road, Kilmarnock.
- \*1867. Dalgleish, John G., of Ardnamurchan, Brankston Grange, Stirling.
- \*1906. Dalgleish, Sir William Ogilvie, Bart., Errol Park, Errol.
- \*1900. Dalhousie, The Right Hon. the Earl of, Brechin Castle, Forfarshire.
  - 1908. DALKEITH, The Earl of, Eildon Hall, St Boswells.
- 1901. Dalrymple, Hon. Hew H., Lochinch, Castle Kennedy, Wigtownshire.
- \*1906. Dalrymple, Lord, M.P., Lochinch, Strangaer.
- 1904. DALEYMPLE, The Right Hon. Sir Charles, Bart. of Newhailes, Musselburgh.
- 1901. Dalziel, Henry, Assistant Forester, Cormiston-Towers, Biggar.
- 1905. DAVID, Albert E., Assistant Forester, Pilsley, Bakewell, Derbyshire.
- 1905. DAVID, William J., Assistant Forester, Turgisgreen, Shewfield-on-Lodden, Basingstoke.
- 1908. Davidson, David, Assistant Forester, Indian Head, Sask, Canada.
- 1904. DAVIDSON, James, 12 South Charlotte Street, Edinburgh.
- 1892. DAVIDSON, John, Forester, Dalzell, Motherwell, Lanarkshire.
- \*1892. DAVIDSON, William, Forester, Margam Park, Port Talbot, Wales.
- 1901. DAVIE, George, Overseer, Balruddery Gardens, near Dundee.
- 1904. DAVIE, Thomas, Assistant Forester, c/o Mrs Blair, Main Street, Cumbernauld, Glasgow.
- 1906. Dawson, Herbert Thompson, The Nurseries, Knowsley.
- \*1908. DAWSON, William, M.A., B.Sc.(Agr.), Lecturer on Forestry, Marischal College, Aberdeen.

1904. DENHOLM, John, Timber Merchant, Bo'ness.

- 1907. Denton, Edward George, Assistant Forester, Heckfield, Swallowfield, Berks.
- 1906. Denton, Sydney, Assistant Forester, Bowood, near Calne, Wilts.
- 1906. Dewar, Alex., Factor, Fasque Estates Office, Fettercairn.
- 1902. DEWAR, H. R., Forester, Beaufort Castle, Beauly.

\*1901. DEWAR, John A., M.P., Perth.

- 1905. Dewar, William, Assistant Forester, Fauldsley, Halliburton, Coupar-Angus.
- 1904. Dick, William, Timber Merchant, Hamilton.
- 1908. Dickson, John, Nurseryman, Dalkeith.
- \*1898. Digby, The Right Hon. Baron, Minterne, Cerne, Dorsetshire.
- 1904. Dodds, Thomas, Cashier, Pollok Estate Office, 216 West George Street, Glasgow.
- \*1903. Don, Alex., Namitomba Estate, Zomba, British Central Africa.
- 1901. Donald, James Alexander, Assistant Forester, Cluny Square, Cardenden, Fife.
- 1893. Donaldson, James, Timber Merchant, Tayport, Fife.
- 1907. Donne, Cyril Henry, Land Agent, Moor Park Estate Office, Rick-mansworth, Herts.
- \*1896. Douglas, Alex., Abbey Gardens, Wykeham 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., Forester, Ingleborough Estate, Clapham, Yorks.
- 1903. Dow, Alexander, Forester, Bretby Park, Burton-on-Trent.
- 1898. Dow, Thomas, Forester, Wakefield Lawn, Stony Stratford, Bucks.
- 1904. Drummie, Alexander, Assistant Forester, c/o Mr I. Embleton, Linolds Wood Cottage, Hexham, Northumberland.
- 1900. DRUMMOND, Dudley W., Commissioner, Cawdor Estate Office, Carmarthen, South Wales.
- 1904. DRUMMOND, William, Forester, West Grange, East Grange Station, Dunfermline.
- 1862. Drummond & Sons, William, Nurserymen, Stirling.
- 1907. Duff, John Wharton Wharton, of Orton and Barmuchity, Morayshire.
- 1903. Duff, Mrs M. M. Wharton-, of Orton, Morayshire.
- 1907. Duff, Thomas Gordon, of Drummuir and Park, Banffshire.
- 1907. Duguid, Charles, Head Forester, Philorth, Fraserburgh.
- \*1883. Dundas, Sir Charles Henry, Bart. of Dunira, Crieff.
- \*1872. Dundas, Sir Robert, Bart. of Arniston, Gorebridge, Midlothian.
- \*1895. Dundas, Lieut.-Colonel Robert, Yr. of Arniston, Kirkhill, Gorebridge.
- 1907. Dunglass, Lord, Springhill, Coldstream.
- 1907. Dunlop, George, W.S., 32 Abercromby Place, Edinburgh.
- 1905. DUNSTAN, M. I. R., Principal of South-Eastern Agricultural College, Wye, Kent.

- \*1902. DURHAM, Right Hon. the Earl of, Lambton Castle, Durham.
- 1873. DURWARD, Robert, Estate Manager, Blelack, Dinnet, Aberdeenshire.
- 1900. DUTHIE, James A., of Benjamin Reid & Co., Nurserymen, Aberdeen.
- 1898. EADSON, Thomas G., Forester, Whaley, Mansfield.
- 1885. EDDINGTON, Francis, Overseer, Monk Coniston Park, Lancashire.
- 1906. EDGAR, James, Factor, Poltalloch Estate Office, Lochgilphead.
- 1898. EDMINSON, Wm. D., Tweed View, Berwick-on-Tweed.
- 1904. Edmond, James, Assistant, Wemyss Castle Estate Office, East Wemyss, Fife.
- 1899. EDWARDS, Alex. W. B., Forester, Thirlmere Estate, via Grasmere.
- 1893. ELDER, William, Forester, Thoresby, Ollerton, Newark, Notts.
- 1903. ELGAR, Walter Robinson, Land Agent, Hill House, Sittingbourne.
- 1902. Ellice, Captain Edward Charles, Invergarry.
- \*1899. Ellison, Francis B., Bragleenbeg, Kilninver, Oban.
- \*1904. ELPHINSTONE, The Lord, Carberry Tower, Musselburgh.
- 1901. ELWES, Henry John, F.R.S., of Colesborne, Cheltenham.
- 1901. ERSKINE, Richard Brittain, Oaklands, Trinity, Edinburgh.
- 1898. EWAN, Peter, Assistant Forester, Wood Cottage, Newland Park, Chalfont St Giles, Bucks.
- 1873. EWING, David, Forester, Strichen House, Aberdeen.
- 1904. EWING, Guy, Edenbridge, Kent.
- 1906. FAICHNEY, John, Assistant Forester, Blythswood, Renfrew.
- 1906. FAIRBAIRN, John, Assistant Forester, Softlaw, Kelso.
- 1905. FARAGO, Adalbert, Forest Nurseries and Seed Establishment to His Majesty the Emperor, Zalaegerszeg, Hungary.
- \*1894. FARQUHARSON, James, Forester, Ardgowan, Inverkip.
  - 1899. FAWCETT, Thos. G., Land Agent, Yarm-on-Tees.
  - 1900. Feaks, Matthew, Forester, Benniore, Kilmun.
- 1904. FENWICK, Andrew, Assistant Forester, Kinnaird Mill, Brechin.
- 1903. FENWICK, William, Factor, Darnaway Castle Estates Office, Earlsmill, Forres.
- 1908. FERGUSON, Donald, Joiner and Timber Merchant, Quarry Lane, Lennoxtown.
- \*1900. FERGUSON, James Alex., Ardnith, Partickhill, Glasgow.
- \*1888. FERGUSON, R. C. Munro, M.P., of Raith and Novar, Raith, Fife.
- 1899. FERGUSON, Sir J. E. Johnson, Bart. of Springkell, Ecclefechan.
- 1880. FERGUSSON, Sir James Ranken, Bart., Spitalhaugh, West Linton.
- 1908. FERNIE, Alexander, Head Forester, Hopetoun, South Queensferry.
- \*1907. FERRIE, Thomas Young, Timber Merchant, 69 Buchanan Street,
- \*1901. FINDLAY, John Ritchie, of Aberlour, Aberlour House, Aberlour.
- 1893. FINLAYSON, Alexander, Ancrum Bridge, Jedburgh.
- 1893. FINLAYSON, Malcolm, Solicitor, Crieff, Perthshire.
- 1907. Fish, Andrew, Assistant Forester, Dean Road, Kilmarnock.
- 1869. FISHER, William, Estate Agent, Wentworth Castle, Barnsley, Yorkshire.

- 1899. FISHER, W. R., Assistant Professor of Forestry, 6 Linton Road, Oxford.
- \*1902. FITZWILLIAM, Right Hon. the Earl of, Wentworth, Rotherham.
- 1899. FLEMING, John, Timber Merchant, Albert Saw-mills, Aberdeen.
- \*1906. FLETCHER, J. Douglas, of Rosehaugh, Avoch, Ross-shire.
  - 1890. FORBES, Arthur C., Department of Agriculture, Dublin.
- 1898. FORBES, James, Factor, Blair Castle, Blair Atholl.
- \*1896. FORBES, James, The Gardens, Overtoun, Dumbartonshire.
- \*1878. FORBES, Robert, Estate Office, Kennet, Alloa.
- 1904. FORBES, Robert Guthrie, Forester, Cliff House, Gulworthy, Tavistock, Devon.
- \*1873. FORBES, William, Consulting Forester and Wood Surveyor, Lea Park, Blairgowrie.
  - 1892. FORGAN, James, Sunnybraes, Largo, Fife.
- \*1869, FORGAN, James, Forester, Bonskeid, Pitlochry, Perthshire.
- 1889. FORSTER, William A., Forester, Belgrave Lodge, Pulford, Wrexham.
- 1904. FOSTER, Henry, Assistant Forester, Glenalmond, Methven.
- 1898. FOSTER, James, jun., Kennet Village, Alloa.
- \*1897. FOTHRINGHAM, W. Steuart, of Murthly, Perthshire.
- \*1866. France, Charles S., 13 Cairnfield Place, Aberdeen.
- \*1901. Fraser, Alexander, Solicitor and Factor, Hon. Secretary and Treasurer, Northern Branch, 63 Church Street, Inverness.
- \*1892. FRASER, George, Factor, Dalzell, Motherwell, Lanarkshire.
- \*1902. Fraser, George M., Estancia "La Selmira," Gualeguaychu, Argentine.
- 1898. Fraser, James, Assistant Forester, 10 Woodside Walk, Hamilton.
- \*1899. Fraser, James, Home Steward, Tregothnan, Truro.
- 1895. Fraser, J. C., Nurseryman, Comely Bank, Edinburgh.
- 1905. FRASER, John, Forester, The Little Hill, Leighton, Ironbridge R.S.O., Salop.
- 1901. FRASER, John M'Laren, of Invermay, Forgandenny, Perthshire.
- 1904. FRASER, Peter, Land Steward, Dalguise, Dunkeld.
- 1904. FRASER, Robert A., Cab Proprietor, 3 Sunbury Street, Edinburgh.
- 1907. FRASER, Robert S., Bunchrew House, Bunchrew, Inverness; Ivy House, Comshall, Surrey.
- \*1892. Fraser, Simon, Land Agent, Hutton in the Forest, Penrith.
- \*1907. Fraser, Sweton, Forester, Gallovie, Kingussie.
- 1896. Frater, John, Foreman Forester, Ardross Mains, Alness, Ross-shire.
- 1902. FRATER, John, Head Forester, Ardross Castle, Alness, Ross-shire.
- 1907. Fyfe, Harry Lessels, Assistant Forester, 10 Lilyhill Terrace, Edinburgh.
- 1906. Fyfe, Robert, Assistant Gardener, Durris, Drumoak.
- 1907. Fyffe, Robert Bullett, Factor, Aden Estates Office, Old Deer.
- 1899. Fyshe, Peter, Newtonlees, Dunbar.
- 1904. Galloway, George, Quarrymaster, Roseangle, Wellbank, by Dundee.
- \*1893. Galloway, Robert, S.S.C., Secretary, 19 Castle Street, Edinburgh.

- 1896. GAMMELL, Sydney James, of Drumtochty, Countesswells House, Bieldside, Aberdeen.
- \*1899. GARRIOCH, John E., Factor, Lovat Estates, Beauly.
- \*1907. GARSON, James, W.S., Albyn Place, Edinburgh.
- \*1903. GASCOIGNE, Lieut. Col. Richard French, D.S.O., Craignish Castle, Ardfern, Argyleshire.
- 1898. GAULD, William, Forester, Coombe Abbey, Binley, Coventry.
- 1902. GAVIN, George, Factor, Falkland Estate, Falkland.
- 1900. Gellatly, John, Forester, Newhall, by Penicuik.
- 1897. Gellatly, Thomas, Forester, Hallyburton, Coupar Angus.
- 1906. Gibson, Harry, Assistant Forester, Chatsworth, Pilsley, Bakewell.
- 1903. GIBSON, William, Assistant Forester, Carcary Hill, Farnell, Brechin.
- 1905. GILBERT, Alexander, Assistant Forester, Dalgety House, Donibristle, Aberdour.
- \*1881. Gilchrist, Wm., Forester, Nursery Cottage, Mount Melville, St Andrews.
- 1897. GILLANDERS, A. T., F.E.S., Forester, Park Cottage, Alnwick, Northumberland.
- \*1904. GILLESPIE, David, Advocate, of Mountquhanie, Cupar, Fife.
  - 1894. GILLESPIE, James, Forester, Blairmore, Braco.
- 1894. GILMOUR, Major Robert Gordon, of Craigmillar, The Inch, Midlothian.
- \*1900. GLADSTONE, Sir John R., Bart. of Fasque, Laurencekirk.
- 1906. Glass, James, Forester, Parkhead, Falkirk.
- \*1901. Godman, Hubert, Land Agent, Ginsborough, Yorkshire.
- 1903. Gold, William, Forester, Dellavaird, Auchinblae.
- 1903. GOODAIR, James Stewart, Assistant Forester, Drumtochty, Fordoun.
- 1906. GORDON, Alex. M., J.P., D.L., of Newton, by Insch.
- 1904. Gordon, Frank, Assistant Forester, Dean Road, Kilmarnock.
- 1907. GORDON, John, Shipowner, Nairn.
- 1900. GORDON, Thomas, County Buildings, Edinburgh.
- 1907. GORMAN, Alfred W., Timber Merchant's Clerk, 126 Woodlands Road, Glasgow.
- \*1868. Gossip, James A., of Howden & Co., The Nurseries, Inverness.
- \*1897. Gough, Reginald, Forester, Wykeham, York.
  - 1897. Gow, Peter, Land Steward, Laggan, Ballantrae, Ayrshire.
  - 1897. Gow, Peter Douglas, Farmer, Bonaly, Colinton, Midlothian.
- 1905. Gow, Robert, Head Forester, Appin House, Argyleshire.
- \*1904. Graham, Anthony George Maxtone, of Cultoquhey, Crieff.
  - 1906. GRAHAM, David A., Teacher, 19 St Fillan's Terrace, Edinburgh.
- 1907. GRAHAM, Hugh Meldrum, Solicitor, Inverness.
- 1908. GRAHAM, James, Marquis of, Brodick Castle, Arran.
- \*1884. GRAHAM, Wm., 6 Royal Crescent, W., Glasgow.
- 1905. Graham, William, Assistant Forester, The Bothy, Invertrossachs, Callander.
- 1887. Grant, Alexander, Forester, Rothie-Norman, Aberdeenshire.
- 1867. GRANT, Donald, Forester, Drumin, Ballindalloch, Banffshire.
- 1908. GRANT, Donald, Forester, Fersit, Tulloch, Inverness-shire.

- 1904. GRANT, Ewan S., Foreman Forester, Chatsworth Estate, Bellsy, Rowsley, Derbyshire.
- \*1874. Grant, John, Overseer, Daldowie, Tollcross, Glasgow.
- 1893. GRANT, John B., Forester, Downan House, Drumin, Glenlivet.
- 1907. GRANT, Robert, Muckrach Lodge, Dulnain Bridge, Inverness-shire.
- 1908. Grant, Sir John Macpherson, Bart., Ballindalloch Castle, Ballindalloch.
- 1906. Grassick, William Henderson, Land Steward, Daviot Branch Asylum, Pitcaple, Aberdeenshire.
- 1907. GRAY, Alexander Reith, Merchant, Garthdee House, Cults.
- 1906. GRAY, David, Wheelwright, 270 Great Western Road, Aberdeen.
- 1907. Gray, George, Foreman Forester, Brounshill, Colstoun Estate, Haddington.
- 1903. GRAY, Hon. Morton G. Stuart, of Kinfauns, Perth.
- 1901. GRAY, Major William Anstruther-, of Kilmany, Cupar, Fife.
- 1902. GRAY, Robert, Timber Merchant, Fraserburgh.
- 1902. GRAY, Walter Oliver, Foreman Woodman, Ladykirk, Berwickshire.
- 1908. Gray, William, Assistant Forester, Pitfour Estates, Mintlaw Station, Aberdeenshire.
- 1906. Greig, Robert Blyth, F.H.A.S., F.R.S.E., Marischal College, Aberdeen.
- 1898. GREY, The Right Hon. Sir Edward, Bart., M.P., of Falloden, Chathill, Northumberland.
- 1908. GRIEVE, J. W. A., Indian Forest Service, Branxholm Park, Hawick.
- 1903. GRIFFITHS, Sir Richard Waldie, of Hendersyde Park, Kelso.
- \*1905. Gurney, Eustace, Sprowston Hall, Norwich.
- 1879. HADDINGTON, The Right Hon. the Earl of, K.T., Tyninghame, Prestonkirk.
- \*1900. HALDANE, William S., of Foswell, W.S., 55 Melville Street, Edinburgh.
- 1905. HALL, Thomas, Forester, Moore Abbey, Monasterevan, Co. Kildare.
- 1906. HALL, William, Head Forester, Tockwith, near York.
- 1904. HALLEY, John Y. (of Garvie & Syme), Ironmonger, etc., Perth.
- 1897. HALLIDAY, Geo., Timber Merchant, Rothesay.
- 1901. HALLIDAY, John, Timber Merchant, Rothesay.
- 1907. Hamilton, Andrew, Naval Architect, 124 Shiel Road, Liverpool.
- \*1882. Hamilton, Donald C., Forester, Knowsley, Prescot.
- \*1899. Hamilton, The Right Hon. Baron, of Dalzell, Dalzell House, Motherwell.
- 1897. HAMILTON-OGILVY, H. T. M., of Beil, Prestonkirk, East Lothian.
- 1904. Hancock, Charles, M.A., Barrister-at-Law, Firlands, Grayshott, Hants; 125 Queen's Gate, London, S.W.
- 1892. HANNAH, George, Overseer, The Folly, Ampton Park, Bury St Edmunds, Suffolk.
- 1903. Hannah, Thomas, Forester, Rendelsham Park, Woodbridge, Suffolk.
- 1905. HANSON, Clarence Oldham, Deputy Conservator, Indian Forest Department, Latimer Lodge, Littledean Hill, Newnham, Gloucestershire.

- 1907. HARBEN, Henry Andrade, J.P., Newland Park, Chalfont St Giles, Bucks.
- 1907. HARBOTTLE, William, Assistant Forester, Harewood, Leeds.
- \*1903. HARDIE, David, Factor, Errol Park, Errol.
- 1903. Hardy, Marcel Edgard, Assistant for Botany, University College, Dundee.
- \*1880. HARE, Colonel, Blairlogie, Stirling.
- 1908. HARLAND, Henry, Park Forester, Sutton Coldfield, Warwickshire.
- \*1896. HARLEY, Andrew M., Forester, 19 Great Quebec Street, Marble Arch, London, W.
- 1905. HARROW, R. L., Head Gardener, Royal Botanic Garden, Edinburgh.
- 1897. HARROWER, William, Forester, Garth, Aberfeldy, Perthshire.
- 1897. HART, John, Factor, Mains of Cowie, Stonehaven, Kincardineshire.
- \*1880. HAVELOCK, W. B., The Nurseries, Brocklesby Park, Lincolnshire.
- 1905. HAY, Henry Ferguson, Assistant Forester, Cannon Hill Park, Birmingham.
- 1892. HAY, John, Overseer, Dollars Estate Office, 8 Rennie Street, Kilmarnock.
- 1904. Hay, Sir Duncan Edwyn, Bart. of Haystoun, 42 Egerton Gardens, London, S. W.
- 1906. HAY, Thomas, Head Gardener, Hopetoun House, South Queensferry.
- 1905. HAY, William Black, Assistant Forester, Nursery, Knowsley, Prescot.
- 1896. HAY, Wm. P., Merchant, Rosebank, Loanhead, Midlothian.
- 1889. HAYES, John, Overseer, Dormont, Lockerbie, Dumfriesshire.
- 1869. HAYMAN, John, Glentarff, Ringford, Kirkcudbrightshire.
- 1902. HAYNES, Edwin, Editor Timber Trades Journal, 164 Aldersgate Street, London.
- 1906. HENDERSON, Henry, Overseer, Bantaskin, Falkirk.
- 1907. HENDERSON, John, Assistant Forester, Gateside, Balbirnie, Markinch.
- \*1908. Henderson, John G. B., W.S., Nether Parkley, Linlithgow.
- 1901. HENDERSON, Peter, Factor, Ballindalloch.
- 1893. Henderson, R., 4 High Street, Penicuik, Midlothian.
- 1893. HENDERSON, William, Forester, Clonad Cottage, Tullamore, King's County.
- \*1906. Hendrick, James, B.Sc., F.I.C., Marischal College, Aberdeen.
- 1898. HENDRY, James, 5 Thistle Street, Edinburgh.
- 1908. Henry, Augustine, M.A., etc., Reader in Forestry, 23 Chesterton Road, Cambridge.
- \*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.
- 1907. HILL, Aaron Wylie, of Lemlair, Dingwall.
- 1895. Hill, Claude, of Messrs John Hill & Sons, Spot Acre Nurseries, Stone, Staffordshire.
- 1904. Hill, George, Assistant Forester, Fothringham, Forfar.
- \*1904. Hill, J. Smith, The Agricultural College, Aspatria.

- \*1903. HILL, Robert Wylie, of Balthayock, Perthshire.
- \*1905. Hillier, Edwin L., F.R.H.S., Nurseryman and Landscape Gardener, Culross, Winchester.
- \*1902. HINCKES, Ralph Tichborne, J.P., D.L., Foxley, Hereford
- 1907. HINDS, John, Forester, Stockeld Park, Wetherby, Yorks.
- 1906. HISLOP, Robert, Assistant Forester, Chatsworth, Pilsley, Bakewell.
- 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.
- 1908. Hogg, Alexander, Assistant Forester, Nibbetstane, Durris, Drumoak.
- 1905. Hogg, Richard, Estate Overseer, Glenapp, Ballantrae, Ayrshire.
- \*1905. Holms, John A., Formaken, Erskine, Renfrewshire.
- \*1902. Hood, Thomas, jun., Land Agent, Bogend, Duns.
- \*1871. HOPE, H. W., of Luffness, Drem, Haddingtonshire.
- 1907. HOPKINSON, James Garland, Factor, Drumtochty Estates Office, 11a Dee Street, Aberdeen.
- \*1876. Horsburgh, John, Aberdour House, Aberdour, Fife.
- 1902. Howe, John Arnold, Assistant Forester, Kippendavie, Dunblane.
- \*1905. Hudson, W. F. A., M.A., Lecturer on Forestry, Agricultural College, Glasgow.
- 1876. Hull, Frank, Forester, Lilleshall, Newport, Salop.
- 1905. Hutton, George Kerse, Assistant Forester, Castle Kennedy, Wigtownshire.
- 1906. HUTTON, James, Head Forester, Glendye, Banchory.
- 1905. IMRIE, Charles, Assistant Forester, The Nursery, Knowsley, Prescot.
- 1901. IMRIE, James, Assistant Forester, Knowsley, Prescot, Lancashire.
- \*1884. Inglis, Alex., Greenlaw Dean, Greenlaw, Berwickshire.
- \*1908. Inglis, Alexander Wood, of Glencorse, Loganbank, Milton Bridge.
- \*1904. Inglis, David, Accountant, National Bank, Allanmore, Abbotshall Road, Kirkcaldy.
- 1897. INGLIS, George Erskine, Estate Agent, Campbeltown, Argyleshire.
- 1891. Inglis, William, Forester, Brodick, Isle of Arran.
- 1895. Innes, Alexander, Forester, Drummuir, Keith.
- 1904. Innes, Alexander Berowald, of Raemoir and Dunnottar, Raemoir House, Banchory.
- 1901. INNES, George, Cothall, Altyre, Forres.
- 1906. Innes, James, Wood Merchant, Sundayswells Saw-mills, Torphins.
- \*1906. IRVINE, Alexander Forbes, J.P., B.A.(Oxon.), Drum Castle, Aberdeen.
- 1904. IRVINE, Cosmo Gifford, Assistant Forester, Hollycombe Estate, c/o Mrs Luckins, Wardley Marsh, Liphook, Hants.
- 1901. IRVINE, John, Assistant Forester, Colesborne, Cheltenham, Gloucestershire.
  - 1906. IRVING, James Rae Anderson, Foreman Forester, Dalzell Farm Motherwell.

- 1907. Jack, David, Assistant Forester, Camis Eskan, Helensburgh.
- 1893. Jack, George, S.S.C., Dalkeith, Midlothian.
- \*1906. Jackson, George Erskine, B.A.(Oxon.), W.S., Kirkbuddo, Forfar.
  - 1895. Jamieson, Andrew, Overseer, Carnbroe, Bellshill.
- 1898. Jamieson, James, Forester, Ynyslas, Llanarthney R.S.O., Carmarthenshire.
- 1896. JARDINE, Sir R. W. B., Bart. of Castlemilk, Lockerbie, Dumfriesshire.
- 1907. JERVOISE, Francis Henry Tristram, J.P., Herriard Park, Basingstoke.
- 1904. JOANNIDES, Pericles, Student of Forestry, Willesden, Sporting Club Station, Ramlek, Egypt; and 4 Merchiston Place, Edinburgh.
- 1901. Johnston, Andrew Reid, Assistant Forester, c/o Mrs Vickers, Pilsley, Bakewell.
- 1899. JOHNSTON, Edward, Forester, Dalquharran, Dailly, Ayrshire.
- \*1901. Johnston, James, F.S.I., Factor, Alloway Cottage, Ayr.
- \*1883. Johnston, Robert, Forester, Bon Ryl Estate, Duns, Berwickshire.
- 1907. Johnston, Robert, Forester, Dalkeith Park, Dalkeith.
- \*1907. JOHNSTONE, Richard, Forester, The Glen, Innerleithen.
- 1900. JOHNSTONE, William, Head Forester, Beil, Prestonkirk.
- \*1882. Jonas, Henry, Land Agent and Surveyor, 23 Pall Mall, London, S.W.
- 1902. Jonas, Robert Collier, Land Surveyor, 23 Pall Mall, London.
- 1903. Jones, Ireton Arthur, of Kennick & Co., Delgany Nurseries, Co. Wicklow.
- 1888. JONES, James, Wood Merchant, Larbert, Stirlingshire.
- 1893. Jones, Thomas Bruce, Wood Merchant, Larbert.
- 1867. KAY, James, Wood Manager, Bute Estates, Rothesay.
- 1907. KAY, James, Nursery Station, Indian Head, Sask, Canada.
- 1904. KAY, William, Grain Merchant, Lasswade.
- 1904. Keir, Alexander, Assistant Forester, Seafield Cottage, St Davids, Inverkeithing.
- 1896. Keir, David, Forester, Ladywell, Dunkeld.
- 1906. Keir, James, Forester, Raith, Kirkealdy.
- \*1901. Kennedy, Frederick D. C.-Shaw-, Dyroch, Maybole.
- \*1890. Kennedy, James, Doonholm, Ayr.
- 1906. Kennedy, Stewart Winter, Assistant Forester, Glamis.
- 1899. Kennedy, Thomas, Assistant Forester, Lambton Park, Fence Houses, Durham.
- 1904. KENNEDY, Colonel Watson, Wiveton Hall, Cley, Norfolk.
- 1906. Kennedy, William Gorman, Timber Merchant, 48 West Regent Street, Glasgow.
- 1901. Kent, William, Forester, Burnfoot, Barskimming, Mauchline.
- \*1892. KERR, John, Farmer, Barney Mains, Haddington.
- 1896. Kettles, Robert, Assistant Forester, Craigend, Perth.
- 1907. KIDD, John, Assistant Forester, Heckfield, Winchfield, Hants.
- 1894. Kidd, Wm., Forester, Harewood, Leeds.
- \*1908. Kimmett, John, Forester, The Lodge, Glenstriven, Toward, Argyleshire.
- 1879. KINCAIRNEY, The Hon. Lord, 6 Heriot Row, Edinburgh.
- 1900. King, David, Nurseryman, Osborne Nurseries, Murrayfield.

- \*1906. Kinloch, Charles Y., of Gourdie, by Murthly.
- 1901. KINLOCH, Sir John G. S., of Kinloch, Meigle.
- \*1903. Kinnaird, The Hon. Douglas A., Master of Kinnaird, 10 St James Square, London.
- 1906. KINNEAR, Alexander T., Wood Manager and Forester, Jeaniebank House, Old Scone, Perth.
- 1905. KINROSS, D. A., Farmer, Hillend, Clackmannan.
- \*1898. Kinross, John, Architect, 2 Abercromby Place, Edinburgh.
- \*1902. KIPPEN, William James, Advocate, B.A., LL.B., Westerton, Balloch, Dumbartonshire.
- 1898. KYLLACHY, The Hon. Lord, of Kyllachy, 6 Randolph Crescent, Edinburgh.
- 1907. LAING, John, Wood Merchant, Inverness.
- 1907. LAIRD, Charles, Assistant Forester, Home Farm, Dalzell, Motherwell.
- 1898. LAIRD, James W., Nurseryman, Monifieth.
- 1907. LAIRD, John, Forester, Powerscourt, Enniskerry, Co. Wicklow.
- \*1896. LAIRD, Robert, Nurseryman, 17a South Frederick Street, Edinburgh.
- \*1901. Lamb, Alexander, Overseer, Freeland, Forgandenny.
- \*1894. LAMINGTON, The Hon. Lord, G.C.M.G., Lamington, Lanarkshire.
  - 1899. LAMOND, Alexander, Forester, Freeland, Forgandenny.
- \*1905. LAMONT, Norman, M.P., of Knockdow, Toward, Argyleshire.
- \*1906. LANGLANDS, James H., Cunmont House, by Dundee.
- \*1896. Lansdowne, The Most Hon. the Marquess of, K.G., 54 Berkeley Square, London, S.W.
- 1906. LAUDER, Alexander, D.Sc., Edinburgh and East of Scotland College of Agriculture, 13 George Square, Edinburgh.
- 1901. LAUDER, William, Steward, Summerhill House, Enfield, Co. Meath.
- 1897. LAURISTON, John, Assistant Forester, c/o Mrs Pickering, Holbeck, Woodhouse, Welbeck, Worksop, Notts.
- 1906. LAWSON, William, Assistant Factor, Cromartic Estates, Kildary, Ross-shire.
- 1902. LEARMONT, John, Nurseryman, Larchfield Nurseries, Dumfries.
- 1904. LEES, D., of Pitscottie, Cupar, Fife.
- 1905. Lees, Ernest A. G., Assistant Factor, Durris Estate, by Aberdeen.
- \*1876. Leicester, The Right Hon. the Earlof, Holkham Hall, Wells, Norfolk.
- 1880. Leishman, John, Manager, Cavers Estate, Hawick, Roxburghshire.
- 1908. Leslie, Archibald Stewart, W.S., Factor to Colonel A. G. Leslie of Kininvic, etc., 33 Queen Street, Edinburgh.
- \*1868. Leslie, Charles P., of Castle-Leslie, Glaslough, Ireland.
- \*1893. LEVEN, George, Forester, Auchincruive, Ayr.
- \*1881. LEYLAND, Christopher, Haggerston Castle, Beal, Northumberland.
- 1898. Leys, Wm. B., Forester, Colstoun Old Mill, Gifford, East Lothian.
- 1907. LINDSAY, Hugh, Head Forester, Torwoodlee Estate, Galashiels.
- 1879. LINDSAY, Robert, Kaimes Lodge, Murrayfield, Midlothian.
- 1907. Lindsay, William, of Messrs J. & H. Lindsay, Ltd., Tourist Agents, 18 St Andrew Street, Edinburgh.
- 1905. LOGAN, David, Factor, Saltoun, Pencaitland.

- 1908. Logue, Hugh, Forester, Knockdow, Toward, Argyleshire.
- \*1883. Loney, Peter, Estate Agent, 6 Carlton Street, Edinburgh.
- 1906. LONGMUIR, Alexander Law, Assistant Forester, Denhead, Fern, Brechin.
- \*1881. Lonsdale, Claud, Rose Hill, Carlisle.
- 1908. LOUDON, Thomas, Assistant Forester, Indian Head, Sask, Canada.
- 1907. LOUTIT, Rev. John Smeaton, Minister of Foveran, Manse of Foveran, Aberdeen.
- \*1898. Lovat, The Right Hon. Lord, C.B., D.S.O., Beaufort Castle, Beauly, Inverness.
- \*1880. Love, J. W., c/o Mrs Boyce, Byron Street, St Kilda, Victoria, South Australia.
- \*1875. LOVELAGE, The Right Hon. the Earl of, East Horsley Towers, Woking, Surrey.
  - 1898. Low, James, Forester, Innes Estate, Elgin.
- \*1900. Low, William, B.Sc., Tighnamuirn, Monifieth.
- 1906. LUMSDEN, David, Assistant Forester, Pitkellony Lodge, Muthill, Perthshire.
- \*1891. LUMSDEN, Hugh Gordon, of Clova, Lumsden, Aberdeenshire.
- 1900. LUMSDEN, Robert, jun., 11 Morningside Terrace, Edinburgh.
- \*1875. LUTTRELL, George F., of Dunster Castle, Taunton, Somersetshire.
- \*1900. LYELL, Sir Leonard, Bart. of Kinnordy, Kirriemuir.
- \*1907. M'AINSH, Duncan, Wood Merchant, Crieff.
  - 1906. MACALPINE-LENY, Major R. L., of Dalswinton, Dumfriesshire.
- 1902. MacArthur, William, Assistant Forester, Queen Street, Waddesdon, Aylesbury, Buckinghamshire.
- 1907. M'BAIN, William, Forester, Estates Office, Drumnadrochit.
- \*1892. MACBEAN, Simon, Land Steward, Erskine, Bishopton.
- 1896. M'BEATH, David, Forester, Brinscall, Chorley, Lancashire.
- 1908. M'CALLUM, Alexander, Assistant Forester, East Lodge, Dunira, Comrie, Perthshire.
- 1894. M'CALLUM, Edward, Overseer, Kerse Estate, Falkirk.
- 1903. M'CALLUM, Hugh, Forester, Annandale Estates, Lockerbie.
- 1898. M'CALLUM, James, Forester, Canford, Wimborne, Dorset.
- \*1901. M'CALLUM, Thomas W., Retired Ground Officer, Dailly, Ayrshire.
- 1904. M'CLELLAN, Frank C., Zanzibar Government Service, Pemba, via Zanzibar, East Africa.
- \*1870. M'CORQUODALE, D. A., Bank of Scotland, Carnoustie, Forfarshire.
- 1893. M'COUBRIE, M. S., Land Steward, Tullamore, King's County, Ireland.
- 1899. M'DIARMID, Hugh, Assistant Forester, Courtworth Lane, Wentworth, Rotherham.
- 1900. MACDIARMID, Hugh, Factor, Island House, Tiree, Oban.
- 1904. MACDONALD, Alexander, Factor, Meggernie, Aberfeldy.
- 1907. MACDONALD, Alexander, Farmer, Rhives, Delny.
- 1908. M'Donald, Assistant Forester, Bowmont Forest, Roxburgh.
- 1902. Macdonald, Donald M'Intosh, Assistant Forester, Budby, Ollerton, Newark, Notts.

1901. MACDONALD, Mrs Eleanor E., The Manse, Swinton.

1893. MACDONALD, George U., Overseer, Haystoun Estate, Woodbine Cottage, Peebles.

\*1900. MACDONALD, Harry L., of Dunach, Oban.

\*1894. MACDONALD, James, Forester, Kinnaird Castle, Brechin.

1897. M'DONALD, James N. B., Forest Nursery Station, Indian Head, Sask, Canada.

1903. Macdonald, James Farquharson, S.S.C. and N.P., Kilmuir, Linlithgow.

1895. MACDONALD, John, Forester, Skibo, Dornoch.

1908. M'Donald, John, Foreman Forester, Culzean Estate, Maybole.

1907. M'Donald, Robert Gregor, 3 Mill Road, Nairn.

1907. MACDONALD, T. Martin, of Barguillean, Taynuilt.

1906. MACDONALD, William Kid, Windmill House, Arbroath.

1904. M'Donald, William Yeats, of Auquharney, Hatton, Aberdeenshire.

1894. M'DOUGALL, Alex., Forester, Tuncombe Park, Helmsley R.S.O., Yorks.

1907. MACDOUGALL, James, Assistant Forester, Pollok Estate, Pollokshaws.

1902. MACDOUGALL, John, 16 St Andrew Square, Edinburgh.

\*1895. MacDougall, Professor Robert Stewart, M.A., D.Sc., 13 Archibald Place, Edinburgh.

\*1884. MACDUFF, Alex., of Bonhard, Perth.

1906. M'EWAN, James, Assistant Forester, Glamis.

1904. M'Ewan, James, Assistant Forester, Abercairney, Crieff.

1904. M'EWAN, Wm., Assistant Forester, Kingswood, Murthly.

1901. MACEWEN, Alexander, Overseer, Castle Lachlan, Strachur, Inveraray.

1898. MACFADYEN, Donald, Assistant Forester, Drumlanrig, Thornhill.

1907. Macfarlane, Archibald, Timber Merchant, Harbour Saw-mills, Paisley.

\*1904. Macfie, John William, of Dreghorn, Rowton Hall, Chester.

\*1901. M'GARVA, Gilbert Ramsay, Factor, Estate Office, Innes, Elgin.

1901. M'GHIE, John, Overseer, Kelburne Estate, Fairlie.

\*1901. M'GIBBON, Donald, Forester, Rossie Estate, Inchture.

1904. M'GIBBON, R., Forester, Wentworth, Rotherham.

\*1902. MACGREGOR, Alasdair Ronald, Edinchip, Lochearnhead.

1890. M'GREGOR, Alex., Jackson Street, Penicuik, Midlothian. 1902. M'GREGOR, Alexander, Forester, Abbeyleix, Queen's Co.

1896. M'GREGOR, Angus, Forester, Craigton, Butterstone, Dunkeld.

1899. M'GREGOR, Archibald, Forester, Airthrey Castle, Bridge of Allan.

\*1906. MacGregor, Evan Malcolm, Factor, Ard Choille, Perth.

1904. M'HAFFIE, John A., Saw-mill Manager, 31 Windle Street, St Helens, Lancashire.

1899. M'HARDY, Alexander, The Castle, Inverness.

1905. M'HARDY, James, Forester, Rosehaugh Estate, Avoch R.S.O., Ross-shire.

1906. M'HARDY, Peter, Seedsman, 30 Guild Street, Aberdeen.

1904. M'HARDY, William, Forester, Chancefield, Falkland, Fife.

1901. M'HATTIE, John W., City Gardener, City Chambers, Edinburgh.

- 1894. M'ILWRAITH, Wm., Forester, Riddell, Lilliesleaf, Roxburghshire.
- 1907. M'Innes, William, Assistant Forester, Advie, Strathspey.
- 1905. M'Intosh, Alexander, Assistant Forester, Parkhead, Hopetoun, South Queensferry.
- \*1895. MACINTOSH, D. L., The Gardens, Stronvar, Lochearnhead.
- \*1879. MINTOSH, Dr W. C., Professor of Natural History, University of St Andrews, 2 Abbotsford Crescent, St Andrews.
- 1904. M'Intosh, Robert, Forester, Cullentragh Cottage, Rathdrum, Co. Wicklow.
- \*1885. MACINTOSH, William, Fife Estates Office, Banff.
- 1901. MACINTOSH, William, Forester, New Chapel, Boncath R.S.O., South Wales.
- 1905. M'INTYRE, Archibald, Timber Merchant, Glenlee, Cardross.
- 1907. M'INTYRE, Charles, Forester, Inver, Dunkeld.
- 1898. MACKAY, Æneas J. G., LL.D., Advocate, 2 Albyn Place, Edinburgh.
- 1892. M'Kay, Allan, c/o Park & Co., Ltd., Timber Merchants, Fraser-burgh.
- 1865. MACKAY, John, Lauderdale Estate Office, Wyndhead, Lauder.
- 1899. M'KAY, John, Forester, Newe Estates, Strathdon.
- 1908. M'KAY, Murdo, Forester, Castlecomer, Co. Kilkenny.
- 1887. MACKAY, Peter, Forester and Overseer, Bargany Mains, Dailly, Ayrshire.
- 1907. MACKAY, William, Factor, Chisholm Estates, 19 Union Street,
  Inverness.
- 1900. M'KECHNIE, Angus, Assistant Forester, Walkergate, Alnwick.
- 1891. MACKENDRICK, James, Forester, Estate Office, Pallas, Loughrea, Co. Galway.
- 1867. MACKENZIE, Alex., Warriston Nursery, Inverleith Row, Edinburgh.
- 1904. Mackenzie, Sir Alexander Muir, Bart. of Delvine, c/o Messrs Condie, Mackenzie & Co., W.S., Perth.
- 1907. MACKENZIE, Sir Arthur, Bart. of Coul, Strathpeffer.
- 1901. MACKENZIE, Charles, Factor, Clunes, Achnacarry, Spean Bridge.
- 1901. M'KENZIE, Daniel, Forester, Wynyard Estate, Stockton-on-Tees.
- \*1872. MACKENZIE, Donald F., F.S.I., Estate Office, Mortonhall, Edinburgh.
- 1904. MACKENZIE, Major E. Walter Blunt, Castle Leod, Strathpeffer.
- \*1893. MACKENZIE, James, Forester, Cullen House, Cullen.
- 1899. M'KENZIE, James, Wood Merchant, Carr Bridge, Inverness-shire.
- 1897. MACKENZIE, John, Forester, Holmhead, Daljarrock, Ayrshire.
- 1907. MACKENZIE, John, jun., Factor, Dunvegan, Skye.
- 1900. Mackenzie, Sir Kenneth John, Bart. of Gairloch, 10 Moray Place, Edinburgh.
- 1908. MACKENZIE, Nigel Banks, Factor, Fort William.
- 1908. MACKENZIE, Nigel Blair, Assistant Factor, Fort William.
- 1907. MACKENZIE, Colonel Stewart, of Seaforth, Brahan Castle, Dingwall.
- 1907. MACKENZIE, W. Dalziel, of Farr, Inverness.
- 1896. MACKENZIE, Wm., Forester, Novar, Evanton, Ross-shire.

- 1905. M'KERCHAR, John, Commercial Traveller and Seedsman, 35 Giesbach Road, Upper Holloway, London, N.
- \*1897. M'Kerrow, Robert, Manager, Carton, Maynooth, Co. Kildare.
- 1907. MACKEZZACK, George Ross, of Ardgye, Elgin.
- \*1898. Mackinnon, A., The Gardens, Scone Palace, Perth.
- 1883. Mackinnon, George, The Gardens, Melville Castle, Lasswade.
- 1902. Mackinnon, John, Gardener, Terregles, Dumfries.
- 1907. Mackinnon, Robert, Forester, Smithton, Culloden.
- 1878. MACKINTOSH, The, of Mackintosh, Moy Hall, Inverness.
- \*1905. MACKINTOSH, W. E., Yr. of Kyllachy, 28 Royal Circus, Edinburgh.
- \*1895. MACLACHLAN, John, of Maclachlan, 12 Abercromby Place, Edinburgh.
- 1904. MACLAGGAN, George C. R., Forester, Munday Cottages, Aberdalgie.
- 1903. Maclaggan, John G., Overseer, Lethendy Cottage, Glenalmond,
  Perthshire.
- 1901. M'LAREN, Donald, Overseer, Sundrum, by Ayr.
- 1908. M'LAREN, James, Sub-Agent, Haggerston, Beal, Northumberland.
- \*1879. M'LAREN, John, 12 Findhorn Place, Edinburgh.
- \*1898. Maclean, Archibald Douglas, J.P., Harmony, Balerno.
  - 1906. M'LEAN, James Smith, Assistant Forester, Douglas, Lanarkshire.
- 1902. MACLEAN, Peter, Forester, Invergarry.
- 1898. M'LENNAN, John, The Gardens, Castle Boro, Enniscorthy, Co. Wexford.
- 1901. M'LEOD, Peter, Nurseryman, Perth.
- 1903. M'MILLAN, Duncan H., Assistant Forester, Houston, Renfrewshire.
- 1895. Macmillan, John D., Steward, The Farm, Ganston Manor, Abbeyleix, Queen's Co.
- \*1904. M'NAB, David Borrie, Solicitor, Clydesdale Bank, Bothwell.
- 1903. M'NAUGHTON, George, Assistant Forester, Duncrub Park, Dunning, Perth.
- 1903. M'NAUGHTON, John, Forester, Auchterarder House, Perth.
- 1906. MacNicoll, David Greenhill, Assistant Forester, Glamis.
- 1906. MACNICOLL, Frank, Assistant Forester, Glamis.
- 1902. M'OMISH, John, Nurseryman, Crieff.
- 1907. MACPHERSON, C. J. B., of Balavil, Kingussie.
- 1901. Macpherson, Duncan, Assistant Forester, Hawkhill Cottage, Alloa Park, Alloa,
- 1890. M'RAE, Alexander, Forester, Buckhill Cottages, Calne, Wilts.
- \*1899. Macrae-Gilstrap, Major John, of Ballimore, Otter Ferry, Argyle-shire.
  - 1900. M'RAE, Henry, Assistant Forester, c/o Mrs Todd, Harewood Estate, Leeds.
  - 1908. M'RAE, John, Assistant Forester, Goddards Green, Mortimer, Berks.
- 1908. MACRAE, Sir Colin G., W.S., 45 Moray Place, Edinburgh.
- 1906. Macrae, John, Forester, Highfield, Muir of Ord, Ross-shire.
- 1907. M'RAW, Donald, Manager, Strathgarve, Garve R.S.O.
- \*1879. MacRitchie, David, C.A., 4 Archibald Place, Edinburgh.
- 1895. M'TAVISH, John, Assistant Forester, The Glen, Skelbo, Sutherland.
- 1905. M'VINNIE, Samuel, Forester, Skeagarvie, Rossmore Park, Monaghan.
- 1884, Main, Adam, Forester, Loftus R.S.O., Yorkshire.

- \*1905 MAITLAND, A. D. Steel, of Sauchie, etc., Sauchieburn, Stirling.
- \*1880. MALCOLM, Lieut.-Col. E. D., R. E., Achnamara, Lochgilphead.
- 1907. MALKIN, Herbert C., J.P., 46 Phillimore Gardens, Kensington, W.
- \*1895. MANN, Charles, Merchant, Lumsden, Aberdeenshire.
- \*1898. MANSFIELD, The Right Hon. the Earl of, Scone Palace, Perth.
- 1896. MAR AND KELLIE, The Right Hon. the Earl of, Alloa House, Alloa.
- \*1895. MARGERISON, Samuel, English Timber Merchant, Calverley, near Leeds.
- \*1901. MARSHALL, Archd. M'Lean, Crogen, Corwen, North Wales.
  - 1902. MARSHALL, George, Broadwater, Godalming, Surrey.
- \*1905. Marshall, Henry Brown, of Rachan, Broughton.
- 1899. MARSHALL, John, Timber Merchant, etc., Maybole.
- 1893. MARSHALL, J. Z., Timber Merchant, 2 Dean Terrace, Bo'ness.
- 1907. MARSHALL, William, Assistant Forester, Harewood, Leeds.
- \*1876. MARTIN, James, Forester, Knipton, Grantham, Lincolnshire.
- \*1884. Massie, W. H., of Dicksons & Co., 1 Waterloo Place, Edinburgh.
- 1907. Masson, William, Forester, Hamilton Lodge, Melton Mowbray, Leicestershire.
- 1906. MASTERTON, James, Wood Merchant, 4 Windsor Street, Edinburgh.
- 1893. MATHER, R. V., of Laing & Mather, Nurserymen, Kelso.
- 1901. MATTHEWS, Robert, Land Steward, Duncrub Park, Dunning.
- \*1894. MAUGHAN, John, Estate Agent, Jervaulx Abbey, Middleham R.S.O., Yorks.
- 1907. Maw, Percival Trentham, Professor of Forestry, Royal Agricultural College, Cirencester.
- 1907. MAXTONE, James, Overseer, Strathallan, Machany, Perthshire.
- 1896. MAXTONE, John, Forester, Duff House, Banff.
- \*1904. MAXWELL, Aymer, Yr. of Monreith, Wigtownshire, Lieutenant, Grenadier Guards.
- 1891. MAXWELL, James, Forester and Overseer, Ruglen, Maybole.
- \*1893. MAXWELL, Sir John Stirling-, Bart. of Pollok, Pollokshaws.
- 1886. MAXWELL, The Right Hon. Sir Herbert E., Bart. of Monreith, Port William, Wigtownshire.
- 1905. MAXWELL, William Jardine Herries, of Munches, Dalbeattie.
- 1907. MEACHER, Sydney George, Land Agent, Marlee, Blairgowrie.
- 1896. MEIKLEJOHN, John J. R., Factor, Novar, Evanton, Ross-shire.
- 1906. MELDRUM, Thomas C., Nurseryman, Forfar.
- 1899. MELVILLE, David, The Gardens, Dunrobin Castle, Golspie.
- 1901. Menzies, James, Assistant Forester, Dollardstown Nursery, Wageney, Carlow.
- \*1908. MENZIES, William Dudgeon Graham, J.P., Hallyburton, Coupar Angus.
- \*1880. Mesham, Captain, Pontryffydd, Bodvari, Rhyl, Denbighshire.
- 1906. MESTON, William, Assistant Forester, Tower Cottage, Durris, Aberdeen.
- 1877. METHVEN, Henry, of Thomas Methven & Sons, 15 Princes Street, Edinburgh.
- 1869. METHVEN, John, of Thomas Methven & Sons, Leith Walk Nurseries, Edinburgh.

- 1892. METHVEN, John, The Gardens, Blythswood, Renfrewshire.
- \*1881. MICHIE, John, M.V.O., Factor, Balmoral, Ballater, Aberdeenshire.
  - 1893. MICHIE, William, Forester, Welbeck, Worksop, Notts.
- \*1893. MIDDLEMASS, Archibald, Forester, Tulliallan, Kincardine-on-Forth.
- 1905. MIDDLETON, James, Factor, Braehead House, Kilmarnock.
- \*1905. MILLAR, John, Timber Merchant, Greenhaugh Saw-mills, Govan.
- 1905. MILLER, Lewis, of Corriegour, Inverness-shire, and Timber Merchant, Benochie, Crieff.
- 1882. MILNE, Alex., of James Dickson & Sons, 46 Hanover Street, Edinburgh.
- 1899. MILNE, Alexander, Factor, Urie Estate Office, Stonehaven.
- 1902. MILNE, Alexander, Forester, Charboro' Park, Wareham, Dorset.
- 1903. MILNE, Colonel George, of Logie, Aberdeenshire.
- 1904. MILNE, Frederick, Assistant Forester, Nursery Cottage, Tarbrax, by Forfar.
- 1895. MILNE, James, Land Steward, Carstairs House, Carstairs.
- 1906. MILNE, John, Assistant Forester, Woodlands, Durris, Aberdeen.
- 1899. MILNE, Ritchie, Assistant, Annandale Estate Office, Hillside, Lockerbie.
- \*1898. MILNE, Robert P., Spittal Mains, Berwick-on-Tweed.
- 1890. MILNE, William, Farmer, Foulden, Berwick-on-Tweed.
- 1902. MILNE, William, Forester, Huntly Hill, Stracathro, Brechin.
- 1906. MILNE, William, Nurseryman (Wm. Fell & Co., Ltd.), Hexham.
- 1901. MILNE-HOME, David William, of Wedderburn, Caldra, Duns.
- \*1897. MILNE-HOME, J. Hepburn, Irvine House, Canonbie.
- 1894. Milsom, Isaac, Gardener and Steward, Claydon Park, Winslow, Bucks.
- 1904. MITCHELL, Alexander, Forester, Dalmeny Park, Edinburgh.
- 1898. MITCHELL, David, Forester, Drumtochty, Fordoun.
- \*1882. MITCHELL, Francis, Forester, Woburn, Beds.
- 1904. MITCHELL, James, Organising Secretary for Technical Education to Fife County Council, County Buildings, Cupar, Fife.
- \*1902. MITCHELL, John, jun., Timber Merchant, Leith Walk Saw-mills, Leith.
- 1904. MITCHELL, John Irvine, M.A., Teacher, 3 Grange Road, Edinburgh.
- 1901. MITCHELL, William Geddes, Estate Agent, Doneraile, Co. Cork.
- 1903. Moeran, Archibald E., Land Agent, etc., Palmerston House, Portumna, Co. Galway.
- 1902. Moffat, John, Forester, Blackwood, Lesmahagow.
- 1908. Moir, William Mortimer, Forester and Gardener, The Gardens, Rosehaugh, Avoch, Ross-shire.
- \*1908. Moiser, Cyril, P.A.S.I., Heworth Grange, York.
- \*1895. Moncreiffe, Sir Robert D., Bart. of Moncreiffe, Perth.
- 1897. Moon, Frederick, Forester, Bowmont Forest, Roxburgh.
- \*1906. Moon, John Laurence, Forest Ranger, Forestry Department, Nairobi, British East Africa.
- 1907. Moore, Frederick G., Assistant Forester, Estate Office, Colwyn Bay.
- \*1897. MORGAN, Alex., Timber Merchant, Crieff, Perthshire.
- \*1899. Morgan, Andrew, Assistant Factor, Glamis.

- \*1895. Morgan, Malcolm, Timber Merchant, Crieff, Perthshire.
- 1907. MORRISON, Andrew, Estate Manager, Brodie Mains, Forres.
- 1895. Morrison, Hew, LL.D., Librarian, Edinburgh Public Library.
- 1903. MORRISON, William, Manufacturer, 80 Park Road, Glasgow.
- 1905. MORTON, Andrew, Assistant Forester, Liverpool Corporation, Brinscall, Chorley, Lancashire.
- 1905. MOTHERWELL, A. B., Writer, Airdrie.
- 1907. MOULTRIE, James, Assistant Forester, Star, Balbirnie, Markinch.
- 1906. Mowat, John, Overseer, Hazelhead Estate, Aberdeen.
- 1906. Muir, William, Estate Clerk, Broomlands, Kelso.
- 1890. Muirhead, George, F.R.S.E., Commissioner, Speybank, Fochabers.
- 1901. MULLIN, John, Forester, Eglinton Castle, Irvine.
- 1904. Munro, Alexander, Overseer, Invereshie, Kincraig.
- 1903. Munro, Alexander J., 48 Castle Street, Edinburgh.
- 1895. Munro, Donald, Assistant Forester, Holkham Hall, Norfolk.
- 1906. Munro, Donald, Wood Merchant, Ravenswood, Banchory.
- 1902. Munro, George A., S.S.C., 6 Rutland Square, Edinburgh.
- 1905. Munro, Sir Hector, Bart. of Foulis Castle, Evanton, Ross-shire.
- \*1902. MUNRO, Hugh Thomas, Lindertis, Kirriemuir.
- 1907. Munro, John, Assistant Forester, Craigo, by Montrose.
- 1907. Munro, John, Land Steward and Forester, The Lodge, Tarland,
  Aberdeenshire.
- \*1892. MURRAY, Alexander, Forester, Murthly, Perthshire.
- 1904. MURRAY, Charles A., of Taymount, Stanley.
- 1901. MURRAY, David, Gardener, Culzean Gardens, Maybole.
- 1906. Murray, David, Assistant Forester, Windsor Cottage, Fern, by Brechin.
- 1900. MURRAY, George J. B., Forester, Garthgwynion Hall, Machyneleth, North Wales.
- 1905. MURRAY, James, Farmer, Outerston, Gorebridge.
- 1902. MURRAY, Bailie John, J.P., 9 Strathearn Road, Edinburgh.
- 1900. MURRAY, John C., F.S.I., Factor and Commissioner, Haggs Castle, Glasgow.
- 1904. MURRAY, John M., Assistant Forester, Royal Botanic Garden, Edinburgh.
- 1900. Murray, William, of Murraythwaite, Ecclefechan, Dumfriesshire.
- \*1896. MURRAY. William Hugh, W.S., 48 Castle Street, Edinburgh.
- \*1899. NAIRN, Sir Michael B., Bart. of Rankeillour, Manufacturer, Kirkcaldy.
- 1904. NAIRN, Robert, Forester, Rowallan, Kilmarnock.
- 1907. NASH, William, Assistant Forester, Airdsmill, Muirkirk, Ayrshire.
- \*1905. NASMYTH, Norman, of Glenfarg, Glenfarg Lodge, Abernethy.
- 1894. NEIL, Archibald, Forester, Warkton, Kettering, Northamptonshire.
- 1893. Nelson, Robert, Assistant Forester, Hannahgate Cottage, Kinmount Estate, Cummertrees, Dumfriesshire.
- \*1908. Nelson, Thomas Arthur, of Achnacloich, Connel, Argyleshire.
  - 1907. NICHOLSON, Daniel, Forester, Erskine, Bishopton.
  - 1893. NICOL, James, Forester, Aird's Mill, Muirkirk, Ayrshire.

- 1895. NICOL, James, Forester, Croxteth, Liverpool.
- 1906. NICOL, William, Forester, Cluny Castle, Ordhead, Aberdeenshire.
- \*1903. NICOL, William Edward, D.L., J.P., of Ballogie, Aboyne.
- 1901. NICOLL, William Peter, Assistant Forester, Kippo, Kingsbarns, Fife.
- \*1901. NICOLSON, Edward Badenach, Advocate, 12 Atholl Crescent, Edinburgh.
- 1893. NISBET, J., D.Œc., Royal Societies' Club, 63 St James Street, London, S.W.
- \*1902. Nisbet, Robert C., Farmer, Kingsknowe, Slateford.
- \*1899. Nobbs, Eric Arthur, B.Sc., Department of Agriculture, Cape Town.
  - 1899. Noble, Charles, Forester, Donibristle, Aberdour.
  - 1904. Noble, Hugh, Assistant Forester, Aldowrie Estate Office, Dores, Inverness.
- 1906. OGILVIE, Thomas, D.L., J.P., Kepplestone, Aberdeen.
- 1900. OLIPHANT, Joseph, Assistant Forester, Quarterbank, Abercairney, Crieff.
- \*1894. ORKNEY, William C., Surveyor's Office, Montrose Royal Asylum.
- \*1899. ORR-EWING, Sir Archibald Ernest, Bart., Ballikinrain Castle, Balfron.
- \*1906. ORR, George W., Cowdenhall, Neilston.
- 1906. ORR, Harry D., Timber Merchant, 73 Saltergate, Chesterfield.
- 1907. OSWALD, Major Julian, Kindar Lodge, New Abbey, Dumfries.
- 1902. OSWALD, Richard Alexander, of Auchincruive, Ayr.
- 1906. OWEN, Harry, Assistant Forester, Chatsworth, Pilsley, Bakewell.
- 1875. PAGE, Andrew Duncan, Land Steward, Culzean Home Farm, Ayr.
- 1908. PARK, Robert, Contractor, Hamilton Street, Motherwell.
- 1900. Paterson, George, Timber Merchant, 64 Queen's Road, Aberdeen.
- \*1879. Paton, Hugh, Nurseryman, Kilmarnock, Ayrshire.
- \*1898. Paton, Robert Johnston, Nurseryman, Kilmarnock.
- \*1902. Paton, Tom W., Nurseryman, Kilmarnock.
- 1898. PATTERSON, Thomas L., Nisbet, Pentcaitland, East Lothian.
- 1897. Pearson, James, Forester, Sessay, Thirsk, Yorks.
- 1899. Pearson, James, Assistant Factor, The Cottage, Airdrie.
- 1869. Peebles, Andrew, Estate Office, Albury, Guildford, Surrey.
- \*1900. Perrins, C. W. Dyson, of Ardross, Ardross Castle, Alness.
- 1904. Peters, William, Assistant Forester, Gateside, Markinch, Fifeshire.
- \*1897. PHILIP, Alexander, Solicitor, Brechin, Forfarshire.
- \*1895. Philip, William Watt, Factor, Estate Office, Gigha, Argyleshire.
- \*1896. PHILP, Henry, jun., Timber Merchant, Campbell Street, Dunfermline.
- \*1896. PHILP, John, Timber Merchant, Campbel! Street, Dunfermline.
- 1907. PILLAY, M. Nagalingom, Banker and Estate Agent, Meenakshipuram, Nagercoil, South India.
- 1903. PIRRIE, John, Sawmaker, Giles Street, Leith.
- 1896. PITMAN, Archibald Robert Craufurd, W.S., 48 Castle Street, Edinburgh.
- 1902. PLUMMER, C. H. Scott, of Sunderland Hall, Selkirk.
- 1901. Pollock, Alexander, Rustic Builder, Tarbolton, Ayrshire.
- 1897. Poole, Wm., Corn Exchange Buildings, Edinburgh.
- 1902. POPERT, E. P., Assistant Surveyor, Forest of Dean, Coleford, Gloucestershire.

- 1899. Porteous, George, Kenmore, Broomieknowe, Lasswade.
- 1899. PORTEOUS, Colonel James, of Turfhills, Kinross.
- \*1856. PORTSMOUTH, The Right Hon. the Earl of, Eggesford, North Devon.
- 1896. PRENTICE, George, Strathore, Kirkcaldy, Fife.
- 1899. PRICE, Aaron W., Forester, Bolstone, Ross-on-Wye.
- \*1898. PRICE, W. M., Factor, Minto, Hawick.
- 1908. PRITCHARD, Henry A., Professor of Estate Management and Forestry, Royal Agricultural College, Circnester.
- 1908. PROCTOR, John, Assistant Forester, Bowmont Forest, Roxburgh.
- \*1878. Punchard, Frederick, Underley Estate Office, Kirkby Lonsdale, Westmoreland.
  - 1907. Purvis, George, Assistant Forester, Doune Lodge, Doune.
- 1907. RAE, Frederick S., Assistant Forester, Dalzell Farm, Motherwell.
- 1907. RAE, Louis, Assistant Forester, Dalzell Estate, Motherwell.
- \*1876. RAE, William A., Factor, Murthly Castle, Perthshire.
- 1901. RAFFAN, Alexander, 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.
- 1907. RALSTON, Charles W., Chamberlain on Dukedom of Queensberry, Dabton, Thornhill, Dumfriesshire.
- \*1908. RALSTON, Claude, Factor, Estates Office, Glamis.
- 1904. RALSTON, Gavin W., M.A., Advocate, 6 Abercromby Place, Edinburgh.
- 1907. RAMSAY, William, J.P., Longmorn House, Longmorn R.S.O.
- \*1855. Ramsden, Sir John, Bart., Byram Hall, Ferrybridge, Normanton.
- 1870. RATTRAY, Thos., Forester, Westonbirt House, Tetbury, Gloucestershire.
- 1908. REDPATH, James, Forester, Athelstaneford, Drem.
- 1908. REDPATH, John, Forester, Paxton, Berwick-on-Tweed.
- 1905. REID, Alexander T., Assistant Forester, Raith, Kirkcaldy.
- 1905. Reid, Andrew, The Gardens, Durris, Drumoak, Aberdeenshire.
- 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.
- 1907. Reid, John, Assistant Forester, Doune Lodge, Doune.
- 1906. Reid, Richard, Assistant Forester, Sunlaws Hill, Roxburgh.
- 1905. Reid, Robert, Overseer, Kincairney, Dunkeld.
- 1903. Reid, Robert Matelé, Druimneil, Appin, Argyleshire.
- 1901. RENNIE, Joseph, Overseer, Hillend, Possil, Maryhill.
- \*1873. RICHARDSON, Adam D., 6 Dalkeith Street, Joppa.
- 1907. RILLIE, Joseph, Assistant Forester, Douglas, Lanarkshire.
- 1892. RITCHIE, Alexander, Overseer, Brucehill, Cardross Estate, Port of Menteith.
- \*1908. RITCHIE, Charles Ronald, Law Apprentice, 37 Royal Terrace, Edinburgh.
- \*1876. RITCHIE, William, Hope Lodge, Moffat.
- 1898. RITCHIE, Wm., Assistant Forester, Moss-side Cottage, Lynedoch, Perth.

- 1906. RITCHIE, William Hamilton, of Dunnottar, Dunnottar House, Stonehaven.
- 1906. Robb, Archibald, Riverslea, Rothes.
- 1900. Robb, John, Road Surveyor, County Buildings, Edinburgh.
- 1907. Roberts, James, Assistant Forester, Goldsborough Mill, Knaresborough, Yorks.
- 1904. ROBERTSON, Alexander, Assistant Forester, Meikledams, Durris.
- \*1897. ROBERTSON, A. Barnett, Forester, The Dean, Kilmarnock, Ayrshire.
- 1897. Robertson, Andrew N., Forester, Glenferness, Dunphail.
- 1899. ROBERTSON, Charles, Forester, Colstoun Old Mill, Gifford.
- \*1879. ROBERTSON, Donald, Forester, Dunrobin, Golspie.
- \*1907. Robertson, Edward Hercules, B.A., Advocate, Burnside, Forfar.
- 1896. ROBERTSON, George, Forester, Ponsbourne Park Estate, near Hertford.
- 1900. Robertson, James, Assistant Forester, Garth, Fortingall, Aberfeldy.
- 1904. ROBERTSON, James, Assistant Forester, Pollok Estate, Pollokshaws.
- \*1866. Robertson, Jas., Wood Manager, Panmure, Carnoustie, Forfarshire.
- \*1905. ROBERTSON, James Morton, of Cowieslinn, Portmore House, Eddleston.
- 1905. Robertson, James W., Head Gardener, Letham Grange and Fern, Arbroath.
- 1907. Robertson, J. P., Forester, Edensor, Bakewell.
- \*1905. Robertson, John, Factor, Panmure Estates Office, Carnoustic.
- 1896. ROBERTSON, John, Forester, Altyre, Forres.
- 1902. ROBERTSON, R. A., M.A., B.Sc., Lecturer on Botany, University, 119 South Street, St Andrews.
- 1906. Robertson, Robert Mackenzie, Assistant Forester, Chatsworth, Pilsley, Bakewell.
- 1895. ROBERTSON, Thomas, Forester and Bailiff, Woodlawn, Co. Galway.
- 1907. Robertson, Thomas, Forester, Vogrie, Gorebridge.
- 1883. ROBERTSON, William, Assistant Forester, Ringwood, Birnam, Perth.
- 1902. Robinson, Stewart, Lynhales, Kington, Herefordshire.
- \*1890. Robinson, William, Gravetye Manor, East Grinstead, Sussex.
- 1899. Robson, Alex., of Smith & Son, 18 Market Street, Aberdeen.
- 1901. Robson, Alexander, Head Gamekeeper, The Kennels, Culzean, Maybole.
- \*1897. Robson, Charles Durie, 66 Queen Street, Edinburgh.
- 1900. Robson, John, Assistant Forester, Baronscourt, Co. Tyrone.
- 1893. Rodger, James, Forester, Leinster Street, Athy, Co. Kildare.
- \*1883. Rollo, The Hon. Wm. Chas. Wordsworth, Master of Rollo, Duncrub Park, Dunning, Perthshire.
- 1893. ROMANES, James, C.A., Fordel, Melrose.
- \*1872. ROSEBERY, The Right Hon. the Earl of, K.G., K.T., Dalmeny Park, Edinburgh.
- 1898. Ross, Charles D. M., Factor, Abercairney, Crieff.
- 1887. Ross, John, Forester, Hopetoun, South Queensferry, Linlithgowshire.
- 1905. Ross, John S., Factor's Clerk, Monreith Estate Office, Wigtownshire.
- 1907. Ross, Colonel Walter C., Cromarty.
- \*1906. ROXBURGHE, His Grace the Duke of, K.T., Floors Castle, Kelso.
- 1903. Rule, John, Forester, Huntly.

- 1893. RUTHERFORD, James A., Land Agent, Highelere Park, Newbury, Berks.
- 1870. RUTHERFORD, John, Forester, Linthaugh, Jedburgh, Roxburghshire.
- 1904. RUTHERFURD, Henry, Barrister-at-Law, Fairnington, Roxburgh.
- 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.
- \*1906. SANG, J. H., LL.B., W.S., Westbrook, Balerno.
- 1904. SANGSTER, Alexander, The Mall, Montrose, c/o Bourlos Land Co., Belcas, Egypt.
- 1903. Schott, Dr Peter Carl, Nursery and Seed Establishments, Knittelsheim, Palatinate, Germany.
- \*1867. Scott, Daniel, Wood Manager, Darnaway, Forres.
  - 1892. Scott, David, Overseer, Dumfries House, Cumnock, Ayrshire.
  - 1901. Scott, Frank, Forester, Comlongon Castle, Ruthwell.
- 1881. Scott, James, Forester, Wollaton Hall, Nottingham.
- \*1907. Scott, James Cospatrick, P.A.S.I., Yarrow Cottage, Poynder Place, Kelso.
- 1903. Scott, John, Forester, Annfield, Hartrigge, Jedburgh.
- 1908. Scott, John A., Assistant Forester, Bowmont Forest, Roxburgh.
- 1890. Scott, John D., Land Steward, Estate Office, Brushford, Dulverton, Somerset.
- \*1906. Scott, John Henry Francis Kinnaird, of Gala, Gala House, Galashiels.
- 1906. Scott, Robert, Solicitor, Hon. Secretary and Treasurer, Aberdeen Branch, 230 Union Street, Aberdeen.
- \*1902. SCRIMGEOUR, James, Gardener, Manor House, Donaghadee.
- \*1890. SCRIMGEOUR, John, Overseer, Doune Lodge, Doune.
- 1897. SHARPE, Thomas, Forester, Monreith, Port William, Wigtownshire.
- 1893. SHAW, Andrew, Victoria Saw-mills, Perth.
- 1904. SHAW, John, Overseer, The Glen Cottage, Cardross.
- \*1896. SHAW-STEWART, Sir Hugh, Bart., M.P., of Ardgowan, Greenock.
- \*1904. Shelley, Sir John Courtown Edward, Bart., Avington, Alresford, Hants.
- \*1898. SHEPPARD, Rev. H. A. Graham-, of Rednock, Port of Menteith, Stirling.
- \*1907. SHIACH, Gordon Reid, L.D.S., etc., Ardgilzean, Elgin.
- \*1903. SHIEL, James, Overseer, Abbey St Bathans, Grant's House.
- 1905. SHIELDS, James, Farmer, Longniddry.
- 1907. SHIELS, George Henry, Forester, Lethen, Nairn.
- 1905. Sim, John, Forester, Fernybrae, Cornhill, Banfishire.
- 1903. Simon, Thomas, jun., Assistant Forester, Montrave, Leven.
- 1906. Sinclair, Robert, Factor for North Harris, Harris, by Portree.
- 1900. SINGER, John G., Forester, Culzean, Ayr.
- 1907. Skirving, Robert, D.L., J.P., of Cobairdy, Huntly, Aberdeenshire.
- 1868. SLATER, Andrew, Estate Office, Durrington, Salisbury, Wilts.
- 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.
- \*1893. SMITH, Charles G., Factor, Haddo House, Aberdeen.
- 1906. SMITH, Douglas, P.A.S.I., Land Agent, Estate Office, Stanage Park, Brampton Bryan, Herefordshire.
- 1904. SMITH, D. D., Nurseryman and Seed Merchant, St Catherine's Street, Cupar, Fife.
- 1908. SMITH, Edwin Hedley, B.L., Factor, Whittinghame, Prestonkirk.
- 1873. SMITH, G. B., Wire Fence Manufacturer, Phoenix Ironworks, Govan.
- 1901. Smith, James, Forester, 1 Oxmantown Mall, Birr, King's County.
- 1908. SMITH, James, Nurseryman, Darley Dale Nurseries, near Matlock.
- 1908. SMITH, James, Assistant, Jeaniebank, Old Scone, Perth.
- 1906. SMITH, James Fraser, F.R.H.S., late Gardener, Barons Hotel, Auchnagatt.
- 1907. Smith, Right Hon. James Parker, P.C., Jordanhill, Glasgow.
- 1895. SMITH, John, Cabinetmaker, 1 Eastgate, Peebles.
- 1907. SMITH, John, Factor, Inverallan, Grantown-on-Spey.
- \*1907. SMITH, J. Grant, Factor for Glenurquhart, Seafield Estates Office, Elgin.
- 1901. SMITH, Matthew, Manager for Dyer & Co., Peebles.
- 1901. SMITH, Sydney, Factor, Drummuir Estates Office, Keith.
- 1901. SMITH, Thomas, Factor, The Castle, Maybole.
- \*1895. SMITH, Thomas, Overseer, The Nursery, Tring Park, Wiggington, Tring, Herts.
- 1896. SMITH, William, Forester, Camperdown, Dundee.
- 1899. SMITH, William, Overseer, Fairnalee, Clovenfords, Galashiels.
- \*1896. SMITH, William G., B.Sc., Ph.D., Lecturer on Botany, University of Leeds.
- \*1907. SMITHSON, Harry S. C., of Inverernie, Daviot, Highland R.S.O.
- \*1882. SMYTHE, David M., of Methven Castle, Perth.
- 1906. SMYTHE, George Henderson, late Gardener, Balcarres Hotel, Echt, Aberdeenshire.
- 1907. Somerset, His Grace the Duke of, Maiden Bradley, Bath; 35 Grosvenor Square, W.
- 1906. Somerville, Hugh Christopher, 2 Fairhaven, Dalkeith.
- 1906. Somerville, Robert Anderson, Eastwoodbrae, Dalkeith.
- \*1889. SOMERVILLE, Dr William, M.A., D.Sc., D.Cc., F.R.S.E., Professor of Rural Economy, Oxford.
- 1904. SOUTAR, William, Forester, The Farm, Titsey Place, Limpsfield, Surrey.
- 1898. Spence, William, Forester, Strathenery, Leslie.
- \*1899. Spiers, Adam, Timber Merchant, Warriston Saw-mills, Edinburgh.
- \*1883. Sprot, Major Alexander, of Garnkirk, Chryston, Glasgow.
- 1899. STALKER, Wm. J., Nurseryman, Nairn.
- 1903. Stephen, Alfred, Assistant Forester, Drumtochty, Fordoun.
- 1907. STEPHEN, John, Forester, Dell Nursery, Nethy Bridge.
- 1904. STEVEN, William, Builder, Muirpark, Dalkeith.
- 1902. Stevenson, Allan, Architect, 14 Cathcart Street, Ayr.
- 1899. STEWART, Alex., Forester, Shadwell Court, Thetford.

- 1905. STEWART, Alexander, Box 72, Holland, Manitoba, Canada.
- 1901. STEWART, Alistair D., Camperdown Estates Office, Dryburgh, Lochee.
- 1897. STEWART, Charles, Forester, Castle Menzies, Aberfeldy.
- 1907. Stewart, David, Assistant Forester, Royal Botanic Garden.
- \*1899. Stewart, Duncan D., Factor, Rossie Estate, Inchture.
- 1901. STEWART, James, Forester, Letham and Fern Estates, Fern, near Brechin.
- 1903. STEWART, John, Forester, Cavens, Kirkbean, Dumfries.
- 1901. Stewart, John M., Forester, Grigorhill, Kinsteary, Nairn.
- \*1892. STEWART, Sir Mark J. M'Taggart, Bart. of Southwick, Kirkeudbrightshire.
- 1908. STEWART, Colonel R. K., of Murdostoun, Murdostoun Castle, Lanarkshire.
- 1876. STEWART, Robert, Forester, Stonefield, Tarbert, Lochfyne, N.B.
- 1899. STEWART, William, Land Steward, Dalhousie Castle, Lasswade.
- 1906. STEWART, William Maitland, Factor, 5 Inverleith Terrace, Edinburgh.
- \*1904. STIRLING, Archibald, of Keir, Dunblane.
- 1907. STIRLING, John Alexander, of Kippendavie, Dunblane.
- 1904. Stobo, Robert W., Assistant Forester, c/o Mrs Luckins, Wardley Marsh, Liphook, Hants.
- 1897. STODDART, James, Builder, Bonnyrigg, Midlothian.
- 1906. STODDART, James, jun., Joiner, Norwood, Bonnyrigg.
- 1902. Stone, Alfred William, Clerk of Works, Ashton Court Estate, Bower, Ashton, Bristol.
- 1893. STORIE, W., Whitway House, Newbury, Berks.
- 1906. STRACHAN, James, Gardener, Cruickshank Botanic Garden, Old Aberdeen.
- \*1908. STRATHMORE AND KINGHORNE, The Earl of, Glamis Castle, Glamis.
- 1906. STUART, Peter, Brewer, Glen Grant, Rothes.
- 1902. STUNT, Walter Charles, Lorenden, Ospringe, Kent.
- \*1880. SUTHERLAND, Evan C., Highland Club, Inverness.
- 1907. SUTHERLAND, George, Assistant Forester and Saw-miller, Doune Lodge, Doune.
- \*1883. SUTHERLAND, His Grace the Duke of, K.G., Dunrobin Castle, Golspie.
- 1892. SUTHERLAND, John D., Solicitor and Estate Agent, Oban, Argyle.
- 1906, Swankie, Frank Murray, Assistant Forester, Vayne, Fern, Brechin.
- 1869. Tait, David, Overseer, Owston Park, Doncaster, Yorkshire.
- \*1892. Tait, James, Builder, Penicuik, Midlothian.
- \*1900. Tait, James, jun., Woodsbank, Penicuik.
- 1898. TAIT, William, Seedsman, 75 Shandwick Place, Edinburgh.
- 1895. TAIT, Wm. A., 13 Brandon Terrace, Edinburgh.
- 1902. TAYLOR, John, Forester, Glentulchan, Glenalmond, Perthshire.
- 1904. TAYLOR, Robert, Assistant Forester, Chapelhill, Logicalmond, Methven.

- 1905. TAYLOR, Robert, Forester, Broomhall Estate, Charlestown, Fife.
- 1897. TAYLOR, William, Forester, Sandside, Kirkcudbright.
- 1905. Telfer, John, Assistant Forester, Heckfield, Winchfield, Hants.
- \*1891. TENNANT, Sir Edward P., Bart. of The Glen; 31 Lennox Gardens, London, S.W.
- \*1877. Terris, James, Factor, Dullomuir, Blairadam, Kinross-shire.
- 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.
- \*1855. Thomson, John Grant, Wood Manager, Grantown, Strathspey.
- \*1902. THOMSON, Peter Murray, S.S.C., Cockbridge, Mealsgate, Cumberland.
- 1903. THOMSON, Robert, Foreman Forester, Park Hill, Ampthill, Bedfordshire.
- \*1901. THOMSON, Spencer Campbell, of Eilean Shona, 10 Eglinton Crescent, Edinburgh.
- 1904. THREIPLAND, Captain W. Murray, Dryburgh Abbey, St Boswells.
- 1906. TINDAL, Robert, Forester, Bellspool Cottages, Stobo.
- 1901. TIVENDALE, William D., Head Forester to Duke of Portland, Burnhouse, Galston.
- \*1871. Tomlinson, Wilson, Forester, Clumber Park, Worksop, Notts.
- 1906. Tosh, Hendry, Assistant Forester, Bridgend, Inverkip, Greenock.
- \*1906. TRAIL, James William Helenus, A.M., M.D., F.R.S., Professor of Botany in University of Aberdeen, 71 High Street, Old Aberdeen.
- \*1902. TROTTER, A. E. C., of Bush, Milton Bridge, Midlothian.
- \*1903. TULLIBARDINE, The Most Hon. the Marquis of, D.S.O., Blair Castle, Blair Atholl.
  - 1900. Turnbull, Andrew, Assistant Forester, Picktree, Chester-le-Street, Co. Durham.
  - 1903. TURNBULL, John, Forester, Arbigland, Dumfries House Station, Cumnock.
- 1898. Tweedie, Alexander, Forester, Faskally, Pitlochry.
- 1883. Underwood, Henry E., Fornham, St Martin, Bury St Edmunds, Suffolk.
- \*1903. Unwin, Arthur Harold, D. C., Town House, Haslemere, Surrey.
- \*1908. URQUHART, Angus, Assistant Nursery and Seedsman, Inverness.
- \*1872. URQUHART, B. C., of Meldrum, Aberdeenshire.
- \*1902. URQUHART, Farquhar, Nurseryman, Inverness.
- 1907. URQUHART, Colonel Robert, Town Clerk, Forres.
- \*1908. USHER, Sir Robert, Bart. of Norton and Wells, Norton, Ratho Station, Midlothian.
  - 1903. USHER, Thomas, Factor, Courthill, Hawick.
- 1903. VEITCH, John, Factor, Fasnacloich.
- 1903. WALKER, Captain George Lawrie, of Crawfordton, Thornhill.
- 1894. WALKER, Henry H., Factor, Monreith, Port William, Wigtownshire.
- \*1878. WALKER, Colonel I. Campbell, Newlands, Camberley, Surrey.

- \*1907. WALKER, James, Wood Merchant, Inverness.
- \*1906. WALKER, John Steven, Yard Foreman, Saw-mills, Hurlford, Ayrshire.
- \*1906. WALKER, Robert Williamson, C.E., Factor and Land Surveyor, 3 Golden Square, Aberdeen.
- 1870. WALL, G. Y., Land Agent, Grange House, Darlington, Durham.
- 1903. WALLACE, Andrew, Saw-miller, Gateside, Balbirnie, Markinch.
- 1893. WALLACE, David P., Forester, The Saw-mills, Filleigh, Molton, S. Devon.
- \*1897. WALLACE, John A. A., of Lochryan, Cairnryan, Stranraer.
- 1893. WALLACE, Robert B. P., Timber Merchant, 12 Danube Street, Edinburgh.
- \*1905. WALLACE, Thomas Douglas, F.S.I., Callendar Estate Office, Callendar Park, Falkirk.
- 1899. WANDESFORDE, R. H. Prior, of Castlecomer, Co. Kilkenny.
- \*1900. WARWICK, Charles, 19 Woodfield Road, Tonbridge, Kent.
- 1901. WASON, Right Hon. Eugene, M.P., of Blair, Dailly, Ayrshire; 8 Sussex Gardens, Hyde Park, London.
- 1903. Watson, Hugh, Forester, Sunnyside Cottages, Maybole.
- 1901. WATSON, James, Manager, Moy Hall, Inverness-shire.
- 1893. WATSON, John, Timber Merchant, Annandale Street, Edinburgh.
- \*1893. WATSON, John T., 6 Bruntsfield Gardens, 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. Weale, James A., Timber Merchant, Boundary Place, Liverpool.
- 1906. Webster, Charles, Gardener and Forester, The Gardens, Gordon Castle, Fochabers.
- \*1891. Welsh, James, of Dicksons & Co., 1 Waterloo Place, Edinburgh.
- \*1871. Wemyss, Randolph Gordon Erskine, of Wemyss and Torrie, Fife.
- 1904. Wentworth-FitzWilliam, George Charles, of Milton, Peterborough.
- 1902. Whellens, Henry, Forester, Gregynog, near Newtown, Montgomeryshire.
- 1905. WHITE, Andrew, Forester, Portmore, Eddleston.
- \*1898. WHITE, J. Martin, Balruddery, near Dundee.
- 1895. WHITE, William, Farmer, Gortonlee, Lasswade.
- 1905. WHITTINGHAM, Edwin, Contractor, St Mary's, Newport, Salop.
- \*1884. WHITTON, James, Superintendent of Parks, 249 George Street, Glasgow.
- \*1899. WHYTE, John D. B., Factor, Estate Office, Elveden, Suffolk.
- 1901. WHYTOCK, James, The Palace Gardens, Dalkeith.
- 1895. Wight, Alexander, Overseer, Thurston, Innerwick.
- \*1869. WILD, Albert Edward (Conservator of Forests, Darjeeling, India), c/o Henry S. King & Co., 65 Cornhill, London, E.C.
- 1883. WILKIE, Charles, Forester, Lennoxlove, Haddington.
- 1891. WILKIE, G., Architect, Hayfield, Peebles.
- 1904. WILKINSON, Henry Bevis, Factor, Holmhead, Corsock, Dalbeattie.
- 1902. WILKINSON, John, Factor, The Grange, Kirkcudbright.
- 1903. WILL, George, Manager, Crichton Royal Institution Farm, Dumfries.

- 1895. WILLIAMSON, John, Bank Agent, Loanhead, Midlothian.
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- \*1898. WILSON, David, Timber Merchant, Troon, Ayrshire.
- \*1889. Wilson, David, jun., of Carbeth, Killearn, Glasgow.
- 1908. Wilson, Edward Arthur, Rockingham, Edgbaston Park Road, Birmingham.
- 1907. WILSON, Ian Hall, Saw-mill Manager, Brodie Cottage, Brodie.
- 1896. WILSON, James, M.A., B.Sc., Royal College of Science, Stephens Green East, Dublin.
- 1900. WILSON, James, jun., Nurseryman, St Andrews.
- 1907. WILSON, James G., Assistant, Dalzell Estates Office, Motherwell.
- 1904. WILSON, James Watt, Seedsman and Nurseryman, Perth.
- 1902. WILSON, Sir John, Bart. of Airdrie.
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- 1897. Wilson, John H., D.Sc., F.R.S.E., Lecturer on Agriculture and Rural Economy, The University, St Andrews.
- 1903. WILSON, Thomas, Head Gardener, Glamis Castle, Glamis.
- 1899. WILSON, William, Timber Merchant, Auchenleck, Ayrshire.
- \*1904. WINK, John, Solicitor, High Street, Elgin.
- 1893. Wiseman, Edward, Nurseryman, Elgin.
- 1895. WISEMAN, William, Nurservman, Forres.
- 1906. Wolfe, George, sen., J.P., Shovel Manufacturer, Millburn, Bathgate.
- 1904. Wood, James, Forester, Marr Doncaster, Yorkshire.
- 1907. Wood, Thomas, Forester, Pitfour, Aberdeenshire.
- 1907. Woolford, Albert, Assistant Forester, Ragmore, Heckfield, Winchfield.
- 1904. WORSFOLD, Edward Mowll, Land Agent, Christ Church Villas, Priory Road, Dover.
- 1904. Wotherspoon, George, Factor, Cromartie Estate Office, Kildary, Ross-shire.
- 1904. WRIGHT, Robert Patrick, F.H.A.S., F.R.S.E., Principal of West of Scotland Agricultural College, Blythswood Square, Glasgow.
- 1906. WYLAM, Ralph J., Assistant Forester, Chester Lodge, Lambton Park, via Chester-le-Street.
- 1868. Wylle, George, Ballogie, Aboyne, Aberdeenshire.
- 1906. WYLLIE, William, Seedsman, 18 Market Street, Aberdeen.
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- 1904. Yook, Thomas, Factor, Menzies Estates Office, Aberfeldy.
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- 1908. Young, John, Hedger and Assistant Forester, Muirhouse, Falkirk.
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ROBERT GALLOWAY, S.S.C., SECRETARY AND TREASURER.

### VOL. XXII.



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1909



# CONTENTS.

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PAGE	The Forest Resources of the United Kingdom. Report of Address to the Society by Sir Herbert Maxwell, Bart., F.R.S.,	I.
8	A Scheme for Establishing a National Industry of Forestry,  (1) Some Criticisms by Mr R. C. Munro Ferguson, M.P.  (2) Our Correspondents Reply.	2
15	The Loganburn Smoke Case. By Alex. Lauder, D.Sc., .	3.
20	Brown, Indian Forest Service, Brown, Indian Forest Service,	4.
26	The Report of the Departmental Committee on Irish Forestry, 1908. By J. S. Gamble, C.I.E, F.R.S.,	5
34	. The Zürich Woods. By Fraser Story,	6.
46	Continental Notes—France. By A. G. Hobart Hampden, Indian Forest Service,	7
- 56	The Royal English Arboricultural Society's Tour in Denmark, 1908. By Fraser Story,	8.
61	. Note on Working-Plan for the Chopwell Woods. By W. S.,	9.
64	The Ardross Working Plan and Larch Canker. By A. D. Richardson,	10.
67 71	Notes of Silvicultural Interest. By Thomas Hall, Report of the Annual Excursion, August 1908 (with Plate),	11. 12.
77	Detailed Report on the Forestry Section in the Scottish National Exhibition, Edinburgh, organised by the Royal Scottish Arboricultural Society, 1st May to 31st October 1908 (with Plate),	13
89	. The Forestry Exhibition in the Highland and Agricultural Society's Showyard at Aberdeen. By a Correspondent,	14

PAGE	
92	of the Royal Agricultural Society of England. By a Correspondent,
97	5 British Forestry,
104	Notes and Queries:—Silvicultural Notes—The Silver Fir— The Appin Woods—Coniferous versus Broad-leaved Forests—Re-afforestation in Italy—Railway Fires Act, 1905—The Douglas Fir in Germany—Remains of Ancient Forests in Scottish Peat Mosses—Larch Disease in Ireland—Sir Walter Scott on Thinning—Appointment, .
115	Reviews and Notices of Books:—Sylvia: A Discourse on Forest Trees. By John Evelyn, F.R.S., with an Essay on the Life and Works of the Author by John Nisbet, D. Cec. A Reprint of the Fourth Edition in two Volumes. cxv. +620 pp., with two Illustrations, including Portrait of John Evelyn. Arthur Doubleday & Co., Ltd., London. 21s. net, .
118	Wald und Forstwirtschaft. Vom KglForstmeister Dr. A. Schwappach. Deutsche Verlagshaus Bong u. Co., Berlin. With Map and many beautiful Illustrations,
118	Neudammer Förster-Lehrbuch. By Several Authors. J. Neumann, Neudamm. Third Edition, 1907. Price 10 marks. 203 Illustrations, including 6 Coloured Plates, .
	Schlich's Manual of Forestry. Vol. V. "Forest Utilisation." By W. R. Fisher, M.A. 2nd Edition. xxii. + 833 pp., with numerous Illustrations and an Index. Bradbury, Agnew & Co. 12s. net,
120	Obituary:-John Booth,
121	7. Forestry in Some of its Economic Aspects. By Professor William Somerville, M.A., D.Sc.,
132	8. The State in Relation to Forestry. By Dr. W. Schlich, C.I.E., F.R.S.,
139	9. Afforestation and Timber Planting in Great Britain and Ireland. By Dr. J. Nisbet,
156	o. Afforestation. By Lord Lovat,
169	I. Afforestation. By R. C. Munro Ferguson, M.P.,
180	2. The Royal Commission on Afforestation: their German and English Critics and remarks thereon. By Bert.

	PAGE
23. Report of the Royal Commission on Afforestation. By Sir John Stirling-Maxwell, Bart.,	186
24. The Erosion and Afforestation Royal Commission Report.  By J. F. Annand,	188
25. Deputation from the Society to the Chancellor of the Exchequer on National Afforestation,	200
26. Afforestation of Waste Lands in Denmark, Holland, France, Belgium, and Germany,	207
27. The Aberdeen Branch of the Royal Scottish Arboricultural Society—Excursion to Forglen and Hatton,	211
28. The Trees of California. By F. R. S. Balfour,	213
29. The Glencorse Smoke Case. By Marion I. Newbigin, D.Sc.,	221
30. Continental Notes—Germany (with Two Plates). By Bert. Ribbentrop, C.I.E.,	227
Notes and Queries: Forestry Museum: Murthly Estate, .	237
Reviews and Notices of Books:—Illustrations of Conifers. By H. Clinton Baker. Vol. 1. 12+75 pp., with 66 beautifully executed full-page plates showing foliage and cones. Printed privately by Simson. Hertford, 1909.	239
Schlich's Manual of Forestry. Vol. V. "Forest Utilisation." By W. R. Fisher, M.A. 2nd Edition,	240
Proceedings of the Royal Scottish Arboricultural Society, 1909, with Appendices.	



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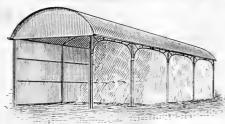


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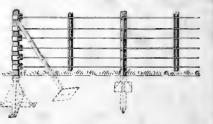


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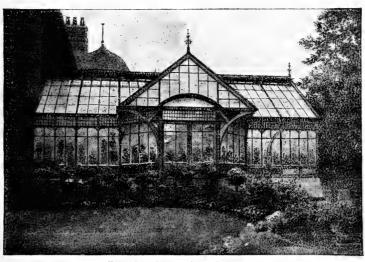
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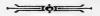
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A room has been secured there for the accommodation of the Society's books and papers; and donations of books on forestry subjects for the Library will be gladly received and acknowledged by the Secretary.

Members having books on loan will oblige by returning them to the above address.

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

which accompanies this Memorandum.

### The Principal Objects of the Society,

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

Meetings.

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

#### Prizes and Medals.

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

### School of Forestry, Afforestation, Etc.

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

As a further step towards the end in view, the Society, in 1890, instituted a Fund for the purpose of establishing a Chair of Forestry at the University of Edinburgh, and a sum of £584, 3s. 10d. has since been raised by the Society and handed over to the University. Aided by an annual subsidy from the Board of Agriculture, which the Society was mainly instrumental in obtaining, a Course of Lectures at the University has been delivered without interruption since 1889. It is recognised, however, that a School of Forestry is incomplete without a practical

training-ground attached to it, which would be available, not only for purposes of instruction but also as a Station for Research and Experiment, and as a Model Forest, by which Landowners and Foresters throughout the country might benefit. The Society has accordingly drawn up a Scheme for the Establishment of a State Model or Demonstration Forest for Scotland which might serve the above-named objects. Copies of this Scheme were laid before the Departmental Committee on British Forestry, and in their Report the Committee have recommended the establishment of a Demonstration Area and the provision of other educational facilities in Scotland.

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

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

#### Excursions.

During the past twenty-nine years, well-organised Excursions, numerously attended by Members of the Society, have been made annually to various parts of Scotland, England, and Ireland. In 1895 a Tour extending over twelve days was made through the Forests of Northern Germany, in 1902 a Tour extending over seventeen days was made in Sweden, and during the summer of 1904 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. In addition to the Annual Exhibition before referred to, a large and important Forestry Section organised by this Society was included in the Scottish National Exhibition which was held in Edinburgh during the past year.

### The Society's Transactions.

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

### Honorary Consulting Officials.

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

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

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

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

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

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

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

#### Local Branches.

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

### Local Secretaries.

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

Register of Estate Men.

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

#### LOCAL SECRETARIES.

#### Scotland.

Counties.

Aberdeen, JOHN CLARK, Forester, Haddo House, Aberdeen.

JOHN MICHIE, M.V.O., Factor, Balmoral, Ballater.

JOHN D. SUTHERLAND, Estate Agent, Oban. Argyle,

Ayr, ANDREW D. PAGE, Overseer, Culzean Home Farm, Ayr.

A. B. ROBERTSON, Forester, The Dean, Kilmarnock. WM. MILNE, Foulden Newton, Berwick-on-Tweed.

Berwick, 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.

W. S. CURR, Factor, Ninewar, Prestonkirk. East Lothian, .

WM. GILCHRIST, Forester, Nursery Cottage, Mount Melville, Fife,

St Andrews.

EDMUND SANG, Nurseryman, Kirkcaldy.

JAMES CRABBE, Forester, Glamis. Forfar, .

JAMES ROBERTSON, Forester, Panmure, Carnoustie.

JAMES A. GOSSIP, Nurseryman, Inverness. Inverness, JOHN HART, Estates Office, Cowie, Stonehaven. Kincardine, JAMES TERRIS, Factor, Dullomuir, Blairadam. Kinross, JOHN DAVIDSON, Forester, Dalzell, Motherwell. Lanark, .

JAMES WHITTON, Superintendent of Parks, City Chambers,

Glasgow.

Moray, JOHN BRYDON, Forester, Rothes, Elgin.

D. Scott, Forester, Darnaway Castle, Forres.

Perth, W. HARROWER, Forester, Tomnacroich, Garth, Aberfeldy.

JOHN SCRIMGEOUR, Doune Lodge, Doune.

S. MACBEAN, Overseer, Erskine, Glasgow. Renfrew,

JOHN J. R. MEIKLEJOHN, Factor, Novar, Evanton. Ross,

Miss AMY FRANCES YULE, Tarradale House, Muir of Ord.

JOHN LEISHMAN, Manager, Cavers Estate, Hawick. Roxburgh,

R. V. MATHER, Nurseryman, Kelso.

DONALD ROBERTSON, Forester, Dunrobin, Golspie. Sutherland,

JAMES HOGARTH, Forester, Culhorn, Strangaer. Wigtown,

H. H. WALKER, Monreith Estate Office, Whauphill.

#### England.

Counties. Beds. FRANCIS MITCHELL, Forester, Woburn. W. STORIE, Whitway House, Newbury. Berks, WM. A. FORSTER, Belgrave Lodge, Pulford, Wrexham. Cheshire, Devon, . JAMES BARRIE, Forester, Stevenstone Estate, Torrington. JOHN F. ANNAND, Lecturer on Forestry, Armstrong College, Durham, Newcastle-on-Tyne. Hants, . W. R. Brown, Forester, Park Cottage, Heckfield, Winchfield. JAMES BARTON, Forester, Hatfield. Herts. THOMAS SMITH, Overseer, Tring Park, Wigginton, Tring. R. W. Cowper, Gortanore, Sittingbourne. Kent. 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. WM. ELDER, Thoresby, Allerton, Newark. Notts.

W. MICHIE, Forester, Welbeck, Worksop.

WILSON TOMLINSON, Forester, Clumber Park, Worksop.

FRANK HULL, Forester, Lillieshall, Newport. Salon.

. GEORGE HANNAH, The Folly, Ampton Park, Bury St Suffolk, . Edmunds.

JOHN ALEXANDER, 24 Lawn Crescent, Kew Gardens. Surrey, . ANDREW PEEBLES, Estate Office, Albury, Guildford.

A. D. CHRISTIE, 16 Oak Tree Lane, Selly Oak, Birmingham. Warwick. ANDREW BOA, Land Agent, Glenmore, The Avenue, Wilts, . Trowbridge.

. D. TAIT, Estate Bailiff, Owston Park, Doncaster. York, .

#### Ireland.

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

# Royal Scottish Arboricultural Society.

#### FORM OF PROPOSAL FOR MEMBERSHIP.

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

	Full Name, .
	Designation, Degrees, etc.,
Candidate's	Address,
	Life, or Ordinary Member,
	Signature,
	Signature
Proposer's	Address,
Seconder's	Signature,
	Address

## 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:—
  - Proprietors the valuation of whose land exceeds £500 per annum, and others, subscribing annually . One Guinea.

  - 3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, subscribing annually . . . . Six Shillings.
  - 4. Assistant-Foresters, Assistant-Gardeners, and others, subscribing annually . . . . . . Four Shillings.
- IV. Subscriptions are due on the 1st of January in each year, and shall be payable in advance. A new Member's Subscription is due on the day of election unless otherwise provided, and he shall not be enrolled until he has paid his first Subscription.
- V. Members in arrear shall not receive the *Transactions*, and shall not be entitled to vote at any of the meetings of the Society. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.

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

- Large Proprietors of land, and others,
   Small Proprietors, Factors, Nurserymen, Timber Merchants, and others,
   Spresters, Gardeners, Land-Stewards, Tenant Farmers, and others,
   3 3 0
- VII. Any Ordinary Member of Classes 1, 2, and 3, who has paid Five Annual Subscriptions, may become a Life Member on payment of Two-thirds of the sum payable by a new Life Member.
- XII. Every Proposal for Membership shall be made in writing, and shall be signed by two Members of the Society as Proposer and Seconder, and delivered to the Secretary to be laid before the Council, which shall accept or otherwise deal with each Proposal as it may deem best in the interest of the Society. The Proposer and Seconder shall be responsible for payment of the new Member's first Subscription. The Council shall have power to decide the Class under which any Candidate for Membership shall be placed.

## CONTENTS.

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

r. The Forest Resources of the United Kingdom. Report of Address to the Society by Sir Herbert Maxwell, Bart., F.R.S.,	
<ol> <li>A Scheme for Establishing a National Industry of Forestry,</li> <li>(1) Some Criticisms by Mr R. C. Munro Ferguson, M.P.</li> <li>(2) Our Correspondent's Reply.</li> </ol>	8
3. The Loganburn Smoke Case. By Alex. Lauder, D.Sc.,	15
4. Demonstration Forests for Scotland. By F. L. C. Cowley-Brown, Indian Forest Service,	20
5. The Report of the Departmental Committee on Irish Forestry, 1908. By J. S. Gamble, C.I.E., F.R.S.,	26
6. The Zürich Woods. By Fraser Story,	34
7. Continental Notes—France. By A. G. Hobart-Hampden, Indian Forest Service,	46
8. The Royal English Arboricultural Society's Tour in Denmark, 1908. By Fraser Story,	56
9. Note on Working-Plan for the Chopwell Woods. By W. S.,	61
10. The Ardross Working-Plan and Larch Canker. By A. D. Richardson,	64
11. Notes of Silvicultural Interest. By Thomas Hall,	67
12. Report of the Annual Excursion, August 1908 (with Plate),	71
13. Detailed Report on the Forestry Section in the Scottish National Exhibition, Edinburgh, organised by the Royal Scottish Arboricultural Society, 1st May to 31st October 1908 (with Plate),	77
14. The Forestry Exhibition in the Highland and Agricultural	.,
Society's Showyard at Aberdeen. By a Correspondent,	89

PAGE	The Forestry Exhibition at the Newcastle-upon-Tyne Show of the Royal Agricultural Society of England, By a
92	Correspondent,
97	British Forestry,
104	Notes and Queries:—Silvicultural Notes—The Silver Fir— The Appin Woods—Coniferous versus Broad-leaved Forests—Reafforestation in Italy—Railway Fires Act, 1905—The Douglas Fir in Germany—Remains of Ancient Forests in Scottish Peat-Mosses—Larch Disease in Ireland—Sir Walter Scott on Thinning—Appointment, .
***	Reviews and Notices of Books:—Sylva: A Discourse on Forest Trees. By John Evelyn, F.R.S., with an Essay on the Life and Works of the Author by John Nisbet, D. & A Reprint of the Fourth Edition in two Volumes. cxv+620 pp., with two Illustrations, including Portrait of John Evelyn. Arthur Doubleday & Co., Ltd., London. 21s. net.
115	Wald und Forstwirtschaft. Vom KglForstmeister Dr
118	A. Schwappach. Deutsche Verlagshaus Bong u. Co., Berlin. With Map and many beautiful Illustrations, .
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119	
120	Obituary:—John Booth,

### TRANSACTIONS

OF THE

### ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

#### 1. The Forest Resources of the United Kingdom.1

In beginning his address, Sir Herbert Maxwell said he felt that, in undertaking to lay before them, in the space of an hour, a view of the present condition and an estimate of the capabilities of British woodland, he was attempting to get a gallon into a quart pot. The utmost he could hope to do was to convince them of the great loss incurred by the State and private owners by their neglect of sound principles of forestry, and the urgent need for a speedy reform in the management of our woods. The urgency of the matter arose from three causes, namely—
(1) The rapidly increasing demand for timber in the United

#### A. QUANTITIES OF WOOD AND TIMBER IMPORTED.

Wood and Timber.	1886.	1905.	Increase.	De- crease.	Per- centage.	
Hewn— Fir, Oak, Teak, Unenumerated, .	Loads. 1,388,278 95,178 40,895 58,411	Loads. 2,596,078 145,663 60,976 53,834	Loads. 1,207,800 50,485 20,081	Loads.  4,577	86°9 53°0 49°1 7°8	
SAWN OR SPLIT— Fir, Unenumerated, .	3,554,769 231,017	5,797,922 188,604	2,243,153	42,413	18.3 63.1	
STAVES,	130,717	119,182	•••	11,535	8.8	
FURNITURE WOODS— Mahogany, Unenumerated, .	Tons. 48,732 50,717	Tons. 95,548 197,111	Tons. 46,816 146,394	Tons.	96°0 288°6	
WOOD-PULP,	117,683	578,012	460,349		391.5	

Dye-woods, tanning material, wood-pulp boards, and some other forest products are not included in this return.

<sup>&</sup>lt;sup>1</sup> Report of a Lecture delivered to the Society in Edinburgh on 5th August 1908, by the Right Hon. Sir Herbert Maxwell, Bart.

#### 2 TRANSACTIONS OF ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

#### B. DECLARED VALUE OF WOOD AND TIMBER IMPORTS.

Wood and Timber.	1886.	1905.	Increase in 20 years.	Increase per cent.	
HEWN—  Fir,	£ 2,191,254 540,242 498,257 192,483	£ 3,495,523 875,875 876,654 225,753	£ 1,304,269 335,633 378,397 33,270	59°5 62°1 75°9 17°2	
SAWN OR SPLIT— Fir, Unenumerated, .	7,813,046 392,446	14,469,574 785,756	6,656,528 393,310	85°1	
STAVES,	532,117	553,092	20,975	3.9	
WOOD-PULP,	724,955	2,759,627	2,034,672	280.6	
FURNITURE WOODS— Mahogany, Unenumerated, .	402,935 407,562	820,995 1,170,785	418,060 763,236	103.4	
Total,	£13,695,297	£26,033,647	£12,338,350	90.0	

Kingdom; (2) a corresponding increase in the consumption of timber in certain other countries; and (3) a serious diminution in the available timber supply in all accessible parts of the world. As to the increase in British consumption, he exhibited Tables A and B, compiled from the Statistical Abstract, showing the increase in the quantity and value of our timber imports during the last twenty years. Much of the timber, he pointed out, was quite capable of being grown in the United Kingdom. The Table showed that there had been a large increase in the quantity of the imports of every class of wood product, except unenumerated hewn wood, unenumerated sawn wood, and staves. But even where there had been a fall in the total quantity imported, the enhanced price had swelled the total amount paid. Thus:—

		Decrease in Quantity.		Increase in Total Price.	
Unenumerated Hewn Woods,			Loads. 4,577	Per cent.	
Unenumerated Sawn Woods,			42,413	18.3	
Staves,	•		11,585	8.8	

The lecturer went on to say that it happened that the article of greatest consumption—sawn fir—was one that could be most readily produced in this country. We had neglected to grow it, and consequently had not only sacrificed, as producers, the profit which we might have secured by timely foresight, but we had to pay far more dearly as consumers.

#### COMPETITION OF FOREIGN CONSUMERS.

If anybody thought that there was no cause for anxiety, that it did not matter where we got our timber so long as we were able to pay for it, let him lay to heart the warning uttered by the Departmental Committee on Forestry, who reported in 1902:—"The world is rapidly approaching a shortage, if not an actual dearth, in its supply of coniferous timber, which constitutes between 80 and 90 per cent. of the total British timber imports." Coniferous timber rose 22 per cent. in price during the twenty years from 1885 to 1905. A plentiful supply of coniferous timber was indispensable to all our principal industries. How many of these industries could be carried on at a profit, if, in the next twenty years, timber rose another 22 per cent.? And everything pointed to such a contingency. There was a rapidly growing demand for an article of which the supply was running short. Some of our former sources of supply were already cut off. Thirty years ago we were drawing large supplies of timber from the German Empire. During that period the industrial expansion of Germany had been so great that, although the annual value of her forests was reckoned at twenty-two millions sterling, she now required every stick of their vield for her own consumption. Not only so, but she had entered into competition with us as a purchaser, importing about 4,500,000 tons per annum of foreign timber, valued at £,15,000,000. with Germany, so with the United States and Canada, where the forests were long considered to be inexhaustible, and doubtless would have proved so but for reckless lumbering. In all the circumstances, it was difficult to conceive anything more economically urgent than that steps should be taken without delay to develop our own neglected forestry resources. It might surprise some people to learn that Great Britain was the most treeless country in Europe. Certainly, far more

#### 4 TRANSACTIONS OF ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

verdure refreshes the eye during a daylight journey from Edinburgh to London than in one from Paris to Marseilles.

"Green fields of England, wheresoe'er
Across the watery waste we fare,
Your image in our hearts we bear,
Green fields of England, everywhere."

And so richly is that image umbraged with hedgerow timber and ornamental planting (economically the two most wasteful methods of tree culture), that we think of Britain as a woodland country. Inexorable statistics shatter that delusion. Compare, in Table C, the relative woodland area of France and the United Kingdom.

#### C. Proportion of Woodland to Total Area.

	Woodland Area.	Percent- age of Woods to Area.	Wood- land Area per Head of Popula- tion.	Percentage of Wood owned by-				
COUNTRY.				Crown or State.	Private Owners.	Church and other endowed Bodies.	Municipalities and other Communities.	Cor- porations.
	Acres.		Acres.					
Sweden,	45,061,984	44*4	9.36	19*9	80'1			
Finland,	50,359,471	38.1	25'77	71'1	18.0			
Russia,	447,592,405	36°o	4*58	60'3	29.7			
Austria,	24,150,215	32.6	1.0	6.2	71°3	7*1	14°0	0'2
Hungary,	22,683,469	28*3	1'27	16.0	41.3	6.6	18.5	17°7
German Empire,	34,734,123	25.8	0.66	32 9	47.5	1,3	15.6	2°3
Norway,	19,280,820	24.0	10.26	12.5	12°5	84.8	2.7	
Turkey, Bulgaria,								
Bosnia and	15,613,830	22*2	3,20			• •		
Herzegovina, . J	66-		-:		660-			
France,	23,360,062	17.7	0.22 1,52	11°1	66°5	22°5		• •
Spain, Belgium,	20,955,480	17.0	0,10		17.8	• • •	• • •	• •
Theles	9,030,320	12'0	0,35	3*8	53.8	42.0		
Holland,	568,100	7'0	0,10	3 0	53 0	43°0	• •	••
Denmark,	508,298	5°4	0'25					
Portugal,	1,165,346	5°1	0'25					
Great Britain and			1 -					
Ireland,	3,029,139	3*9	0.04	2°3	97.7	(		

#### DEFICIT ON WOODLANDS.

Very few, indeed, were the British landowners who could show a profit on the year's management of their woods. Were it possible to ascertain the facts relating to the whole 3,000,000 acres, it could not be doubted that they would show a very heavy deficit. They had the facts relating to the Crown woodlands in this country. The balance-sheet of the Office of Woods and Forests for 1903-4 showed, under the heading of "Royal Forests and Woodlands," a revenue of only £32,481,

against an expenditure of £58,402, a net loss of £25,911. They were not to suppose that he was casting any blame on the Commissioners, who had administered the woodlands in the past according to the instructions of Parliament—namely, as a mixture of pleasure ground, common grazing, and amateur forestry. He was glad to recognise that since Mr Stafford Howard became Senior Commissioner he had been successful in persuading the Treasury to initiate a better system, the first fruits of which was the purchase of 13,000 acres in Argyllshire as a State Forest. A comparison with the German forests showed that if British forest management were as successful as German, the 3,000,000 acres of woodland in these islands, instead of costing enormous sums to maintain, should return an annual net profit of a round million, or 6s. 8d. an acre.

#### CLIMATIC CONDITIONS.

The most common objection to forestry enterprise in the United Kingdom was founded upon the score of climate. "Oh," it was said, "you need not try to grow trees for profit in Britain; our storms are far too violent and frequent." There was a perfectly satisfactory answer to that. In the first place, there was no evidence that our climate was more stormy than it was when the Romans landed here nineteen hundred years ago, and found the whole island covered with dense primeval forest up to the 1500 feet level. Secondly, atmospheric disturbance was not more violent or frequent with us than in the United States, Canada, Scandinavia, and other lands. It was quite true that our proportion of exposed seaboard, where profitable planting was out of the question, was excessive, but all our inland and mountainous regions were no more exposed to the wind than those of other countries. It was also true that British woodlands, such as they were, suffered more from wind damage than Continental forests did, not because our gales were more frequent, but because our woods were almost invariably laid out in small blocks or in belts, with a view to game, ornament, or shelter, and because we had got into the practice of overthinning them, encouraging heavy, branchy heads, which invited calamity. A thousand contiguous acres of wood grown in close canopy would successfully resist a gale that would work havor in 1000 acres scattered over an estate of 10,000 acres.

Wind was certainly the forester's main enemy. Soil—its quantity and quality—was a minor consideration in forestry, provided it was not water-logged.

#### DIFFICULTIES NOT INSUPERABLE.

It would take, not one lecture, but a course of lectures, to enter thoroughly into the question of profit. He could only touch upon the principal difficulties to be overcome, and he thought they would agree that these difficulties were by no means insuperable. And the time had arrived when either the difficulties must be overcome or landowners must cease to grow trees, because the increased expense of land management, the great fall in value of agricultural land, the steady rise in rates, and, above all, the paralysing effect of the Death Duties, made it imperative that woodland should not continue to be treated as an ornamental luxury. Despite the incessant and growing demand for timber in this country, the complaint was very commonly heard from those landowners who had fine timber to dispose of, that they could not get a decent price for it. Until British woodlands had been brought into regular rotation, and could supply timber of uniform quality and regular annual quantity, timber merchants would resort to those countries where these conditions were fulfilled. Speaking of the natural regeneration of timber where the ground was protected from grazing, and where there was little or no ground game, Sir Herbert Maxwell said, that if British landowners could but realise the enormous cost of maintaining a stock of rabbits, we should soon see the last of that accursed race-except in their proper place, the fenced warren. In connection with this part of the lecture, many details and illustrations were given regarding the different classes of trees, and the results obtained with them.

#### TO INCREASE RURAL POPULATION.

There was another aspect of the forestry question which was almost as important as the commercial one—namely, the social aspect. The attention of all of them—politicians, philanthropists, and people in general—was greatly absorbed by the question of rural depopulation. Owing to the great fall in the value of sheep farms, there were hundreds of thousands of acres suitable for forest growth now rented at from 6d. to 2s. an acre. From

some of this land a revenue was derived from its sporting capabilities, but much of it carried few or no grouse. Such land was constantly being offered for sale, and, taking the price at twenty-five years' purchase, might be had for from £,700 to £2500 for a thousand acres. He believed the Government paid less than £,2 an acre for the estate of Inverliever. He supposed that hitherto the working population on that area of 13,000 acres consisted of about one shepherd to every 1000 acres. Henceforward there could not be less than one woodman to every 100 acres. Apply that over an annually increasing area, and they would not only convert a revenue of 6d. to 2s. an acre into one of 6s. to 11s. an acre, but they would have increased the rural population by 900 per cent. Nor was that all, by any means. Forestry created and supported a host of subsidiary industries. For instance, there was a vast amount of wood in every forest of which at present we could make no use in this country, for coal had supplanted wood as fuel. He believed there were two or three pulping-mills or cellulose factories in England, but they actually imported the soft woods required for pulping, for the simple reason that there were no woodlands in Britain managed on such a system as would ensure the miller a regular supply of raw material. The result upon this country was that we imported from Germany wood-pulp, paper material, and paper manufactured from wood to the value of between eight and ten millions sterling per annum. Every pound of this might be grown and manufactured in this country if we had but the system established. Dealing with the objection that the adoption of a scientific and economic system of forestry would destroy some of the fairest landscapes in the United Kingdom, especially park scenery around country houses. Sir Herbert Maxwell said, that to produce the finest park scenery, the woodland must pass through the stage of close canopy and high-forest. Then, when the crop was mature, they might carve it into landscape according to their fancy. Nor was the process of felling a disfiguring one. conclusion, the lecturer said he hoped he had shown some reason for the proposition that there was urgent need for strenuous action on the part of the Government before it was too late. The more closely they inquired into the facts, the more clearly they would realise how much they were sacrificing by indifference to the forest resources of the country.

# 2. A Scheme for Establishing a National Industry of Forestry.<sup>1</sup>

I. Some Criticisms by Mr R. Munro Ferguson, M.P.

To the Hon. Editor of the R.S.A.S. Transactions.

SIR,—In the last issue of the *Transactions* you invite discussion upon an article with the above title, which is welcome as a very clear and ingenious "financial scheme to attract Treasury support for afforestation," and indeed these words would be a more accurate title for this extremely able and well-informed, if unconvincing, article. It deals wisely with many features of the situation, whilst the financial proposals set forth are as sound as anything of the kind is likely to be.

In the first place, it is necessary to reiterate the fundamental fact that silviculture differs from all other industries, in this respect, that the man who plants never sees his money again, nor does he reap the profit of his investment.

This obviously discourages private enterprise, and indicates that, in the absence of Methusaleh, the State is the only investor who can both put in the money and take it out again, and provide that continuous good management without which there cannot be sound financial results. The absence of these essential elements of commercial enterprise discourages investment by the individual, and points to the State as being the only owner who is in a position to carry on successfully this great industry. The very different fates of agriculture and silviculture under private ownership, sufficiently illustrate what a determining factor the absence of immediate return and the uncertainty as to future management is in the life of an industry." Scottish agriculture, under the fostering care of the landowners, and thanks to their expenditure on agricultural equipment, is the finest in the world—while silviculture is for all practical purposes non-existent.

Further, the dangers of the scheme are-

- 1. That it will distract an already distracted Treasury from the true solution of our difficulties, and prolong already intolerable delays.
- 2. That it ignores and sets aside (1) the Departmental Forestry Report of 1902, and the subsequent concentration of competent opinion in favour of a large

<sup>&</sup>lt;sup>1</sup> See Vol. XXI, p. 135.

State Demonstration Forest, which led to the purchase of Inverliever; (2) the fact that the only security for profitable afforestation is continuous good management, which can only be guaranteed by the State.

Afforestation by loan is, in brief, a policy founded on the idea that the ordinary proprietor and his staff being usually more economical and careful than a Government official, the State will find the money, and the owner provide the land and the management, State and owner having a common profit and loss account, and continuing in co-partnery until the latter repays the loan, or until, failing repayment, the State steps into his empty shoes. This last contingency is indeed, under existing conditions, perhaps the most promising aspect of the scheme, but at best it is a penny wise pound foolish policy. The State, reluctant to spend 30s. to 40s. to acquire the land, is nevertheless willing to lend 100s. an acre for planting it, and is expected to hand it over to a management which is defective just because it is liable to change in purpose and capacity from one generation to another. This may involve the State in a loss of £,100 per acre, and entail its being obliged in the end to take over a wasted property of ill-grown timber. It has been officially declared that existing woodlands are worked at a dead loss, owing to this difficulty of securing perpetual expert control, and to the incidental ravages of game, wind, fire, and ignorant management, and yet the State is invited to bolster up a system which would retain that particular feature which is the cause of present failure.

It is not difficult, it is true, for owners to obtain skilled advice, though this may be vitiated by lack of knowledge, on the part of the expert, of local conditions, without which his conclusions are apt to err. The accepted theories of forestry are readily applicable in Scotland, but they are still in the experimental stage. Nor are silvicultural Crichtons in any form to be found under every gooseberry bush. There are many enlightened lairds and admirable foresters, but few amongst them are trained in accordance with Continental standards; and there is no known instance of a trained enthusiast who has achieved individual success, having a successor competent to carry on his work. In Britain, therefore, there is no silvicultural standard acquired by scientific study and preserved by custom. The agriculturist who cut his corn

green, or allowed it to seed itself, or left it to the mercy of bird and beast, would attract attention, but the ordinary owner of woodlands may complacently commit equivalent follies with the approval of a public which enjoys sport or silvan scenery, and is hardly yet awakened to the social importance of silviculture.

It is, indeed, not unlikely that practical public sympathy for silviculture may take the impulsive form of advancing State loans for afforestation, upon which the urban unemployed will have first call, to the signal detriment of silviculture. In the absence of competent, responsible, continuous control, afforestation loans would be wasted in the future as have been private resources in the past. It is doubtful whether, without legislation, any individual proprietor could tie up property for the hundred years rotation of his timber crop,—in fact, recent legislation has tended towards further loosening the grasp of the dead hand.

Assuming that the difficulty of a long lease between the State and a succession of owners is overcome, there remain other factors that have brought ruin to existing silviculture. Some of these dangers have been mitigated, it is true, by the Squirrel Club, the increasing dislike of the rabbit, the influence of the Royal Scottish Arboricultural Society, the legal compensation for loss by fire—which latter would be more than counterbalanced by the effects of the access to Mountains Bill. The broad fact remains, however, that to grant loans under existing conditions to private individuals would be, from the Treasury point of view, a visionary scheme, unsupported by either competent opinion or official reports.

To grasp the real problem, it must be remembered that to develop the latent resources of the soil of Scotland 5 million acres should be afforested. This project offers an occasion so signal for increasing the resources and the population of the poorest and least populated district as to rule out a wasteful palliative, in favour of a comprehensive, well-thoughtout scheme of development. Loans can be safely granted to a Board of Forestry, or to corporations whose forest lands would be under the direct control of the Board's forest officers.

Public expenditure on training and experiment there must be, if any effective progress is to be made, and this is preliminary to the purchase of other Inverlievers by the State, or to the granting of loans in any form. The immediate essentials are a Demonstration Forest costing about £100,000 to buy and to equip, and a Board of Forestry for Scotland to deal with and to develop the scheme of the 1902 Report. Since that date much has happened. Public opinion has ripened, legislation is impending which would greatly reduce the amount of land available for silviculture, a timber famine is in sight, and our views have been supported by the admirable Report of the Irish Forestry Committee.

We do not know what the true silvicultural area of Scotland is, or where it mainly lies, and to ascertain this would be one of the first duties of the Board. Private owners have enough to do in setting in order their existing and decreasing woodland area. The Board would have to plan the rest. This preliminary undertaking would take some years, during which it would bring the Demonstration Forest into working order, train its foresters, and conduct experiments in combination with the many landowners who have done so much original research work of recent years on their own estates.

Why should the Government hesitate to purchase either in the open market, or with compulsory powers? It cannot be because of the price of the land, when from 20s. to 40s. is the capital value of many hundred thousand acres of the best timber-lands in the Highlands, which could be made to produce almost a like annual value, and rival if not excel those of Germany.

It is assumed under the Loan Policy that the State would advance £5 an acre for planting. At the same rate it could both purchase and plant enough land to keep the Board of Forestry busy for many years to come. It is urged that State purchase would involve taking over mansions, farms, or villages which the State does not need. That is so, but this need not entail loss. Mansion-houses could be resold with less land and could often be excluded from the transaction, and so with farms and villages, where also the State and local authorities could well conduct to the best advantage popular experiments in small holdings. Then there is the expedient of compulsory leasing by the State, as under the English Land Bill, which is quite justifiable so long as the security for the rent was sufficient to allow the lease to be readily sold-for the objection to reviving hereditary entails for owners is no less strong than that to continuing incapable

occupiers upon the soil by fixity of tenure and fair rents. By purchase alone can the State acquire a really free hand and responsible control, and avoid that worst of all tenures, divided ownership. Successful silviculture is no mere matter of finding capital, nor of paper conditions. Capital cannot be advanced for silviculture by a stroke of the pen in a country where unparalleled ignorance of the subject is the rule. The interests of the State and of silviculture alike demand that action should be taken, not on these lines, but on those of the Report of the 1902 Committee, to which you, Mr Editor, were one of the signatories. It may be that the Government will prefer the attractions of this able scheme, which appeals to many of their predilections, as illustrated by the Scottish Land Bill. It sets aside the advice of responsible advisers entrusted to prepare a scheme. It terminates responsible ownership. It advances loans without provision for responsible management-relying upon the classic phrase that the "selfinterest" of occupier or owner will sufficiently safeguard the Treasury or any other interest. It is this curious assumption that land industry, as distinct from any other, needs no responsible control, that a divided responsibility is a positive advantage, and a legal interpretation an unfailing instrument—which vitiates the whole official present day land policy in Scotland.

The choice before the country, on the one side, is that some body such as the Crofters Commission or the Congested Districts Board, under Dover House, should administer, amongst other doles, loans for afforestation to anyone who cares to apply; and upon the other, a competent Board of Forestry, with a regular training and research system, and a system of working-plans, which eventually would utilise as national forests a quarter of Scotland which is presently non-productive.

It may be that in the future, when scientific afforestation is established in our midst, a stimulus to fresh enterprise by a system of loans might well form part of a great State scheme for afforesting our waste places, but the central feature of that scheme must be State forests with their complement of demonstration areas, training schools, and experimental plots. Let us therefore concentrate on the essential, and work out subsequent developments when the time comes, and when we have attained our preliminary object.

#### 2. OUR CORRESPONDENT'S REPLY.

#### To the Hon. Editor of the R.S.A.S. Transactions.

SIR,—You have courteously invited me to reply to Mr Munro Ferguson's comments on the paper which I contributed to the July number of the *Transactions*. I have always followed Mr Ferguson's views on forestry with the greatest interest, and it is perhaps largely due to this that I think you will find the ideas expressed in my paper are in the main in accord with the opinions he holds and now repeats:—

- (1) That private management under existing conditions is a failure, the exceptions being sufficient merely to prove the rule;
- (2) That training and education are essential if effective progress is to be made; and
- (3) That, to use Mr Ferguson's own words, "the State is the only investor who can both put in the money and take it out again, and provide that continuous good management without which there cannot be sound financial results."

Mr Ferguson goes on to say that "to grasp the real problem, it must be remembered that to develop the latent resources of the soil of Scotland, 5 million acres should be afforested." The difference, if difference there be between us, is on the question of how this process can best be carried out. Mr Ferguson thinks that it must be done by buying out the private owners, while I, taking perhaps a more lenient view of proprietors as a class, would like to work with them and encourage, while controlling, their individual efforts.

To meet one of my objections to a purchase scheme, Mr Ferguson suggests that the Government might resell the portions of estates it bought that were not suitable for planting—farms, mansions, etc. This would be a serious speculation in land for the State to venture upon, and I fear the results would only give fuller proof that the State as a merchant has always to buy dear and sell cheap. Certainly it would greatly reduce the money that might be made available by Parliament for actual planting. Still, at times tracts of land may be for sale, consisting almost entirely of land suitable to plant, unencumbered with buildings and clear of game value. Even Inverliever is not perfect in this respect. Some such tracts of bare land, if

offered cheap, I agree might quite well be bought and planted up by Government. But I fear we would have to wait long for such to be found in any quantity, even longer than we have had to wait for Inverliever.

But Mr Ferguson, I gather, inclines to think that any large scheme of afforestration by the State—whether his or mine—may be apt to hinder progress in scientific training and the acquisition for this purpose of a demonstration area. If I thought that training and education would thereby be sacrificed, I would be the first to join with him in urging delay. But, on the contrary, I think that we shall never make any real progress in getting a class of highly trained foresters in this country till we have some national scheme; and for this reason, that, till we can offer the prospect of important and responsible posts, men will not sacrifice time and money to go through a thorough course of scientific training. As one of the most experienced foresters in Scotland remarked to me the other day, the average pay of a head forester just now does not exceed £,70 per annum, with the off chance of a pension if he has a generous employer. we expect educated men to be attracted by such reward? only by State assistance in some shape that it is possible to form extensive forest areas, systematically managed, which will justify the employment of well-paid forest managers, be the land privately or publicly owned. I feel sure in this Mr Ferguson will agree with me, as I agree with him that it is allimportant that we should be united in what we ask Government to do. Under such a scheme as I suggested, the Governmentcontrolled areas would be useful for demonstration purposes, especially if scattered throughout the country.

We have reached a stage when public opinion seems ripe for some practical scheme for the planting of our waste land, and if such could be submitted in definite shape, some progress might be made. The Report of 1902 showed us that it is useless to look to individual effort in this matter, but the Departmental Committee was apparently unable at the time to agree as to a general scheme of State afforestation. Surely it is now time to make some proposal and save the precious years that are slipping by. Might not the Council of the Society endeavour to propose some scheme for national assistance on sound principles?

YOUR CORRESPONDENT.

#### 3. The Loganburn Smoke Case.

By ALEX. LAUDER, D.Sc., Consulting Chemist to the Society.

The action brought by Lord Inglis of Glencorse in 1877, against the Shotts Iron Company, to interdict them from burning ironstone near his estate, the fumes from which, he alleged, were seriously damaging his plantations, is one of the most famous, if not the most famous, of the many cases in which damage to trees is said to have resulted from manufacturing or chemical operations. The importance of the action is due not merely to the extent of the interests involved on both sides, but to the large amount of evidence, both professional and scientific, brought by pursuer and defenders, and to the great amount of scientific work of an accurate kind carried out in connection with the case. The action was first tried before the Lord Ordinary, who granted interdict; an appeal was taken by the Iron Company to the Second Division of the Court of Session, and refused; finally, the House of Lords confirmed the interdict, and the calcination of iron ore in open heaps at distances less than one mile from pursuer's boundaries was prohibited.

It should be noted at first that the question involved was one of fact and not of law. The plantations in question on the Glencorse estate were replanted, mostly by Lord Inglis, in 1856, '57, '58, and '59, and consisted chiefly of oak, ash, beech, birch, lime, elm, horse-chestnut, and, as regarded the fir tribe, the usual firs of that time, viz., Scots pine, larch, Norway spruce, and silver fir. A considerable number of the newer varieties of coniferæ were also planted.

According to the evidence of the pursuer himself, as well as that of his head forester and other independent witnesses, the plantations, up to the year 1877, were generally in a very flourishing condition.

In the spring of 1877 the Shotts Iron Company commenced calcining or burning ironstone at their pits, close to the boundary of the pursuer's estate. In the summer of the same year the first signs of injury to the plantations began to appear, and the appearance of injury went on increasing rapidly up to the date of the action.

It may not be out of place to give here a short account of

the process of calcination or burning of iron ore, and the more important chemical actions involved. Blackband ironstone contains a considerable quantity of carbonaceous matter, the amount varying from 10 to 50 per cent., and before the ore is smelted in the blast furnace for the production of cast iron, it is subjected to a preliminary process of burning or calcining, with the object of getting rid of this carbonaceous matter, water, and other volatile substances. In open roasting, the process employed by the Shotts Iron Company, the ore is simply spread in heaps or "bings," set fire to, and allowed to burn itself out. The ore is broken and heaped up to a height of about 8 feet over an area of about 2 acres; one edge of the heap is first mixed with coal, and the heap or "bing" set fire to along that edge; it then burns gradually throughout the entire extent, the burning taking from two to three months to complete.

In addition to this carbonaceous or coaly matter, however, the ore contains about 1 per cent. of sulphur, and during burning the greater part of this is set free in the smoke as "sulphurous acid," the chemical substance to which the familiar sharp pungent smell of burning sulphur is due. This sulphurous acid gradually combines with oxygen gas from the air, especially if the air is moist, to form sulphuric acid—the substance known in the concentrated state as "oil of vitriol." Both these substances, but especially the sulphuric acid, are exceedingly hurtful to vegetation if present in any quantity in the air. Although the quantity of sulphur burnt off from the ore—less than I per cent.-may not seem large, yet when we remember the enormous quantities of ore roasted, it is seen that a very large quantity of sulphurous vapours is being poured into the air during the time the operation is in progress. It was not enough, however, to prove that large quantities of sulphurous vapours were given off at the burning bings; it had to be shown that by the time the smoke reached the plantations it still contained, even although much diluted by mixing with the air, sufficient sulphurous fumes to cause the damage complained of, and further, that the damage was due to the fumes and to nothing else. The amount of smoke which reached the plantations depended obviously on a considerable variety of circumstances—the distance of the woods from the burning bings, the direction of the prevailing winds, whether the plantations stood at a higher or lower elevation than the

bings-to mention only some of the more important factors. The solution of the problem presented many difficulties, and a very thorough and complete chemical investigation, extending over several years, had to be undertaken. This chemical investigation was carried out for the pursuer by Professor Dewar, of Cambridge, and the late Professor Dittmar, of Glasgow. To give some idea of the difficulties encountered, it may be noted that the bings were not burning continuously, so that there were enormous variations in the amounts of smoke and fumes present in the air, making the selection of suitable methods of chemical analysis exceedingly difficult; that the different plantations were variously situated with regard to the bings, making it necessary to carry out many perfectly distinct series of observations. Finally, the difficulties of getting a reliable method of analysing the air, capable of being worked for months at a time, under what we may term "field conditions," proved so great that direct analysis of the air was given up. Instead of this, analysis of the rain-water collected at different points in the plantations was adopted, with very satisfactory results. The sulphurous vapours already referred to dissolve in water, so that rain falling through the smoke would take up a certain amount of the vapours—the percentage of the vapours actually taken up depending on whether the rain was heavy or light, whether there was much wind, and various other causes. It is further evident that the sulphurous fumes could only be captured if rain happened to be falling: the rain-water might, and generally would, contain less sulphuric acid than there was present in the air; it could not possibly contain more, and so there was no possibility by this method of exaggerating the amount of sulphurous vapours which actually reached the woods. The rain-water collected in the bottles employed was analysed at the end of each month, and showed, as was to be expected, considerable variation, not only in the amount of sulphuric acid present, but also in the amounts collected at the different stations. The average results showed an amount of sulphuric acid five times as much as that commonly present in the air of inland places in Scotland, and at some of the collecting stations the amount was many times greater than this. Pure air contains no sulphuric acid at all. but there is always a certain amount present where coal fires are burned.

Many other witnesses for the pursuer—foresters, botanists, and timber merchants—were also examined, and testified that the plantations were properly planted and drained, that the trees were suitable to the locality and generally free from disease previous to the commencement of the operations complained of. Several of these witnesses also stated that the injury to the trees was typical of the action of sulphurous fumes on vegetation, with the effects of which they were familiar in other parts of the country.

So much for the main lines of the pursuer's evidence. For the defence it was attempted to prove that the decay of the trees was not due to any evolution of sulphurous fumes from the burning ironstone, but to a variety of natural causes. was alleged, first of all, that the fumes could not be the cause of the damage, as sound trees were found alongside decaying ones all through the woods, and that the trees nearest to the burning bings were sometimes not affected, while those farther back showed marked signs of decay. It was pointed out in answer to this, however, that the nearer trees sometimes escaped the fumes owing to differences of level and the direction of the prevailing winds, more than trees farther back. Then it was further alleged that the planting had not been properly done; that the trees were too crowded, that the roots of the trees previously in the plantation had not been removed, that the ground had not been properly drained, and that it was waterlogged, and that the trees were suffering from the effects of an attack of fungi. With regard to the fact that the damage began to appear soon after the bings started burning, it was maintained that the real cause was the various natural agencies mentioned above, together with the excessive rainfall of 1877 and the previous year. The average rainfall at Glencorse is 36 inches. In 1876 it was 45 inches, and in 1877 54 inches, both years being exceptionally wet and cold. With regard to the sulphurous fumes, it was also urged for the defence that, long before the fumes had reached the trees, the free acid had been diluted so much by the air, and neutralised to such an extent by ammonia, which, it was said, was also given off in the process of burning, that there was not sufficient free sulphuric acid present to do any harm. The evolution of ammonia from the burning bings, in sufficient quantity to have any appreciable effect in neutralising the acid vapours, was, however, denied

by the chemists acting for the pursuer; they were of the opinion that any ammonia evolved would be burned owing to the high temperature of the burning ironstone, and could not therefore neutralise any acid. It was proved, moreover, by many witnesses for the pursuer, that a distinct sulphurous smell could be detected in the woods when the smoke was being blown in that direction. In giving judgment in the final appeal to the House of Lords by the Iron Company against the interdict, the Lord Chancellor gave the following review of the evidence led on behalf of the Iron Company:—

"It was attempted by the appellants (the Shotts Iron Company) to account for all the mischief by natural causes, and to meet the difficulty arising from coincidence of time by suggesting that the effects of those causes may have been aggravated by the prevalence, at that time, of unusually wet and cold seasons, and that the trees only then attained that stage of their growth at which such effects would be likely to be developed. I have no doubt that, to some extent, the natural causes suggested by the appellants' witnesses, or some of them, were really in operation in these, as they would probably be in most plantations similarly situated, and planted or managed on a similar system. It is also highly probable that when to the ordinary operation of such natural causes was superadded the deleterious influence of sulphurous vapours, those trees which, from wet or bad soil, from overcrowding, from want of light and air, or from any other source of disease or decay, were weaker than the rest might suffer most and soonest. Whatever might be the causes at work, it is perfectly consistent with experience that strong plants would resist them longer and better than weak, and that a noxious vapour or fluid, descending more or less intermittently in a diluted state, might operate upon the stronger plants only as a slow poison, requiring continuance during a considerable space of time before its effects would become fully manifest. This might well account for much difference in the appearance of neighbouring trees even of the same kind.

"And the facts also relied upon by the Iron Company, that some of the trees and plants which withered and died were more distant from the bings than others which did not in like manner suffer, is of much less weight than at first sight it might seem to be, when the variations of atmospheric influences,

on which the incidence of the deleterious vapours must always depend, are taken into account. Primarily the fumes start upwards. They may or may not be earlier or later brought to the ground, according to lateral winds and other conditions, and in certain conditions portions comparatively near the bing may be less affected than portions farther away."

With the judgment of the Lord Chancellor the other Lords who also heard the appeal (Lords O'Hagan, Blackburn, and Watson) concurred, and, as already stated, the interdict was confirmed.

As will be seen from the above necessarily brief summary, the case abounds in questions of the greatest interest, not only to the forester but to the chemist; it is remarkable for the elaborate nature of the investigations carried out in connection with it, and also illustrates, incidentally, the great difficulty which sometimes arises in legally proving the source of an injury, although, to the ordinary observer, there may not be any doubt whatever as to the cause.

#### 4. Demonstration Forests for Scotland.

By F. L. C. COWLEY-BROWN, Indian Forest Service.

The continued existence of a tendency to minimise the importance of Demonstration Forests in connection with forest education in Scotland, can only be due to a lack of acquaintance with the first principles of scientific forest training.

The forester of the old school may almost be said to have habitually confounded silviculture (the science of growing forests) with arboriculture (the art of growing individual trees). The two are entirely different, both as regards the result aimed at and the method to be adopted, and any attempt at compromise must end in disappointment and failure. Isolated trees, or small groups of trees, are grown primarily for purposes of ornamentation in parks, gardens, avenues, etc.,—the financial return or timber-yield being at best of very secondary importance. In the management of forests proper, on the other hand, the main object is the regular annual or periodical yield of produce, and a similarly regular financial return. In the scientific management of a forest, æsthetic considerations should

have no weight whatever, while even the financial yield should be held strictly subordinate to the welfare of the growing stock, and the enhancement of the quality of the locality.

The size, quality, and kind of produce to be yielded of course depend upon local exigencies of demand, and the meteorological and physical conditions of the locality. It is of the first importance to realise that the objects of management (previously determined on often for a long period of years) can, under ordinary circumstances, be realised with remarkable accuracy, provided that the working-plan be drawn up in accordance with the principles of scientific forestry, and the execution be entrusted to a properly trained staff.

As regards the shape of the trees composing the growing stock of a high-forest, it may be laid down that, as a general rule, the object to be aimed at should be the production of tall, healthy trees, with well-developed crowns and clean cylindrical boles, free from branches. Such trees, to the eye of the trained forester, possess a charm and beauty all their own, but would probably not appeal at all to the landscape arboriculturist, who would naturally prefer the area to be studded with short-boled, branching silvan monarchs, of the "spreading chestnut tree" type. Such specimens, magnificent as they are from the artist's standpoint, are essentially the product of bad forestry, as they present per acre the maximum of branches and foliage, and the minimum of marketable timber. To obtain clean-boled timber, the primary consideration is that of light. Certain species of trees demand an exceptional degree of light, and are termed "light-demanders." Others can bear considerable shade, and will thrive with a very slight modicum of light. These are known as "shade-bearers." Between the two extremes ranges every degree of "light-demand," and it is in effectively playing upon this gamut of sensitiveness that one of the main opportunities of the foresters' science consists. For when a portion of a tree is deprived, by any cause, of the quantity of light requisite for its full development, the members so affected dwindle and become impoverished. The growing energy of the tree is then immediately directed to the development of the side and extremities to which the light has still access. Consequently, it may be said to "seek" the light. It follows that if the tree is practically surrounded by other trees of an equal or less height, the only outlet available is towards the

canopy of the forest, and, as a result, trees so grown develop the great height-growth and cylindrical clean boles desired by all scientific foresters. Delicately adjusted combinations of shade-bearers and light-demanders, as undergrowth and under-storeys, complicate the problem considerably, and, when successful, are naturally a source of special triumph to the silviculturist. But the principle to be remembered is that the shape of timber-trees is chiefly affected and controlled by the degree and intensity of the light admitted.

From the foregoing it will be evident that the effects of this important factor in the development of forest-trees can only beproperly studied when the latter are associated in masses and blocks, extending over very considerable areas. The element of light scarcely enters into the consideration of the arboriculturist responsible for the production of what is popularly known as a well-timbered park-viz., a fine open expanse of verdure, dotted with gnarled and branching trees of great girth and gigantic spread, but supported by a short bole, bifurcating into a multitude of foliage-laden boughs. Consequently, it is hardly a matter for surprise that, in the selection of Demonstration areas for instructional purposes, the vital necessity for forests of comparatively large extent, under systematic management, is scarcely realised by those who have never had the privilege of visiting the superb examples found on the Continent-and more especially in France and Germany. The importance of such areas can scarcely be over-estimated. Forestry is not an exact science in the sense of chemistry, nor can the factors of silvicultural problems be reduced to sediment in a test-tube, and subjected to laboratory analysis. The very elements of any forest question are primarily the trees themselves collectively, and they must be studied as such in situ, after the theory has been explained and discussed in the lecture-room.

Demonstration Forests need not, and should not, be under completely successful management throughout their extent. Object-lessons of errors and mistakes, as showing what to avoid, are no less essential than the ideals of silviculture presented by the portions of the area subjected to correct silvicultural methods. Both have their uses, and both are found in the vicinity of the

<sup>&</sup>lt;sup>1</sup> Past silvicultural errors are, unfortunately, too common here to render it necessary to show examples of them on the limited area of the Demonstration Forest.—Hon. Ed.

great Continental forest schools. At Nancy l'Ecole Nationale Forestière de France has, within a radius of a few miles, Demonstration Forests covering thousands of acres, in which even such difficult and complicated operations as the conversion of coppice to high-forest can be studied first-hand, comparative suitability of natural and artificial reproduction, the effect of thinnings at various stages, and of the density of the canopy on the acre-volume, the requisite closeness of the final crop, and the adaptability of various species to the environment, are only among a few of the other problems that may be studied or demonstrated in this magnificent State property. The Reale Instituto Forestale at Vallambrosa, in Italy, is similarly provided with an instructional area of large extent. In this case the forest is actually at the doors of the college—an advantage beyond all estimate. In both cases examples of mismanagement and erroneous systems are to be found close by, in adjoining private forests-to the undoubted benefit of students properly instructed.

All over Europe the necessity for such Demonstration Forests has long been admitted, and surely therefore it can hardly be held that, what is regarded as a sine quâ non by the greatest silvicultural experts on the Continent, is unnecessary in Scotland, where the science is as yet only in embryo, where the faulty teaching of centuries has to be eradicated, and a foundation of forest management on a scientific basis is only now being laid.

This rather lengthy dissertation on the principles of forestry is necessitated by the importance of realising that a proper Demonstration Forest for Scotland is an absolute necessity, if silvicultural education is to be raised to the level demanded by the gravity of the interests involved. By a proper Demonstration Forest, it will be understood, is meant an area to be placed under methodical scientific management, and of sufficient extent to enable various systems of treatment to be adequately displayed, as well as to permit the undertaking of experiments of all kinds. For this purpose the area should not be less than 1500 acres—the nearer it approximates to 2000 acres the better.

Comparative accessibility is also of the highest importance. Assuming Edinburgh to be the centre of Scottish Forest Training, the forest should not be more than, at the most, a few hours' distance by rail. As has been seen, the ideal condition

would of course be a forest at the doors of the lecture-room. This, unfortunately, is impossible, and therefore the next best expedient should be aimed at, viz., an area sufficiently near to admit of a visit there and back within a day. To effect this vital object, some sacrifice of the extent to be acquired may be accepted, for it is of pre-eminent importance to be able to demonstrate in situ, at once—on the same day if possible the theory expounded in the lecture-room. Failing this, the length of the journey should be sufficiently moderate to keep the railway fare within the limit that can be reasonably afforded by the students proceeding to the forest for a few days' camp. It would, undoubtedly, be desirable to acquire two areas, one for the treatment of conifers and the other for broad-leaved trees, as the conditions of environment necessary for the proper development of these two classes differ so greatly. The latter area should be situated in the south, and would presumably be nearer Edinburgh than the conifer area, for which probably Perthshire would be found a suitable locality. The various modifications of coppice, selection-coppice, and coppice-withstandards would also be demonstrated in full detail in the broadleaved area.

An extremely important feature of the administration would be the registration of recorded results, and the subsequent compilation of yield tables from such data. Then only will it be possible to assess properly the quality of the locality. It is at least doubtful whether the elaborate tables based on German researches are of much practical use in Great Britain, where the local physical conditions differ so greatly from those obtaining on the Continent. It is the lack of such data that militates so greatly against progress in silviculture with us. Under the present conditions of forestry in England, it would seem to be a sine quâ non that the forests should be entrusted to the management of an officer who has been at least partially trained in a Continental school. It is indeed scarcely possible for any one who has not had the advantage of studying professionally the noble ideals presented by the best Continental forests, to realise the correct objects of management.

The forest selected should be in as satisfactory a condition as regards silviculture as can be obtained, and should be as fully stocked as possible, so that, after a few years of correct treatment, it may be expected to present to students the salient features of good silviculture. For this reason, the purpose would not be served by comparatively bare areas of waste land, such as the Argyllshire property, recently taken up by the Commission of Woods and Forests. It stands to reason that, admirable as the acquisition of the latter is as the first real attempt at afforestation on the part of Government, it would for many years be of no use as an illustration of the scientific management of a properly stocked forest.

For educational purposes, two other requisites are necessary. These are sample areas, or a Forest Garden and a Forest Nursery. The former is, to all practical purposes, merely a miniature forest, with a rotation reaching to about thirty or forty years. It is primarily intended for purposes of practising forestry, and should be devoted to experiments of various kinds as regards silvicultural methods, artificial reproduction, and utilisation of produce. The extent of land requisite for this purpose need not exceed 100 to 150 acres, which would be divided into regular compartments, grouped in one or more series. In such an area, when fully stocked, all the primary operations of silviculture could be practised and demonstrated. The ultimate problems, such as final fellings and natural reproduction, would be reserved for the Demonstration Forest proper.

The Forest Nursery would, of course, be devoted to the raising of plants from seed, from cuttings, and from small seedlings. Experiments in germination, and the physical and chemical analysis of soils, would most suitably be studied here. Five to ten acres would suffice for all the purposes of a nursery. It is absolutely essential that the sample area of the Forest Nursery should be within easy reach of the lecture-room, so that students would be able, without difficulty, to spend there a few hours after lecture, and verify for themselves the theories expounded in the morning's instruction. If the Demonstration Forest were close to Edinburgh, a separate sample area would not be required, as it would occur naturally in the various stages of the growing stock, and the nursery would, of course, be made in the forest itself. But this ideal being unattainable, the small extent of land required for a sample area should be at once secured and put in order. The ground should lie as near as possible to the tram-line, or other ready means of communication.

To sum up the foregoing: Instruction in Scientific Forestry in Scotland necessitates the acquisition of two Demonstration

Forests of about 1000 acres each—as near Edinburgh as can be conveniently arranged—and the formation of a sample area and a Forest Nursery on the outskirts of the town.

The present is, without doubt, the psychological moment. Public attention is aroused to the growing deficit in the national timber-supply, and to the enormous bill of £26,000,000 now being paid for foreign timber, the whole of which could be produced in this country if silviculture were on the same scientific basis that it is in France and Germany. The absolute necessity for scientific instruction in forestry has been established, and is beginning to be thoroughly realised by the general public. If, through any notion of false economy, of short-sighted adherence to old traditions and empirical myths, the present enthusiasm is not guided along liberal and scientific lines, the opportunity will be lost, and the progress of British silviculture will be retarded for another thirty years or so, by which time, perhaps, the accumulation of mischievous errors will be irreparable.

# 5. The Report of the Departmental Committee on Irish Forestry, 1908.

By J. S. GAMBLE, C.I.E., F.R.S.

This important Committee, appointed by the Vice-President of the Department of Agriculture and Technical Instruction for Ireland, by Order dated 29th August 1907, began its sittings on 3rd October 1907, under the presidency of T. P. Gill, Esq., Secretary of the Department. The subjects laid down for its consideration were—

- (1) The present provision for State aid to Forestry in Ireland;
- (2) The means whereby, in connection with the operation of the Land Purchase Acts, existing woods may be preserved, and land suitable for forestry acquired for public purposes;
- (3) The financial and other provisions necessary for a comprehensive scheme for afforestation in Ireland.

The Committee took the evidence of numerous witnesses, made many direct investigations, considered a number of special reports, conferred with representatives of the County Councils, and then prepared the complete Report which is now before us.

In Part I. of the Report it is explained that, so far as could be satisfactorily ascertained, the area of woodland in Ireland was, in 1907, 306,661 acres, or 1.5 per cent. of the total area of the country, the smallest percentage of any country in Europe except Iceland. The percentage is compared with the 5.3 per cent. in England, 4.6 per cent. in Scotland, and 3.9 per cent. in Wales; while on the Continent the percentages are, among others, for France 17, for Germany 26, for Hungary 27, and for Austria 32. In Ireland, the area is said to be slowly shrinking, while the quality of the wood is deteriorating, largely in consequence of the operation of the Land Acts. It was shown that the breaking up of large estates under those Acts naturally had the effect of lessening the interest of landlords in keeping up their woodlands; and that, even in estates purchased by the Commissioners, they cannot in practice buy the woods on any terms that would be satisfactory to the landlords, or if they bought them, keep them. The result, therefore, of recent legislation, has been that forests are being cut down and the material sold, while no steps are being taken for restocking. Even the shelter-belts, so valuable for agriculture, are disappearing.

In Part II. are discussed the effects of forest denudation on the industries of the country, the chief among such industries being the manufactures of chairs, carts, coaches, furniture, packing boxes, bobbins, spools, toolheads, etc., together with the supplies of the building trade and the railways. The evidence went to show that almost everywhere an early cessation of business is to be expected owing to the supply of the raw material giving out. The obvious remedy is for the State to take measures to save the existing woodlands, and to ensure a sufficient area of forest worked upon a proper financial basis.

In Part III. are considered the arguments for a scheme of afforestation. The defects in recent land legislation described in Parts I. and II. are considered to have made a change an urgent matter. The Commissioners considered that on the disappearance of the landlord, the State or some public authority must take over his duties in respect to woods, and step in to manage them; and it should at the same time provide for dealing with mountain and other so-called waste land, which is being sold with estates, and of

which a considerable proportion would be suitable for afforestation. After discussing the present condition of waste of forest resources, or neglect to work forests under proper silvicultural rules, not only in Great Britain but in other countries and notably in America, they quote evidence to show that Ireland is likely to be one of the most suitable countries in respect to soil and climate for the growth of trees. They point out that forestry, properly carried on, has a great influence on the general prosperity of rural districts and industries, and that a considerable supply of forest material is of the utmost importance to Ireland itself; and they end with the conclusion that an area of woodland of 1,000,000 acres, "should be regarded as affording not more than a moderate insurance for the agricultural and industrial needs of the country in the matter of timber; and that Ireland will not be managing her business as a prudent nation if she does not take every measure open to her at the present time to establish at least such a forest area."

Part IV. proceeds to discuss the "limits of afforestation," and the extent of land in the country available for the purpose. The Commissioners point out that two classes of land must be barred out in forming an estimate. (1) Land which would pay better for tillage or pasture; and (2) genuine waste land, which, from its exposed position, altitude, or character, would not grow trees successfully at all. There remain then chiefly, (a) large blocks of 500 acres or more of mountain land comparatively free from occupied holdings and unsuitable for agriculture: (b) moderately-sized blocks of 100 to 500 acres of inferior pasture or mountain land, chiefly attached to large holdings and demesnes; and (c) small areas of under 100 acres of rough and semi-waste land interspersed with arable and pasture, and uniformly distributed over the country; and they consider that, from their inquiries, at least 750,000 acres of suitable land are available, of which from 200,000 to 300,000 fall into category (a). They finally consider that the problems to be worked out are—(1) the proper utilisation, through private owners and County Councils, of about 300,000 acres of existing woodlands; (2) the creation of a State forest on about 200,000 to 300,000 acres of mountain or other rough land in large blocks; and (3) the planting of a further 500,000 acres, chiefly in comparatively small blocks, through private owners and County Councils, so that within a period of about eighty years there may be in Ireland an ultimate forest area of at least 1,000,000 acres.

In Part V. are given the reasons why it is necessary that action in the organisation of forest work in Ireland should be undertaken by the State, and the paragraphs on this subject are distinctly among the most interesting in the Commissioners' Report. One of the strongest points mentioned, among several well-known and unanswerable arguments, is that while the interests of the private owners are restricted to the commercial profit realised on the investment (it is interesting to read this when we know that in Great Britain, commercially managed private forest estates are the exception rather than the rule), the far more valuable indirect returns, economic and social, go to the community as a whole, and the private owner cannot be expected to take them into account as the State can. The Commissioners consider that in Ireland especially the State is obliged to take action, and we cannot do better than quote their words:--

"At this moment the process of destruction of the woodlands which is going on, and which has been described in Parts I. and II., is due to the legislation of the State, and, as we have already pointed out, this grievous waste of the woods, with its menace to industries depending on them, must continue unless the effects of this legislation are checked by further State action. But in the past it may be broadly stated that the excessive reduction of the woodland area of this country is due either to what the State has done or to what it has neglected to do. Leaving aside the cutting of forests in certain districts for political purposes which had 'reasons of State' to explain it, the conditions under which great grants of land were made after the various confiscations requiring their use for the public benefit, were never enforced in this respect. These lands, including the Crown lands from which the Ouit and Crown Rents that are now administered by the Commissioners of Woods and Forests have been drawn, contained vast areas of forests which are described in the grant deeds as the King's Woods. No precaution was taken by the State to save these in any way. Throughout the 17th and 18th centuries the grantees were allowed to do with the timber as they pleased, and what they pleased was in the main to realise

with reckless extravagance, with the result that the greater part of the country, for which at least shelter might have been preserved, is in its present bare and wind-swept condition. Had provident and intelligent Government action been applied to the subject in Ireland, undoubtedly the forest area and the general agricultural wealth of the country would be in a far better position than they now are. It is, moreover, an important factor in the case that the proceeds of the Quit and Crown Rents, which are entirely derivable from these lands, and which have yielded a return of upwards of £60,000 a year, have never, since the union of the Irish and the British exchequers, been directly spent in Ireland or applied to Irish purposes, but have been, with the general Crown revenues, invested in Great Britain, sometimes even in promoting forestry.1 There is, finally, the fact that the State, in abolishing the landlord through the Purchase Acts, is bound to provide, and has not yet provided, a machinery to discharge his functions in respect of several matters, including woods, which cannot be left to individual tenant purchasers, and in which the general community, as well as the tenant purchasers, has now a specific interest. Having regard to what is at present occurring in the country, we cannot hesitate to say that, not only does the responsibility lie on the State for taking action, but that if action be not taken at once it will mean a gross neglect comparable with the improvidence of the past, and far less excusable."

They then proceed to point out that the State agency already exists in the Department of Agriculture and Technical Instruction, which was endowed with power, under the Act of 1899, to develop forestry. But they consider that the Forestry Section of the Department should be specially assisted by an Advisory Committee; and here it is allowable to disagree, and to suggest that such work is not suitably managed by committees of persons who very likely may differ considerably in opinions, and at any rate are liable to change, and so to fail in maintaining those permanent and definite aims which are necessary in the management of estates which depend for successful results on continuity of action. It might be thought that a better plan would have been to appoint one

<sup>&</sup>lt;sup>1</sup> Four sums, amounting to a total of £77,601 (including £15,636 invested in Bank of Ireland Stock), form the only exception to this rule. (*Report*, App. II.)

really competent permanent head official as a branch of the Department, and to leave him unhampered and unhindered by the alterations of policy inseparably connected with a changeable Advisory Committee.

The Commissioners then proceed to explain the duties of the Forestry Section, both as regards the management of existing State forest lands and the acquisition of others, and the means to be taken to encourage private owners to grow and properly manage woodlands; and they advise that the Section be granted power to acquire suitable lands and to purchase grazing rights. They recommend that the smaller woods should be managed by the County Councils through their surveyors and staff. It would take too long to explain fully all the details of this rather complicated scheme, and all that can be hoped is that misgivings as to its success will be falsified if it is ever put into action. The simple plan of a Government Forestry Department with its own staff, managing, as in France and elsewhere, all the public forests as State Reserves, under the general supervision of the Department of Agriculture, would seem more likely to succeed. Of course it would work in constant communication with the County Councils. Communal forests in France have not been everywhere managed without political trouble, owing to rightholders being often important persons at election time, and it may be foreseen that political exigencies and political strife in Ireland may prevent that proper continuity of management that is an absolute sine qua non for permanently successful forestry.

Part VI. draws attention to the present lack of organisation in the Irish timber industry, there being no systematic business management either applied to the woodlands or to the methods of utilisation of material cut. The Commissioners comment on the fact that only a small portion of the timber cut is sawn, and even that which is sawn up is treated in primitive machinery, involving much waste and an absence of proper grading of the scantlings produced. The remarks on this subject, too long to quote, are most interesting, and the remedy suggested is the introduction of technical knowledge and skill, together with a proper co-operation between all the parties interested—the State, the owners of woodlands, and the proprietors of wood-working industries.

In Part VII. the question of technical instruction in forestry is gone into, and it is pointed out that by the institution of the Department's Forestry School at Avondale, in County Wicklow, a considerable advance has already been made. That school was opened in 1904 with a teaching staff of three, the object being to train working woodmen as distinguished from forestry experts. The following extract from the Memorandum on the Avondale School is quoted as likely to interest the readers of this journal:—

"The main idea in view in connection with the school has been the training of men in such practical forestry as is carried out in well-managed woods in these countries. Before any practical advance towards the reafforestation of Ireland can be made, men must exist who not only know the theory of planting, thinning, and felling woods, but are also able to carry out these operations with their own hands. Such work as the planting of waste land, or the clearing away of worn-out woodland, and the formation of new plantations, requires the services of skilled labourers, and the latter can only be trained by men who themselves have handled the spade, the axe, and the saw, and are able to supervise the work of others in an intelligent and business-like manner.

"The function of the Avondale Forestry School is neither that of training men in the theory of forestry alone, nor of manufacturing rule of thumb labourers, but in so combining theory with practice that the men there trained can adapt themselves to the varied conditions under which they will probably have to work in the future. To attain this end, applicants for training are received as apprentices, and practical work has been made the basis of the instruction. Science and theory are included in so far as they are necessary to supplement practical work, and invest it with sufficient intelligent interest to destroy its monotony, and prevent mere rule of thumb practice. Before being admitted to the school, a man must show that he not only has done manual work in the past, but is willing to do such work in the future."

The course occupies three years, and in 1906-07 there were eighteen apprentices at the school. In regard to the question of providing higher instruction, the Commissioners point out that Scholarships are already being offered at the Royal College of Science, and they recommend the development of these arrange-

ments so as to provide for the higher training of a sufficient number of students, and the promotion of scientific investigation and research in forestry.

Part VIII. contains certain miscellaneous considerations, the most important of which is the question of amendments in the Land Purchase Acts, in regard to which the Commissioners recommend provisions—(1) to prevent the cutting down of plantations on estates while negotiations for sale are pending; (2) to exclude from a holding any plantation or land suitable for planting; (3) for the acquisition of grazing rights; and (4) for the building of woodmen's cottages.

It is interesting to note that the Commissioners take a common-sense view of the question of using the "unemployed" in forest works. They point out that all evidence goes to show that the chief requisite in forest labour is "skill," and make it clear that, in their opinion, forestry is not "an industry which lends itself to furnishing temporary and irregular employment to those who may for the time being be out of work in other callings."

Part IX. is devoted to "Finance," i.e., to the cost of the scheme which we have briefly described, and the probable receipts after a few years. It is arranged under the heads of State Forest, 400,000 acres; County Council woods, 50,000 acres; and existing woods taken over by the State, 50,000 acres; and the provisions for each kind. It is not easy to give a clear account of these complex figures, and so it is better to refer readers to the actual Schedules in the Report, and to quote the Abstract given by the Commissioners themselves, as follows:—

- "(1) That the net expenses of the national scheme of afforestation recommended, including the purchase of the land required, are estimated to amount to  $\pounds 44,525$  per annum in the first decade, to  $\pounds 66,725$  in the second decade, to  $\pounds 74,600$  in the third, to  $\pounds 67,100$  in the fourth, and to  $\pounds 32,600$  in the fifth, after which period the scheme provides a surplus over purchase annuities and working and administrative expenses, eventually yielding a return of  $4\frac{1}{2}$  per cent. on the total capital invested.
- "(2) That the proceeds of the Irish Quit and Crown Rents might be appropriately utilised for promoting forestry

in Ireland; and would suffice to finance the national scheme with the exception of a sum of £13,600, which would require to be annually provided by Parliament for five decades, and £8600 for the sixth decade, after which a surplus would be available."

This notice may be concluded by congratulating the Committee on having accomplished an important inquiry, and followed it up by valuable suggestions, which, it may be presumed, the Government are now engaged in studying. It is to be hoped that their studies will be expedited, for in such a case the country cannot afford to lose much time, and delay may result in the cutting down of many of the most valuable existing woods before it is possible to stop it.

## 6. The Zürich Woods.

By Fraser Story.

In Volume XIX. of this Society's *Transactions* Mr Meiklejohn has already given us a most interesting account of his visit to the Zürich forest. But I venture to think that he would be the last to claim that he had exhausted the subject, so I may be allowed to supplement his article with some notes which I gathered together during a visit to Switzerland in 1907.

When Mr Pinchot remarked that the town woods of Zürich were well managed "before the discovery of America," he was quite within the mark. Their history as an organised forest dates back to 1491, when the first demarcation of boundaries took place. But there are records of the composition and treatment of the forest in the thirteenth century; while the history of the ownership of the Sihlwald, and detached notes regarding the woods, have actually been traced back over a thousand years, to 851!

The principal portion of the Zürich corporation woods lies on the left bank of the river Sihl, along which the forest stretches for eight miles. The point that visitors ought to go to first is Forsthaus Sihlwald, situated about nine miles from Zürich, with which there is convenient communication by rail. The elevation of the forest varies from 1600 to 3000 feet above sea-level—quite a moderate altitude for woods in Switzerland.

The aspect for the most part is north-east. Not less than twenty-two tiny rivulets—sometimes mere dry channels, but at other times swollen into dangerous torrents—abruptly divide the main bank into smaller sections. Against the erosive effects of these streams Herr Meister, who controls the forest, is taking energetic measures, and as he is doing so by means of various devices, many useful lessons are provided even in this connection. The gradient is steep in places, but it is found that where the slope is under 36°, forest canopy is still possible. Beyond this, however, there is difficulty, and the Forstmeister places the ordinary limit for satisfactory tree-growth at about 42°.

The soil of the greater portion of the area is of a marly nature, overlying Keuper sandstone (Triassic). This is easily eroded, and the tendency is for the smaller water-courses to deepen their channels, and to cause subsidence of soil from the sides. The lower ground near the river Sihl is comparatively level, and consists of a tenacious clay with some loam in it. On other parts of the area diluvial soils have been deposited, and there are also moraines in places. Speaking generally, the soil is of excellent quality for the growth of trees, but its productivity is chiefly due to the long continued, careful management of the forest. One cannot help thinking that, under the management generally given to land of this description in Britain, the area would have yielded very much poorer results. Were the Sihlwald not cared for in quite a special way it would deteriorate remarkably fast. Instead of being neglected, however, the forest resources are husbanded with a watchful regard such as might be bestowed on a market garden. Labour is not cheap, nor is it lavishly applied to the forest: it is rather that the treatment is so intensive and so scientific that nothing is allowed to lie waste or deteriorate.

Careful investigation has been made in regard to the nature of the soil. Professor Schultze, of Zürich, finds that where the largest proportion of fine particles exists, the "quality of the locality" is highest and the land is most productive. This practically means that within bounds, and under the conditions which obtain at Sihlwald, the higher the proportion of clay, the greater is the fertility of the soil.

As to the mineral matter in the soil, it has been found that lime plays the most important part in determining productive capacity. In the first or best class of Sihlwald soil there is 5 per cent. of lime, and in the fourth class only 0.4 per cent. The quantity of phosphates has also a marked influence; but the proportion of magnesia and potash seems to remain fairly constant, the poorest "locality class" being nearly as well provided in respect of these as the most productive.

#### Composition of the Forest.

At present about two-thirds of the forest consists of broadleaved trees, and a hundred years ago these hardwoods occurred to the extent of 90 per cent. But it was not always so; in the Middle Ages the Sihlwald was practically a coniferous forest. At that time, as the investigations of the Forstmeister have proved, fir and pine timbers were those most desired by the inhabitants of the district, who used the wood for fencing purposes and house-building. Later, when stone came more largely into use in the construction of dwelling-houses, and the population increased, more timber was required for fuel. Attention was then turned more to the beech, along with other broad-leaved trees, and a rotation of 80 to 100 years was instituted. No doubt, too, more enlightened methods of silviculture had something to do with the change, for the beech was needed to improve the fertility of the soil. In this connection Herr Meister makes the interesting remark that where light-demanding conifers predominate, the soil has certainly been impoverished, and that it is no longer of sufficient strength for the growth of hardwoods. Moreover, the fact has been noted that communal or other forests, well managed on co-operative lines, are largely beech forests, whereas the more neglected and comparatively poorly treated private woods bear coniferous species. Of course one must not push this generalisation too far, because, as we all know, a well managed forest of evergreen conifers can, and does, fully maintain productivity. In fact, the tendency in the Sihlwald to-day is to increase the proportion of softwoods, particularly silver fir; but it is interesting to observe the high esteem in which beech is held by Continental foresters.

The beech is by far the commonest tree in the Zürich woods. Occupying an important place along with it are ash, sycamore, maple, and Wych elm. Room is also found for the hornbeam and common alder, birch, aspen, and willow; but the last

three appear only in young regeneration areas, being removed at an early age. The quantity of beech roughly amounts to 75 per cent. of the broad-leaved species, sycamore and ash each about 10 per cent.

The fine quality of the beech may be judged from the form-factor, which for ninety-year-old trees is 0.55 to 0.63, while the total height is from 90 to 115 feet. The sycamore is found to be less exacting than the Norway maple, and both resist frost so much better than beech and ash, that in the lower situations they take the lead over the beech. Wych elm is able to hold its own with the other species only where the soil and situation are distinctly good; in particular, it must have plenty of moisture in both the soil and air. Ash seedlings spring up everywhere at Sihlwald, even in the coniferous portions. Where there is sufficient moisture the tree grows freely, keeping pace with the beech until after middle age. It is then apt to suffer in the struggle for light, and ought to be removed, together with the maples and elm, in the advance cuttings which precede natural regeneration.

A point about the Sihlwald which would strike many British foresters as most peculiar is that in the hardwood forest there is hardly any oak, and in the coniferous forest practically no larch. Occasional examples of oak are found, as, for example, upon the lower ground, where it does not suffer so much as the beech from late frosts, but the species is of little account in Sihlwald. The vigour of growth of the beech is such that oak, in evenaged mixture with it, is early suppressed through want of light. Long continued careful elimination of unsuitable species has reduced the number of birch, aspen, and the like to a minimum, but the cherry (*Prunus avium*) is to some extent encouraged on account of the value of its timber, which sells well for furniture-making.

The principal conifer of the Sihlwald is the spruce. On the right bank of the river it grows magnificently, with long, clean, cylindrical boles of the finest quality. This seems to be largely due to the fact that the woods are purely coniferous, because just on the other side of the stream, where the spruce occurs scattered among broad-leaved trees, the quality is much inferior. In the latter situation the tree grows rapidly, but coarsely and unprofitably.

The larch was first planted in the Zürich woods in the middle

of the eighteenth century, just about the time that the Duke of Atholl introduced the tree in to his Perthshire estates. At Sihlwald it grows satisfactorily in mixture with other species, especially beech—southern and south-eastern aspects are found to suit it best. But, as I have already indicated, the tree is of no importance in the forest. Next to nothing has been done in the planting of North American or other exotic species, the Forstmeister being of opinion that the forest revenue is not likely to be increased by the use of these.

The restocking of the forest is effected almost entirely by natural regeneration from seed. All the prevailing conditions appear to favour this method, and the flourishing appearance of areas recently undertaken convinces one of its thorough efficacy. In contrast to the practice in the majority of German forests treated in this way, no preparatory fellings are here made. Towards the end of the rotation, the woods are thinned much more severely than hitherto, in order to encourage crown formation and to reduce the quantity of raw humus on the ground; then follow two or three "seed-fellings." The trees are capable of bearing satisfactory crops of good seed after they are seventy years of age. From the original dense condition to the time when the last of the sheltering, seed-producing trees are removed, a period of from eight to ten years elapses. In the middle and north of Germany this would be considered a remarkably short regeneration period. Occasionally the young plants are damaged by spring frosts, but it is usually found in these cases that there has been a rather hasty removal of the old shelter-trees.

### ORGANISATION OF THE FOREST.

A forest cannot be brought into a model condition all at once. To obtain a proper sequence of age-classes, together with completely stocked areas, generations of patient work are required. In the case of Sihlwald the present admirable condition of the forest is the outcome, or rather the continuation, of centuries of careful maintenance. As already mentioned, attempts in the direction of forest regulation were made in the thirteenth century. In the fourteenth century these efforts became more systematised, and since the end of the sixteenth, the organisation has been wonderfully complete. During the last three hundred years the annual yield shows so little variation

that it has seldom risen or fallen more than 5 per cent. The single marked exception to this rule occurred quite unavoidably in the period between 1885 and 1888, when a terrible snowstorm upset temporarily the normal course of action. This snowstorm, which occurred so early as September 28th, in the year 1885, completely destroyed 250 acres of most beautiful beech forest, and caused a great deal of injury to all the woods. The first clearance, made immediately after the storm, showed that 432,000 cubic feet of timber had been destroyed, but later operations connected with the removal of damaged material brought the total up to 1,200,000 cubic feet (British measure).

One can imagine the chaos that would reign in the hitherto orderly forest, and the feeling of despair that must have possessed the Forstmeister. To him it must have seemed that the elaborate system of forest conservancy for which the Zürich woods are famous, and over which he and his predecessors in office had so patiently toiled, was hopelessly disorganised. But such is the healing power of time and labour, that to-day the forest shows but little trace of the catastrophe, and the annual yield, far from being lessened, has materially increased.

## INCOME FROM THE FOREST.

The forest now provides an average return of 30s. 6d. (95'70 fr. per hectare) net profit per acre each year. This sum is mainly derived from the forest itself, 79'40 fr. being thus obtained, the works of utilisation accounting for the remaining 16'30 fr. In other words, forest management alone produces 83 per cent. of the profit, and the conversion of the raw material 17 per cent. The gross annual income is 97s. 6d. per acre, and the expenditure 67s. per acre. Such expenditure appears at first sight almost excessive, and it is improbable that any other forest district in Europe spends so large a sum. The explanation, of course, lies in the intensive treatment which the forest receives, and its justification is found in the high and steady income which accrues.

#### THE FOREST STAFF.

At the head of the controlling staff is the Stadtforstmeister. He has the assistance of a highly-trained assessor, a secretary and office clerk. There are some five foresters, or gangers, who superintend planting and felling, one foreman of the saw-mills, and about one hundred workmen. The wages of the workmen range from 3s. 6d. to over 4s. per day. The men are well-housed, insured against sickness and accident, have the advantages of post, telephone, and telegraph offices close at hand, as well as railway facilities, while even a local scheme of old age pensions is now under consideration.

The labour statistics given by Herr Meister are extremely interesting. Forest labour provides work for 66 men, while the manufacture of the produce requires the services of 38 men. As these men work upon 1045 hectares, the labour force is equivalent to 10 men for each 100 hectares (250 acres), or 1 man for 25 acres. Taking forestry work alone, 40 acres absorb the labour of one man for the whole year, reckoning upon 300 working days. "Day-work" is more common than "piece-work" in the exploitation of the forest, largely because the diversity of the requirements in utilisation makes it desirable to have a perfectly free hand in directing the operations. Both classes of labour cost 20 per cent. more nowadays than they did in 1880.

### TIMBER UTILISATION.

The development in what may be called the manufacturing department at Sihlwald has been a remarkable one. Up to forty years ago, no attempt was made to utilise the felled timber beyond rough conversion into logs and billets for transference into Zürich by means of the river Sihl (Floesserei). More recent industrial progress, with its consequent increased demand for timber, together with improvements in machinery, however, eventually suggested the establishment of large sawmills and a turnery factory. The success of these led to the introduction of plant for the impregnation of timber, while machines were brought into use for the manufacture of implement handles, "wood-wool" (Holzwolle), split firewood, and for mortising, planing, and polishing. The latest addition is a timber-drying chamber, heated artificially by means of refuse material, principally bark-chips and sawdust. manufacture of firewood is so important that 150,000 large bundles are sold annually. The treatment of timber with copper sulphate under hydrostatic pressure (Boucherie system), seems to have certain advantages which are appreciated at Sihlwald,

though the method is not likely to gain much ground in Britain. In its favour it may be said that the plant is not costly to instal, the timber is not discoloured in the process as it is with creosote, nor increased materially in weight; further, no strong smell is imparted to the wood, and the method is suitable for operations within the forest, as the timber must be impregnated when green—that is, immediately after felling. Under hydrostatic injection, however, the effects are not so enduring as they are when the timber is impregnated by the pneumatic system or by steam under pressure. The timber of course sells at a much higher price after treatment, as it enables spruce and silver fir to be utilised for telegraph posts and vine poles: it also adds to their durability as flooringboards, fencing-material, barrel staves, etc., while beech timber so treated can be used for railway sleepers. Even weak stems from thinnings, otherwise valueless except for firewood, command a fair price after impregnation. While the factory as a whole is not large, it certainly is wonderfully complete, every species, and even every part of every tree, being carefully considered in the light of its most economical conversion. Managed in this way, local manufacture is an undoubted success.

#### TRANSPORT OF PRODUCE.

For the transport of the material to the saw-mills and station, various appliances are in use. Logs are carried from the steepest ground by means of overhead cables or wire ropes; at other places, where the gradient is not quite so abrupt, wooden timber slides are employed. As the timber glides down these merely by its own weight, a good deal of engineering skill has to be exercised in their construction, particularly at awkward turnings and at the bottom of the slide. A few of the old-fashioned sledge-ways still exist, and are used principally for short distances, and only for the smaller material. The sledges, which weigh about 100 lbs., and are 6 feet 6 inches long, are carried up the hills when empty by the workmen. The foregoing methods do not exhaust the means of transport. however, for the light railway has yet to be mentioned. This was the first forest tramway in Europe, being constructed in 1876. Improvements on the original form have been introduced, and the gauge is now 2 feet; the railway is in part permanent and in part temporary, the latter portion being easily transportable in sections to the immediate neighbourhood of felling areas. The system has many advantages over ordinary haulage methods, particularly at Sihlwald, where the ground is so hilly and the slope so much eroded by numerous rivulets. The only thing which struck me as being scarcely up-to-date was the use of oxen for the conveyance of the empty waggons on the return journey uphill. I have not the least doubt, however, that the selection of these animals has been made after due consideration.

#### ZÜRICH FOREST SCHOOL.

Before leaving Zürich I visited, under the guidance of Mr Rordorf-Mahler, the State Forest Academy, the experimental station connected with it, and also that portion of the town woods on the Zürichberg so largely made use of by the citizens for recreation. The Forest School I found well furnished with large collections of plants, cones, insects, implements, timber sections, models, and so forth, and suitably supplied with lecture rooms and laboratories, though perhaps in these respects the institution does not reach the standard attained in Germany or France. The School was opened in 1855. Instruction is provided by a staff of sixteen professors, and the course extends over three years, with one additional year's practical work. At the time of my visit some thirty students were attending the classes.

The investigation-plots at Forsthaus Adlisberg proved highly interesting, as experiments connected with heredity had just reached an instructive stage. From what I then saw, it seemed quite clear that plants raised from seed collected at a low elevation maintained growth for a longer period in the year than those from very high elevations. In the case of spruce the difference was very marked. Seedlings from seed collected from trees grown on ground with a northern aspect also had a longer growing season than those from that with a southern aspect, while in many cases malformation seemed to be hereditary, young plants showing the same deformities as their parents. This matter has been recently dealt with by Professor Somerville, who mentions the Zürich experiments in his article (*Transactions*, Vol. XXI.). Professor Engler, who directs the investigation, has been kind enough to send me seeds. These

have been sown at Bangor with a view to testing some of the results in this country.

As a matter of fact, my last year's tour neither began nor ended in Zürich, for I came through the Black Forest and went on to the Engadine, the Bernese Oberland, and several other forest districts; but interesting though these were, the Zürich woods cling to the memory as the most instructive, the most perfectly managed, the most profitable, and therefore, from the economic point of view, the most important of them all.

# IMPRESSIONS OF SWISS FORESTRY.

In regard to Swiss forestry generally, I was surprised to find so little larch in the country. Perhaps I expected too much; the larch so dominates one's thoughts in Britain, and so strictly do we regard it (rightly enough) as an Alpine tree, that the visitor to Switzerland is apt to be disappointed at the comparative absence of this species. The larch of course occurs, and at great elevations it is as abundant as the Cembran pine, but that is all. It is poorly represented, taking the country all over, and modern silviculture does not tend to increase its area. Recent plantations are formed for the most part with common spruce and, to some extent, with Scots pine, but larch seems to be rarely used. The spruce is the tree of Switzerland, and in many localities one may walk or drive long distances without seeing any other species. Beech, again, is the commonest of the broad-leaved trees, but it occupies the lower situations.

The forest flora of the Alps is extremely interesting. One may begin at a moderate altitude, say near one of the larger lakes, where walnut, acacia, sweet chestnut, and even the fig and almond may be growing luxuriantly, a little higher up there are meadows and beech woods, then may come a stretch of Scots pine, but, as we ascend, this species soon gives place to the spruce. This tree continues in great masses to an extraordinary elevation; ultimately, however, at perhaps 6000 feet, it also gives up the struggle, which is carried on by the larch and Cembran pine, or "arve." Small groups and single trees of birch, mountain ash, and mountain pine may also be found at an extreme height, but the Cembran pine and larch grow

to within a foot or two of the glaciers, and to an elevation of over 7000 feet. Still higher there is but a scanty growth of hardy herbage, then come the bare, grey rocks and the perpetual snow without a sign of life. Nor is there any movement in the great expanse, except when now and then a mass of snow becomes dislodged and sweeps down the side of the mountain, leaving behind it a long powdery trail of purest white. The influence of heat and cold is thus strikingly demonstrated, because all these effects are really due to temperature.

One-fifth part (20.6 per cent.) of Switzerland is under forest—a goodly proportion when one considers that 3300 square miles are occupied by rocks and moraines, another 700 square miles by glaciers, while a still greater area lies at such a high elevation that profitable forestry is out of the question.

It says much for the foresight of the people that the forest area of Switzerland continues to increase in spite of many disadvantages. Transport difficulties alone are extremely grave in a country where there are no canals or navigable rivers, and where no part of the land reaches to the sea.

Much the largest area of forest belongs to corporate bodies (towns, villages, communes, etc.)—67 per cent. being thus owned, while 20 per cent, is under private proprietorship. The State possesses very little forest land (only 4 per cent.), but it exercises control over the corporation woods, and to a large extent over private forests also. In the Canton of Zürich, according to a law passed in October 1907, no wood may be felled without permission, and restocking of the ground must take place immediately afterwards-at latest in the spring following the removal of the timber. Private owners are further obliged to attend properly to the young forest growth, being required to have the regenerated areas fully stocked and the plants kept clear of weeds when young. A State forest officer must declare the work to have been efficiently carried out before it is "passed." The protection of neighbouring property, so that, for example, felling operations on one estate may not endanger the woods on another, is also provided for by the State. Assistance is given (to the extent of 20 per cent. reduction of cost) when several landowners co-operate and place their woods under the supervision of an expert forester working upon a definite scheme of regulation. Indeed, by fulfilling certain obligations, subventions to the extent of 75 per cent. of the total cost of formation may be allowed.

In the case of protection-woods (i.e., woods scheduled as being necessary for the protection of the land, for checking erosion, preventing avalanches, etc.) laws of much severity are enforced, but private owners of such areas are duly compensated for loss and restriction of rights. Everyone will, of course, recognise the need of having laws regarding protection-forests in a mountainous country, but the adoption of such paternal methods in regard to other woodlands is more remarkable.

In Switzerland there is on the one hand encouragement and direct financial aid where new areas are being planted, and on the other hand restriction in the case of those landowners who would unwarrantably deforest. We may not agree with such interference with the voluntary action of the individual, but that it has been resorted to by a country so justly famed for the freedom and independence of its people as Switzerland is, shows at least that forestry matters are seriously considered there. The obvious intention of the Swiss Government is not only to conserve existing forest resources but to add to the wooded area of the country by every means in their power; and I believe that the restrictive measures have not aroused any feeling of resentment because the treatment of the forest-owner on the whole is recognised as being just if not even generous.

For most of the information contained in the above account of the Zürich woods, I am indebted to Herr Forstmeister Meister, whose book *Die Stadtwaldungens von Zürich* should be consulted for a full account of the forest. Letters of introduction were kindly given me to Herr Meister and others, by Mr John Mahler, of Penissa Glyn, Chirk, who is a relative of the Forstmeister. I am therefore particularly grateful to him and to Mr Rordorf-Mahler, of Zürich, who not only acted as my friend and guide in Zürich, but arranged the details of the rest of my Swiss tour. To Herr Forstassessor Tuchschmid I am also much obliged for many useful notes, and for his great kindness in conducting me through the Sihlwald.

# 7. Continental Notes-France.

By A. G. HOBART-HAMPDEN.

If we take the Bulletin de Franche-Comté et Belfort and the Revue des Eaux et Forêts for the past few months, we shall be able to see how forest matters are progressing in France, and shall find some points of interest.

1. The veteran M. Charles Broilliard has an article on the species which should be employed in afforesting the various soils met with in the upper basin of the Saone, at heights between 900 feet and 1800 feet. He speaks, as he has a right to, ex cathedra, from his experience of a country where he has spent most of his life—so that his words should carry weight with those who think of growing woods under similar conditions.

Considering first the hills and plateaux of the Jura and Vosges-rocky, calcareous soil, with which are ordinarily found alternating patches of stiff marl and clay. In the former case the great thing is to get the soil covered with something which is quick-growing, and then to add to this, perhaps sparsely, the particular species (e.g., the larch) to which it is intended to look for the future revenue. With the addition, later, of a fertilising species like the beech, the forest will gradually adjust and constitute itself. In the second case the principal species will be the oak—the sessile in the drier, the pedunculate in the moister, soils. This should be introduced sparsely. With the oak, it is advised, should be addedstill more sparsely—poplars and aspens, and, later, hazel and hornbeam. Thus the author would have about 1500 oaks, 300 poplars, and 600 hazel and hornbeam to the hectare  $(=2\frac{1}{6}$  acres). This is thin, but M. Broilliard justifies this under existing conditions.

M. Broilliard also considers the afforestation of better soils—into which matter we need not enter, beyond mentioning that in speaking of fresh, silicious soils, his principal species is the oak; his quick-growing auxiliary is the birch; and his soil-enriching species, subsequently introduced, the beech.

It is to be noticed that the quick-growing auxiliaries introduced early have a light cover, otherwise the oak would have but a poor chance. On the silicious soils it is also good to use as principal species various conifers, among them the Douglas; but M. Broilliard says it is always wise to go cautiously with exotics, planting them, to start with, as individuals in the woods and watching their development. Such advice is, of course, sound; but as to the Douglas, its value in Europe is surely now fully established, and we need no longer hesitate much. It is stated to have given remarkable results nearly throughout Belgium, and we know how well it does with ourselves. As compared with larch and spruce it has been found to give four times the value in an equal time, and the wood is known to be excellent.<sup>1</sup>

Some of our author's *dicta* are interesting, as, for example—"A thinning has not as its object the prevention of a struggle among the crowns, but its abridgment."

M. Broilliard has an important note about the "June oak," which occurs at a certain locality which he specifies. Being a month later, in flower and leaf, than the ordinary oak, it is safe from spring frosts, caterpillars, and cockchafers (which can completely defoliate a whole forest), and is also, apparently, strong enough to resist heavy winter frosts. Since the wood is first class, its acorns should be collected and sown in nurseries. Evidently this June oak should be studied, and the cause of its appearance discovered.

It may be mentioned that M. Broilliard speaks very highly of the acacia (we presume he means *Robinia pseud-acacia*), but says it should not be pruned nor coppiced early. We are inclined to think that the old eighteenth-century craze for this species was sound, and its planting might well be revived on warm aspects and free soils. The wood is valuable, and the outturn may be most paying.

A long article, dealing with many soils, is concluded with the advice to avoid yielding to the common desire to plant together a crowd of exotics of which the behaviour is not known.

M. Broilliard expressively calls it a "salad."

2. In France, as with us, the question of taxation of woodlands is a burning one; the woodland proprietors have at least progressed so far as to extract from the Minister of Finance an admission that the existing law is defective, and he has

<sup>&</sup>lt;sup>1</sup> The variety referred to is probably the Vancouver or Oregon type.— Hon. Ed.

even made proposals for a revision of the illogical system in force. When, we may ask, are we going to do something thorough about this absolutely vital matter? The injustice of the present situation is admitted; the fact that our demand for wood is enormous and increasing is well known; it is the case that we have to buy the bulk of our wood abroad and pay into the pockets of potential enemies for it; it has been shown repeatedly that we have land surface (of an entirely suitable kind) whereon to establish sufficient woodland to meet, at least, a large part of our wants; it is certain that we should, had we the woodlands, bring back the population to the land by the creation of forest industries, the money expended on which would remain in the country instead of going abroadand yet, with all this, we are almost entirely prevented from correcting matters by our present system of woodland taxation. As long as this system stands, very few proprietors can afford to plant and wait a large number of years for a return. Once the woodland is established, it is often more valuable than agricultural land, sometimes it is worth more than twice as much, and, properly worked, it will continue to be so. In this connection it is significant to note certain figures given for the Department of the Rhone. Approximately, Scots pine gives a net annual revenue per acre of 26.4 francs at 50 years; Corsican pine, 36 francs at 32 years; silver fir, 76 francs at 70 years; oak pays  $4\frac{3}{4}$  per cent. at 21 years; and sweet chestnut and acacia (Robinia?), 81 per cent. at 15 years. But while the private owner, who locks up his capital in woodlands, both loses interest for a time and pays rates and taxes, the State surely need not worry about taxing its own forests; it should go forward far more vigorously with planting than it actually does.

The Americans only a dozen or so years ago suddenly awoke to the forest question, and as a beginning President Cleveland signed a decree reserving 21,000,000 acres. Now they have 151,000,000 acres under forest protection. Belgium, which has 1,500,000 acres of waste, has started a scheme of lending money on very easy terms, and gives technical aid to communes willing to afforest; she is evidently going to do all she can to encourage afforestation. Even Spain is doing something similar.

The Society of Franche-Comté et Belfort has lately appointed

a committee to examine the question of the method of taxing woodlands, and has published a pamphlet entitled *Le Revenu Imposable des Forêts* (Imprimerie Jacquin, Besançon). The writer ventures to think that this report contains material that would be of interest and value to those (e.g., those Members of the Royal Scottish Arboricultural Society who are members of Parliament) who may have to draft a new law to remedy the difficulties at present interposed by the existing law in the way of the afforestation of the United Kingdom.

3. The Vicomte de Larnage discusses the tapping of Austrian and Scots pine in the south of France. The latitude, of course, affects the outturn, but considering the increasing demand for resin, and especially for the turpentine in the resin, it is nowadays wise to consider the capacity of the various resinous trees in this respect. So far not much tapping has been done with species other than the maritime pine in France, the Scots pine in Northern Europe, Pinus longifolia in India, and we believe the long-leaved pine (and perhaps others) in America, M. de Larnage places the Austrian and Scots pine in a lower grade as to outturn than the maritime (i.e., the cluster) and Corsican pines, but says that they are nevertheless worth tapping, and that the percentage of turpentine obtainable from the resin is actually higher. This fact makes it necessary to collect the resin quickly, and from narrow cuts, to prevent evaporation. The tapping increases the density of the wood, and consequently its value, by at least a third. So it has long been stated, and I suppose the point must have been decided on good evidence. but it seems contrary to probability,1 and I believe it to be a fact that the timber of P. longifolia taken from a tapped tree is much lighter than that taken from an untapped tree. M. de Larnage says only large trees are worth tapping, and I might add that it is always necessary to remember that the tapping of small trees destined to be felled much later, particularly with long cuts carried far up the bole, must decrease the value of the timber, inasmuch as there must obviously be weakness, as well as a disfiguring scar, at the point of occlusion of the wound. Accordingly, it appears that this gemmage à vie practised on

<sup>&</sup>lt;sup>1</sup> The ordinarily accepted explanation is that the tapping causes an abnormal flow of resin to the lower part of the bole, which thus becomes highly charged with the substance, and is therefore rendered heavier and more durable.—Hon, ED.

relatively young trees  $^1$  is of doubtful wisdom, whereas gemmage  $\grave{a}$  mort practised just previous to the utilisation of the timber, may be an economical operation.

4. The Forest Research Station at Zürich has lately published a volume of 345 pages, the work of twenty years. The book contains tables of production for the spruce and beech. Up to 80 years of age the spruce produces nearly twice as much wood as the beech, and the proportion is the same at 120 years when the forest is in the mountains. In the plains the spruce has a fast growth only up to 60 years old, when the growth diminishes. At 80 years the decrease becomes rapid, and it is the exception to find spruce forest 100 years old in low altitudes; they have died away. In the mountains, say from 2500 feet level, the rate of growth is slow in early years, and reaches its maximum very late, but the tree retains its productivity there up to 140 years or later. As the growth is more regular in the mountains, the wood is more valuable. The spruce suffers badly from fungus, but this becomes less and less the case as the elevation increases. It does not appear that the trouble is in any way affected by the degree of density of the stock in a pure spruce wood, but it is the case that when mixed with broad-leaved species the spruce is at its healthiest.

Very important results must follow from the establishment of research stations. Everywhere abroad, in Europe and America, and now at last in India, we find them. There are so many secrets of nature still awaiting the forester; silviculture is the youngest, and probably the least explored, of the sciences, and, we think, the most fascinating. Many results will no doubt be arrived at by accident, in the course of other investigations, but there are some obvious objects to be sought by long observation, as for example, the rate of growth of species at different periods of their lives, upon which depends the length of rotation to apply. There is no manner of doubt that careful, patient, accurately recorded research is of the utmost importance. To be in tune with the forest movement in these islands, and, above all, to render the movement permanent, the time has come for England, Scotland, and Ireland to each establish a research station. Although there are research stations in many

<sup>&</sup>lt;sup>1</sup> Twenty years ago gemmage à vie was not practised on the dunes of Gascony until the trees had attained a girth of nearly 4 feet.—Hon. Ed.

places abroad, each country has its own special local conditions, and requires independent study.

- 5. I am tempted to digress here for a few lines. It is probable that the advocates of "possibility" by volume hope to arrive at accuracy in this matter through careful and long sustained observations on the outturn of various forest crops. That we should not remove annually more material than the forest can put on in a year is, of course, a sound axiom, but will it really be possible to ever discover this amount? I believe it to be a counsel of perfection. It seems more than doubtful, for a thousand different things affect it-altitude, aspect, climatic conditions, the physical and chemical properties of the soil, the method of treatment, the density of the stock throughout the rotation, the mixture of species, storms, insect invasions and so on, and most of these constantly vary from point to point and from time to time. We can, with comparative ease, ascertain the age to which we must grow our trees, the commercial or other maturity, and I venture to think that "possibility" by area, with a girth check corresponding to the age of maturity, will meet the case sufficiently well, and even ensure truer silvicultural treatment. It is enough, from the point of view of the supply to the market, to provide an approximately even yield, and this, I think, can be sufficiently well attained by a careful allocation of the annual felling areas according to the condition of the stock, by differentiation in the size of the annual felling areas, and by having a fair number of working sections, so that the lower annual outturns in some are likely to be counterbalanced by the higher annual outturn in others. Given the size below which we may not remove a tree unless silvicultural considerations require it for the actual improvement in growth of the stock, shall we not automatically arrive eventually at the great aim of possibility by volume, namely, the non-removal annually of more than the wood can put on? I believe also that a true normality in age-classes would eventually be automatically attained, provided our silviculture treatment were correct.
- 6. There is an article by M. Henry, the Nancy professor, on the *rouge du sapin*, an expression used in regard to the strangling and withering off of side branches of the silver fir in the Jura. Someone had made a great outcry that the whole of the silver fir forests of the Jura, said to be the finest in the world, were

being killed by this attack. M. Henry rebuts this with vigour, and says that the matter is insignificant. He says the attack is due to *Phoma abietina*, discovered by R. Hartig. At the same time he admits that the attack was widely spread, and surely the loss by the withering off of the ends of millions of branches is not insignificant; but more is admitted—namely, that *Phoma* induces a condition of languor favourable to the installation of bark beetles and saprophytic fungi. What serious damage the various beetles can do, more particularly with the spruce, but also with the silver, we know. It seems a little contradictory, but at any rate we sympathise with M. Henry in his indignation over the scare.<sup>1</sup>

- 7. M. A. Mathey has a long article in the Revue des Eaux et Forêts about Algeria. The French have to contend with great difficulties there, both from man and from nature, but they appear to be rapidly conquering. M. Mathey describes in picturesque language the awful scenes of desolation that are met with in the mountains, but prophesies that with patient labour even these places may eventually be reclaimed—first with grasses, then with bushes, and finally with forest. Such difficulties are not met with at home. Nevertheless we have many and extensive bare spots, like downs, bogs, and moors, upon which we might try our hand. And we do not suffer from the greatest of difficulties, a lack of rain. There are many spots, like sand-dunes, which might (as at Holkham) be most profitably planted up. Let us hope the Commission on Coast Erosion will make proposals of this kind.
- 8. Apropos of this subject, M. Pierre Buffault has a description in the *Revue* of a large afforestation project which the Italians have in hand at the headwaters of the Sele river, in the neighbourhood of Naples, where the usual danger of streams drying up is threatened by the destruction of the woods. This project embraces nearly 450,000 acres of ravines and plateaux—chalk, clay and marl, at a fairly high altitude. The species used, which are succeeding well, are the Austrian pine on the higher parts, Corsican on the lower, and Robinia on the loose banks of ravines. Also the Neapolitan alder (*Alnus cordifolia*) is wonderfully successful in very dry and exposed situations, the very last place one would expect to suit an alder. It may be

<sup>&</sup>lt;sup>1</sup> This suggestion as to the cause of failure of the silver fir merits attention here.—Hon. Ed.

noted that evidence is constantly accumulating to point to the fact that the Austrian and Corsican pines are specially adapted for an exposed, steep, chalk slope.

9. M. Jolyet, who has charge of the Arboretum at Nancy, in the east of France, gives his observations on the behaviour of a number of exotics. Nancy lies about 49° N. latitude and 6° E. longitude, and being well inland has a distinctly hot summer and a very severe winter. The writer of these notes has known temperatures of 14° below zero Fahrenheit there, and months of intense cold. M. Jolyet says at the start that his observations are taken from plantations that are as yet quite recent, but still the results are interesting. Among conifers, the Douglas, Abies concolor and Abies Nordmanniana have grown admirably, while the Japanese larch has made an extraordinarily rapid growth. Thuya gigantea in a good soil stood drought well; Thuya Mertensiana, Chamacyparis obtusa, and Lawsoniana also did well. The deodar and Picea Morinda suffered to the extent of becoming "fatigued" by the great cold, and this is perhaps not surprising when we find that the thermometer dropped to 11° Fahrenheit. Both are Himalayan species, ascending to some 10,000 feet above sea-level, and are accustomed to frost and snow, but not to such a very low thermometer. Among broad-leaved species Quercus rubra, Betula lenta and B. papyracea, and Liriodendron tulipifera did well, but not, oddly enough, Juglans nigra. This Aboretum was made on land occupied by coppice-with-standards, and M. Jolyet cut away the coppice, leaving numerous standards. He found the oak standards did no harm, while where the coppice had shot again he found his neighbouring exotics did well, and he believes that the indications are that when we plant exotics the best places are the blanks in a coppice three to five years old, or those of an open high-forest. It should be remembered, I may add, that exotics like larch must have a great deal of room when planted in an already established wood—a small blank will not suffice, and this is an important point, for it seems certain that the mixture of conifers and. say, beech is excellent for the growth of the former, and that we shall do better to adopt this method rather than plant the conifers pure.

10. M. Huffel has a note on the wonderful oaks in Spessart, Bavaria. The forest, of which half belongs to the State, is

something over 300 square miles in extent. A part still suffers from the damage done in past centuries by temporary glass factories, which not only used the wood, but for a long distance round collected the dead leaves for potash. In passing we may draw attention to the fact that proprietors at home are often careless in regard to this most pernicious custom. Very much apropos is M. Henry's contention that he has now distinctly proved, from careful experiments, that dead leaves can, especially when the substratum is moist, actually fix the free nitrogen of the air through the presence of microorganisms. If this is true, and the contention is confirmed by other subsequent observers, it is a new scientific discovery of the utmost importance. Here, precisely, is the kind of result that research stations will achieve.

Other parts of the Spessart contain most marvellous oaks with straight boles, free of branches to a great height. The timber is famous for its straight fibre and regular growth, and is of a beautiful golden yellow. The prices obtained are so enormous, that the writer has heard it stated that oak is actually brought round by sea from Hungary, and passed off as Spessart oak. A sale of Spessart oak in 1907 resulted in the following figures:—332 oaks, 350 to 480 years old, produced 777 logs which without bark cubed 2,744,100 cubic feet, bringing in an average of about 3s. 7d. or 3s. 8d. a cubic foot; 24,053 cubic feet stacked of boarding (probably slabs), laths, etc., about 7d. or 8d. a cubic foot stacked; and 43,478 cubic feet stacked of fuel. Among the logs, the ten finest, cubing about 1480 cubic feet, were sold at a little over 8s. the cubic foot. The highest price offered, which was for a log about 26 feet 4 inches long, with a mid diameter of 311 inches, was about os, the cubic foot. A single tree fetched nearly £150. The prices have never yet been quite so good, but better are expected next year. There are not a great number of very old trees left, and when these are gone there is bound to be a hiatus. The wonderful growth would not, one would imagine, have been attained had not the soil been kept properly covered, for M. Huffel says of it that it is a more or less clayey sand, somewhat poor, but capable of carrying the finest tree crops, provided the indispensable moisture is retained.

11. MM. Mathey and Buffault have long articles on the

larch in its natural habitat in the Alps, that is, between 5300 and 7800 feet. The growth is very slow but the timber is magnificent, and of extreme durability, even though the tree may be stagheaded. It grows there mostly pure, though sometimes mixed with various pines. When pure, the young crop should not be allowed to remain too long close grown. At those altitudes the species can do well on all aspects provided there is sufficient depth of soil, or even sufficient fissures in the underlying rock for the tap-root. In point of fact, the tree appears to prefer the cold aspects N. and E., but M. Buffault declares that this is only due to the fact that on the other aspects agriculture and pasture interfered more with the growth of the trees. Such observations, however, may be quite misleading for our own lower altitudes, where different factors intervene.

12. Turning now to subterranean waters, under forest and outside forest, we may recall the work of Ototsky and Henry, who took careful measurements for long periods of the waterlevel at far distant points, two in France and two in Russia, and invariably found that the subsoil water-level was markedly lower inside the forest than outside, even close outside. Similar observations have now been made in the Bombay Presidency by Mr R. Pearson, of the Indian Forest Service, and his results are similar, only far more marked. He has shown also that the presence of forest makes the movements of the water-level very much more gradual than they are outside the forest, and that in spite of a heavy rainfall the maximum height of water level does not occur under forests for months after the cessation of the monsoon. It will be remembered that in India the rainy periods are very definite. M. Henry, considering the data given by Mr Pearson (in the February, 1907, number of the Indian Forester), remarks that two-thirds of the rain layer were taken up by the forest before reaching the subsoil, as much by evaporation from the surface of the leaves as by transpiration through the leaves, and by the imbibition of the soil covering and the upper soil layers. The quantity of the water thus returned by the forest to the atmosphere to fall elsewhere—upon crops for example—is simply prodigious. We have thus apparently reached a definite stage in our knowledge of the interaction of forests and waters.

# 8. The Royal English Arboricultural Society's Tour in Denmark, 1908.

By FRASER STORY.

The English Society this year visited Denmark, and inspected several typical forest districts in Jutland, Langeland, and Zealand. They had the advantage of the very able guidance of Herr Mundt, of the Danish State Forest Service, and of some of the foremost foresters upon private estates.

At Palsgaard, in the south-west of the peninsula, a remarkably poor tract of land was shown to the visitors. The soil is of a sandy nature, but is rendered almost sterile by the presence of an impermeable stratum or "iron pan." In treating the area previous to planting, the natural herbage, which principally consists of heather, is burned off, then the "pan" is broken by subsoil ploughing to a depth of 2 feet, after which the grubber and harrows are used. It takes from three to five years to prepare the land, as the hard layer requires to be exposed to the air for some time before it weathers. Complete cultivation of the soil is practised, instead of the system of ploughed strips alternating with uncultivated land, which is the method adopted upon somewhat similar land in the Lüneburg Heath and many other parts of Germany. Spruce and mountain pine are planted in the proportion of two of the former to one of the latter. These are arranged in lines which are 4 feet apart, while the plants in these lines are slightly over 2 feet from each other. The total number of plants per acre is 4320.

The nature of the soil would suggest the planting of Scots pine, but, strange to say, this species has failed, chiefly owing to severe attacks of the leaf-fungus Hysterium (Lophodermium) pinastri and the pine-shoot Tortrix moth (Tortrix buoliana). Other trees, such as larch, various firs, and birch, have also been tried without success. Pure spruce woods do not thrive well either, but in association with the mountain pine fairly satisfactory growth is made by this species. Probably the reason for this is that the mountain pine kills the heather that would otherwise impede the growth of the spruce. Some scientists claim, in addition, that there is a useful exchange of food materials between the mycrorhiza on the roots of the two species. The Pyrenean mountain pine (Pinus montana uncinata), which has a much more erect habit of growth than the common Pinus montana, is planted in pure woods to some extent, but better results are expected from the spruce and ordinary

mountain pine in mixture together. The latter is only tolerated so long as it has a beneficial effect upon the soil, and it is removed gradually in the "weedings" or thinnings. At the margins of the plantations, as a protection against wind, the American white spruce (*Picea alba*) has been planted in considerable numbers, and up to the present it has grown as well as the common spruce.

One of course admires the courage of the Danes in afforesting such an arid region as Palsgaard, but at the same time one feels that the money might have been more advantageously spent in planting land naturally adapted for the growth of trees. No doubt the area, if not afforested, would be practically unproductive, but it is not a menace to the district as shifting sand would be, and, therefore, might have been left as it was. The land belongs to the State, and about 10,000 acres of it have already been planted with trees.

Some private forests were visited by the Society. One of the most interesting of these belongs to Count Friis, and is situated at Boller. Beech is the principal species in these woods, and the system of natural regeneration is followed. Thinnings, which would be considered severe in either Germany or France, are carried out at frequent intervals. It is estimated that during the course of the rotation, the quantity of timber extracted in these thinnings is equal to that obtained at the final felling. In some of the later thinnings, but long before regeneration is contemplated, as much as 20 per cent. of the crop may be removed. This system is practised very generally in Denmark, both in the State forests and on private estates. It would not be approved of by German and French foresters, but where the conditions are such as obtain on the Boller Estate, there is much to be said in defence of it. The soil in this part of Jutland being fertile, and the climate fairly humid, greater liberties may be taken than where less favourable conditions prevail.

When the woods are about eighty years old they are opened out, the trees that are allowed to remain being isolated without much in the way of "preparatory fellings." One hundred to one hundred and twenty trees to the acre are left in order to sow the ground and shelter the young crop. An expensive but thorough cultivation of the land precedes the restocking. All undecomposed leaf-litter is removed from the surface with rakes, and the ground is then ploughed and twice harrowed. The cost is said to amount to  $\pounds_{3}$  per acre, a sum which would be

considered extravagant for natural regeneration in some other countries. An abundant crop results; on the average, one hundred seedlings springing up on each square yard, i.e., 484,000 plants per acre! The removal of the "mother-trees" extends over the short period of six years; vacancies occurring where old "shelter-trees" were left temporarily are filled in with Japanese larch. Young plants of ash, which make their appearance mixed singly with the beech, are cut down at once, as Danish foresters prefer to have this species in pure groups only. It was interesting to notice in this forest how trees, which had been isolated for a lengthened period, not only did not grow well, but actually died in large numbers. This was evident in the case of beech, but was particularly noticeable in all spruce woods. The fungus Hysterium macrosporum was, however, stated to have hastened the death of the latter.

On the island of Langeland privately owned woods were visited at Lohals and Tranekiger. Some good beech woods were seen, many of the individual trees being 120 feet high, with clean boles to half that height. The yield in some cases had amounted to 5600 cubic feet (English measurement) per acre at 120 years of age, or 460 cubic feet per acre per annum. Beech timber in Denmark has a value of about 9d. per cubic foot. Ash was also observed to be growing well, and even the walnut, though not used as a forest tree, occurred here and there. An arboretum belonging to Count Ahlefeldt was also viewed with interest by the visitors. Willows are cultivated on this island with success; these for the most part are cut annually, but a portion is allowed to grow for three years, in order that basket-traps and chairs may be made from the Spraying with a solution of copper sulphate is necessary in order to prevent serious damage by "rust" on the leaves. The yield of willow-produce from 21 acres generally amounts to about 20 tons. Before leaving Lohals, a small but typical Danish saw-mill was inspected. Here the beech timber is converted into staves for butter casks, for which there is a large demand.

At Thureby, on the island of Zealand, a property belonging to Count Moltke was visited. The estate is a large one, and there are no less than 4000 acres of forest. Pure oak woods are being established in place of the beech, which was formerly the principal species. Acorns brought from the south of Denmark are thickly sown in cultivated strips, which are 4 feet

apart, 12.5 hectolitres per hectare (14 bushels per acre) being used. The Forstmeister, who is regarded as one of the foremost forest experts in Denmark, is never satisfied with less than 80,000 young oaks per acre. In regenerating the woods, about thirty trees per acre are left over from the old crop to provide shelter, but nothing in the way of seed seems to be expected from these.

The State forests of Holte, near Copenhagen, were visited. As on so many estates in Denmark, the beech tree was found to predominate, 4 or 5 square miles in the district being covered by this species. An interesting feature of these woods was the manner of establishing a beech crop under birch. The birch trees are planted first, about 6 feet apart; when they are six or seven years old, beech transplants about 1 foot high are planted underneath them. When the birch has reached the age of twenty years it is removed, and thenceforth one has simply a beech plantation. The birch not only protects the beech from injury by frost, but also encourages the heightgrowth of the latter. As small birch timber is marketable in Copenhagen, there is the additional advantage to the planter of an early return.

Some enormous silver firs in the Copenhagen woods measure fully 130 feet in height, and, carrying their great girth well up the stem, contain in some cases upwards of 400 cubic feet of timber per tree. In order to show the visitors the various implements used in the cultivation of the soil, prior to the regeneration of a beech wood, a demonstration was given with the forest plough, grubber, and harrows.

A method of planting beech in these State woods was much criticised. It is what is called "block-planting," and is really a kind of "bunch-planting." A number of plants—generally about five, but occasionally over a dozen—are lifted from the seed-beds when two years old and transferred to the planting area, where they are inserted in strips that have been previously cultivated. The method differs from ordinary bunch-planting in that the plants are lifted with a ball of earth adhering to the roots of the seedlings. This is perhaps the only justification for it, because it lessens the shock of removal. In practice, however, the "ball" often gets broken in transit, and there remains only the disadvantage of a large number of plants being huddled together. It is said in defence of this system, that whereas mice would destroy single plants, they cannot so easily reach those at the centre of a small group. Rodents

(particularly the field-vole, Arvicola agrestis) are certainly a very serious pest in Denmark. The little plants when bunched together rub against each other, and the fungus Nectria cinnabarina gains an entrance at the wounds. The cost, too, is great, as the method requires such a large quantity of seed and nursery ground. Sometimes, however, seedlings from the woods are used.

To show what an important place beech occupies in Danish forestry, it may be pointed out that 240,000 acres are covered by this species. The tree which comes next to it in this respect is the common spruce, which occupies 125,000 acres, and it will surprise many to hear that the mountain pine fills the third most important place, occurring upon 75,000 acres. Herr Mundt tells me that the annual yield from all the forests of Denmark amounts to about 30,000,000 cubic feet (English measurement), and that 10,000,000 cubic feet of this is timber of large size. A privately owned forest called Berahetrolleborg claims to have the largest annual yield in timber, the woods being said to produce 70 quarter-girth cubic feet per acre per year. There are 4000 acres of this forest, and its principal species is beech.

A society called the Hedeselskabet, or Heath Association, appears to do much for the advancement of forestry in Denmark, although its operations are not by any means limited to tree-planting, for it aids farmers in the reclamation of peat-lands, constructs light railways, and carries out other improvements. Government acts through it in assisting private landowners, as much as 25 per cent. of the cost of formation being paid in certain cases, conditionally on the land remaining permanently under forest, and being subject to occasional inspection as regards the efficiency of the management. In one year this society distributed free of cost as many as 13,000,000 plants in order to encourage a more general interest in tree-planting. From a note kindly given to me by Herr Mundt, the ownership of the forests in Denmark is approximately as follows:—

Woods privately owned,	63 per cent.	
Woods belonging to the State,	20	"
Protection forests (principally situated		
on the west coast of Jutland), .	7	"
Woods held by societies, corporations,		
and communes,	10	,,
	100	

# 9. Note on Working-Plan for Chopwell Woods.1

"Tempora mutantur et nos in illis."

When the first forest school in these islands was established in 1885, the authorities at Coopers Hill College naturally were anxious to have a "school forest." After a protracted discussion, the Commissioners of Woods "graciously" agreed to let the College have 800 acres of heath land on the outskirts of Windsor Forest, under the condition that all receipts should go to the Commissioners of Woods, while all expenses were to be met by the College. It was stipulated that not less than £200 should be spent annually on planting alone.

Twenty years later, such a change had come over public opinion that the Commissioners of Woods made over Chopwell Woods, covering 930 acres, to the Armstrong College on more reasonable terms, to serve as a "school forest."

Mr Annand has now prepared a working-plan for the area.

The woods are situated within eight miles of the city of Newcastle, at an elevation between 280 and 720 feet above sealevel. In former times they seem to have contained chiefly oak, and part of the timber of which "The Royal Sovereign" was built in the seventeenth century came from these woods. After undergoing various changes, the greater part of the area was replanted with oak between the years 1812 and 1821. About the year 1858 it was recognised that the oak had no future, and, on the advice of Mr James Brown, these young woods were cleared away and the area replanted with larch, a little Scots pine being introduced on the high lying exposed parts and spruce in the bogs. If the poor, marshy, clayey portions of the area were unsuitable for oak, they proved more so for the larch. A great many died off, leaving portions of the ground unstocked, except for the stool-shoots of the oak and a few other broad-leaved species, such as ash, alder, birch and sycamore. At present, therefore, the crop consists of those stool-shoots, reduced to a single stem on each stool, and the surviving 50-year-old larches. The Scots pine, occurring in small quantities, is too thinly stocked, having suffered from squirrels and probably also from gales and snow-break.

<sup>&</sup>lt;sup>1</sup> "Working-Plan for Chopwell Woods," by J. F. Annand, Lecturer in Forestry, Armstrong College, 1908.

few of the original seedling oaks also remain. About 9 acres were planted thirteen years ago, chiefly with larch. These, then, are the unpromising woods with which Mr Annand had to deal.

Nor are the general conditions very favourable. Long ridges of deep sand or pebbly gravels are intermingled with stiff clay soils, clay loams, and sandy loams, while shallow deposits of peat over stiff clay are met with in various places. During winter the cold is often severe, and snow lies for a considerable length of time on the colder stiff soils at the higher altitudes. Coal-mining operations under the woods interfere with the draining of the land.

The objects of management are given as follows:-

- (1) To produce, if possible, the largest possible outturn of clean straight timber of highest technical value.
- (2) To protect the soil against further deterioration, and, if possible, to improve its yield-capacity.
- (3) To provide a demonstration-area for the students of the College.

After deducting unproductive parts, there remain 872 acres to which the present scheme applies. The area is divided by a public road into two divisions, namely, the north-west division with 456 acres, and the south-east division with 416 acres.

It is proposed to clear gradually the existing, unpromising crop, and to replant the area, beginning with the worst parts, that is to say, to deal, during the first twenty years, with 197 acres in the north-west division and with 125 acres in the southeast division, or with 322 in all. This would give about 16 acres annually. The series of fellings are indicated on the map accompanying the plan; they will commence in the east and proceed towards the west, against the prevailing wind. An important point is that each year's cutting will be concentrated in one of the divisions. Certain areas now blank will be planted up at once, and for the rest the coupes will be placed alternately into one of the two divisions. This is a wise proposal, though it might perhaps have been even better if four cutting series instead of two had been arranged, so that three vears would pass before a fresh cutting is made adjoining a previous one. In that case, possible damage by insects would have been further reduced, while the success of the previous plantation could have been secured before adding a new clearing to it.

The new crops will largely consist of coniferous species, oak being planted in exceptionally suitable localities only. Larch will be planted on the best naturally-drained loamy soils. Scots pine will be used on the poorest soils, in some parts together with black pine. Corsican pine will be used to a fairly large extent in the north-western division. Spruce will be planted to a limited extent in moist, peaty hollows. Sitka spruce and Douglas fir are also mentioned, as well as ash and sycamore.

It is proposed to use beech to a considerable extent to mix with the other species, so as to avoid pure woods as much as possible, and to bring the soil into a more fertile condition. This refers more especially to the larch, which should be freely mixed with beech.

There being no local demand for very small thinnings, it is not proposed to plant densely, but probably 4 feet by 4 feet or even 3 feet by 6 feet may be adopted. Owing to a rank growth of coarse grass and other weeds, the plants are to be three or four years old.

As regards the areas not to be replanted during the first twenty years, Mr Annand is very doubtful whether underplanting with beech, or even Douglas and silver fir, would lead to satisfactory results, because the time for doing so is past. The larches would probably begin to fall off before the beneficial effect of underplanting could make itself felt. Still he proposes to try underplanting in certain restricted areas of the best portions of the existing woods.

The new crop, it is estimated, would probably reach the financial rotation on the poorer soil in sixty years, and on the better soil in eighty years. We confess that we do not quite follow Mr Annand in this argument, since, ordinarily, the financial rotation on the poorer soils must be higher than that on the better soil.

The rest of the working-plan deals with income, expenditure, roads, control books, fences, wind-mantles, and injuries to which the crops are subject.

On the whole, we have no hesitation in saying that Mr Annand has done his work well. If his plan is carried out in a judicious manner, the area should become one of great usefulness to the students of Armstrong College.

# 10. The Ardross Working-Plan and Larch Canker.

By A. D. RICHARDSON.

Having taken some interest in the larch canker question, it was in the expectation that some fresh light had been thrown on the subject that I turned, as I have no doubt others have turned, on the invitation of the Honorary Editor at page 230 of the volume of the *Transactions* for 1908, to the above workingplan, in order to see for myself what the authors had to say regarding it; and as I understand that the pages of the *Transactions* would be a proper place to discuss the matter, I now seek the opportunity to lay some of my views on their proposals thereanent before the members.

A perusal of what the authors of the working-plan say about larch canker at once convinces one that they have nothing to add to what was already known regarding it; in fact, I seriously doubt if they are quite au fait of all, or even the major part of, the literature of the subject. If they are, then I have no hesitation in saying that they are simply courting disaster with open eyes; if they are not, the sooner they realise the danger to which they propose to expose the Ardross plantations the better.

The fundamental idea with the authors of the plan is to grow larch vigorously, so that it may maintain mastery over the disease (a doctrine to which every one will most willingly subscribe), and this it is proposed to do by the very rational procedure of planting larch only in localities thoroughly suited to it, and by mixing with it another species which is better able to shelter the ground. But while these excellent precepts are laid down by the authors, they, as it seems to me, proceed to defeat the very object they have in view by their method of arranging the plants on the ground. Whether a larch and Scots pine mixture is the best to adopt is perhaps a moot point, and without personal knowledge of the ground it would, of course, be impossible for any one to give an opinion as to the advisability of using it in this case; but what strikes one most forcibly is that the authors of the plan have no faith in their own proposals. "If the disease is to be reduced, or perhaps gradually cured, this can be done," they say, "only by growing

<sup>1</sup> The Note referred to is not an editorial.—Hon. ED.

vigorous trees. By planting larch pure the soil is too much exposed, healthy conditions are interfered with, and the disease is likely to be dominant; hence, the larch should be mixed with another species, which is better able to shelter the ground. For Ardross we recommend the Scots pine on the dry parts of the area and the spruce on the moist parts.<sup>1</sup> The mixture can be made—

"Either by planting larch and Scots pine, or spruce, in alternate lines, so that each species occupies one-half of the area;

"Or, one line of larch alternating with two lines of Scots pine, or spruce, so that larch occupies one-third of the area.

"In either case the following would happen:—If the larch remains fairly healthy, the thinnings will be made so, with the advancing age of the woods, that larch ultimately occupies one-half of the area, if not more. If the larch becomes badly diseased, it will be removed in the thinnings, and the Scots pine or spruce, as the case may be, will form a fully stocked wood to grow on to maturity. Even diseased larch can be used for various purposes, or sold at remunerative rates. To enable the forester to control these operations, it is essential that the two species should be placed *into alternate lines*, and not mixed irregularly."

It requires, I think, very little discernment to see that in a case such as this, one has a choice of a pure larch wood, or of one of larch mixed with Scots pine or spruce, on the one hand, while one is tied down to a pure wood of Scots pine or spruce on the other; but what, I ask, have our foresters been doing in this way ever since the larch was introduced into the country? Have they not, just as the authors of the plan propose to do, been planting larch in mixture with other species—Scots pine chiefly—and taking the chance of getting the best results they could? What is there which is new about this in the working-plan? Absolutely nothing; but there is something which is very dangerous.

It would be tiresome to reiterate all the details of the lifehistory and method of propagation of the fungus, but it may just be stated that the commonly accepted theory as regards

<sup>&</sup>lt;sup>1</sup> Due regard is to be paid to the individual requirements of these two species as regards moisture in the soil, but none is to be paid, apparently, to those of the larch, although it is quite as indispensable in its case as in those of the others to give attention to this very important matter.—A, D, R,

infection, based on the experiments of Hartig and others, is that the spores of the fungus, when shed, float in the air, and are wafted from tree to tree, and that they find their way into the young and tender bark through any wound they may meet with, and there commence growth. I think it will be conceded that, apart from questions of soil and aspect, the general opinion of planters is that isolation of the larch, by treating it as a subordinate species in mixture with other kinds, is the only practicable precautionary measure which can be adopted against attack by the fungus. But what have we here? The whole area covered by a series of lines of larch plants, 31/2 feet apart, which, from a preventive point of view, are in no better a position than a pure larch plantation would be, and this is done apparently because the authors of the plan think it essential to have the plants in lines in order that the forester may be able to control thinning operations! There is an undoubted advantage in planting in lines for easier control, and in practically no other case can any objection be urged against it; but surely it is courting disaster to do this with larch in the way suggested here? The whole area on which larch is to be grown is to be covered with a series of infecting lines, and if it be the case, as some believe it to be, that Chermes laricis is a potent factor in the spread of the disease, the danger is greatly accentuated in the case of the larch and spruce mixture by the presence of the two host-plants necessary for the insect to complete its life-cycle. If larch is to be used, why not give it a fair chance to succeed? Where lines of larch and lines of Scots pine alternate, what is the objection to planting larch and Scots pine plants alternately in the lines in which it is proposed to plant larch only, and thus reduce the proportion of larch to Scots pine from one-half to one-quarter? or, what would perhaps be better, where two lines of Scots pine alternate with one line of larch, to make every third plant only a larch plant in the proposed lines of larch, and thus reduce the proportion of larch to Scots pine from one-third to one-ninth? It would give all the advantages of easier control, would isolate the larch plants, and would give far better protection to the soil.

# 11. Notes of Silvicultural Interest.1

By THOMAS HALL.

Sycamore as a Paying Crop.—Sycamore reproduces itself from seed more freely than most other trees, especially in a damp climate like Ireland. That it returns a good profit the following may prove:-A large quantity of sycamore was cut and sold on this estate during last winter, for which 4d. per cubic foot was received. The logs were to have a diameter not less than 75 inches at the small end, and to be any length. (average measurement) contained 7 cube feet of timber, and showed 26 annual rings. On 1 acre of an old oak plantation, which has been overthinned in its youth, a test was made, twenty poles being cut averaging 7 cube feet each, which gave a return of f, 2, 16s. 8d. Next year twenty more on the same acre may be cut, as they were nearly large enough this year. This, of course, could not be maintained, under the present circumstances, as the poles in recent years have always been cut down whenever they were large enough to make fencing rails; but if the oak standards were clear cut, and this part of the wood allowed to grow a pure crop of sycamore, at least ten trees could be cut annually per acre, which would give a return of 23s. 4d. per acre per annum.

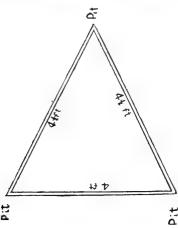
The young seedlings spring up in thousands all over the wood, rabbits do them very little injury, and although they thrive best where they have deep soil, they seem also to thrive where the soil is only 4 inches deep on limestone rock. Curiously enough, very few of them—even where the soil was shallowest—were blown down in the storm of February 1903.

The Planter's Triangle.—Where a large number of pits have to be opened for planting, and especially when the work has to be done by contract, and regularity is desired, it will be found a great advantage to use the triangle. It is made with three light pieces of lath, one 4 feet long,—or whatever distance apart it has been decided to plant,—and if this is to be the distance, two more pieces  $4\frac{1}{2}$  feet long, and nailed together, as shown in the diagram. The first row should be begun by setting a line wherever it is desired to start work, the triangle being laid down with the 4 feet side close to, and parallel with the line.

The three holes are then marked by taking out a notch at each

<sup>&</sup>lt;sup>1</sup> See also Vol. XXI. p. 179.

corner of the triangle with a spade, the triangle is then turned over and over on the 4 feet side all along the line, and the operation repeated until the first row is marked out; after this the line can be dispensed with, the triangle being laid down with the corners on the 4 feet side exactly in the notches made for the preceding row, and the extreme point of the triangle marked every time it is turned over. The correct distance will then be kept without the least trouble, and with the greatest regularity. With this simple device a man can mark out from 2500 to 3000 holes a day, and his last line will be as straight and the pits as regular as the first.



Douglas Surpassed by Cypress.—A case of Douglas fir being surpassed in growth by cypress came under my notice quite recently. The wood or rather strip might be thirty years old, light penetrated from each side to the centre, and the plantation was sheltered on the most exposed side by a high embankment thrown up to carry the public road over a railway which skirted one end of the wood. This shelter one would naturally think should have proved most favourable to Douglas fir for the first few years after planting.

The trees in the plantation were all planted at one time, and they now principally consist of Cupressus macrocarpa, Cupressus Lawsoniana, Austrian pine, Pinus rigida, Cryptomeria japonica, larch and Douglas fir. The Douglas are now all surpassed in height by the larch, and the larch are in their turn overtopped by the Cupressus macrocarpa, Austrian pine, and Pinus rigida, which species are now entirely dominant.

No disease or canker of any kind can be seen on the larch or Douglas except that they have an unhealthy yellow tinge, which may have resulted from the side shade of the other trees. The soil is a light red loam, with a gravelly subsoil on which both larch and Douglas should thrive well. The presence of a small proportion of lime could not be regarded as the cause, as I have seen Douglas beating larch on pure limestone in other parts of the same county.

Several authorities on the subject tell us that the ordinary green or Oregon type of Douglas fir, which is of more rapid growth than the glaucous or Colorado Douglas, will outstrip in growth any other kind of tree planted at the same time, but such does not appear to be the case in this instance, although the Douglas referred to seem to be the common green variety.

Buckwheat as a Greencrop for the Nursery.—It becomes necessary, after a long rotation of forest-tree crops on nursery ground, to stimulate the soil's productiveness in some way or another. This is usually done by manuring the ground and cropping with potatoes or turnips. But the best method of stimulating spent nursery ground is to sow a greencrop on summer fallow and dig or trench it in when it possesses its maximum of succulence and weight.

Buckwheat answers this purpose best, as it never grows to a great height, and is in consequence easily dug in. To obtain the best results, buckwheat should be sown in the first or second week of June, and dug in about the end of July, when it will just have begun to bloom. Sown at 10 stone to the imperial acre, it will stand thickly on the ground and keep down all annual weeds. This is one of its strong points, as it cleans land much better than a potato or turnip crop, even with the constant cultivation which attends them.

When it reaches first bloom the buckwheat should be trampled or rolled down flat on the ground, and then trenched in, the ground, as it is turned over, being smoothed with the back of the spade so as to close the seams and prevent evaporation. The buckwheat will then ferment and form a rich manure. When the soil has a light friable texture it ought to be consolidated by rolling, else the decaying stems of buckwheat will render it loose and hollow, and when it is clayey and tenacious, it receives great benefit, and is mellowed and made porous by the manuring. All kinds of trees do much better after this form of manuring than they would after a turnip crop heavily manured.

Pitting versus Notching.—What we are generally told about notch planting is that it is cheaper than pitting, and that it is more suitable for planting rough hill-sides. Certainly it is cheaper to begin with, as the figures which invariably accompany this statement show; but if the number of deaths which follow during the next three years were to be given, very few notched plantations would be found to be cheaper in the long-run than pitted ones. Professor Schwappach, in Vol. XVII. of the Transactions, mentions an area which he saw in Scotland, where 60 per cent. of the plants were dead. Of course we must suppose that the plants were small and did not cost more than 5s. per 1000, but when more than half had to be replaced, and this perhaps for two years or more after the plantation was first made, then one wonders where the cheapness comes in.

The number of deaths which result from notch planting, especially on steep mountain land, is not due alone to the method of planting, but rather that the plant is denied the nourishment so necessary to its existence. The rain falls only to run off on the surface without penetrating to the roots of the plant, and although some may find its way down through the recently closed slits, it is at once absorbed by the closely matted roots of grass or heath. Perhaps the best method for planting mountainous land is pit planting with the mattock. The handle of the mattock is 31 feet long, and the broad end, which is shaped much like an adze, and can readily skim off the most matted surface, is 16 inches long, the pointed or pick end is 17 inches long, and is used to loosen the soil to the required depth, or to break through the moorpan where this may be encountered. The sod when stripped off is laid back to the lower end of the pit, and the undersoil picked up and pulled slightly outwards. The planting operation can be readily performed with an ordinary garden trowel. The trowel is inserted into the soil in the middle of the pit, and drawn towards the planter with the right hand, the roots of the plant are then inserted with the left hand, and the soil is allowed to fall back, the plant is then given a slight shake so as to bring the roots into their natural position, the rest of the soil is then filled in and firmed with the foot, leaving the outer edge of the pit always highest so as to catch and retain the moisture. One man can plant to two, and on very bad ground to three men making the pits. The advantage of this method over notch planting is, that the plant gets a sufficient supply of moisture for its wants.

# 12. Report of the Annual Excursion, August 1908.

(With Plate.)

The Thirty-first Annual Excursion of the Society was held in the Counties of Edinburgh and Fife on the 4th, 5th, 6th and 7th August. Headquarters were established at the Carlton Hotel, Edinburgh, where a number of the party assembled on the 3rd.

### FIRST DAY.

The day's programme included visits to Dalkeith Park, Newbattle, Dalhousie and Arniston, at each of which places every arrangement was made for the comfort and convenience of the visitors. The party, who numbered about seventy, were under the guidance of Mr Charles Buchanan, Convener of the Excursion Committee.

DALKEITH PARK.—Conducted by Mr Pearson, chamberlain, and Mr Whytock, head gardener, the party proceeded first to the gardens, and then inspected the old oak trees, which are the sole remaining representatives of the ancient Caledonian Forest. A number of fine cedars of Lebanon, and the Montague avenue of lime trees were afterwards specially noticed. Before quitting the estate, Messrs Pearson and Whytock were cordially thanked for the services they had so willingly rendered.

Newbattle.—By the courtesy of Mr Kirk, the occupant, the party, after visiting the mansion-house, under the guidance of Mr Ramsay, clerk of works, inspected the grounds, where, among other objects of interest, they saw some evergreen oaks, Spanish chestnuts, sycamores, limes, yews, and some memorial trees. Special attention was given to an enormous beech of peculiar habit, which was said to be the largest in the country; it girthed 19 feet  $9\frac{1}{2}$  inches at 5 feet from the ground. The tree appeared to be in excellent condition. Mr Kirk was cordially thanked.

Dalhousie.—Here the party were received by Mr William Stewart, estate overseer, and Mr Pirie, head gardener, and were conducted through the gardens and grounds, where many fine trees of various species were seen, including a well-shaped fern-leaved beech, larch, sycamore, English yew, Atlas cedar, wych elm, and horse-chestnut. They were then hospitably entertained

by Mr and Mrs C. W. Cowan, who were cordially thanked by Mr Buchanan on behalf of the Society. The party were photographed in front of the castle.

ARNISTON.—The party were conducted by Mr Cook, estate overseer, but were subsequently joined by Colonel Dundas and Mr M'Taggart, head gardener. Many fine trees were seen in the park, the "Wilderness," and the glen; attention being specially directed to the varying development of the spruce trees, some of which had remarkably pendulous branches, while those of others stood out well from the stem. Before leaving the estate the party were entertained to tea by Sir Robert Dundas, who was thanked for his kindness on the motion of Mr Buchanan. This concluded the day's work. A considerable time was spent in measuring some of the largest of the trees, and the following results were obtained:-Beech, 15 ft. 9 ins.; Scots pine, 10 ft. 2 ins.; Spanish chestnut, 12 ft.; larch, 11 ft. 9 ins.; cedar of Lebanon, 12 ft. 6 ins.; and another cedar 17 ft. 7 ins. The beech avenue was next inspected. Two of the trees measured respectively 12 ft. 3 ins. and II ft. 7 ins. All the trees on one side of the avenue appear to have been pollarded.

### SECOND DAY.

The programme included a visit to the Edinburgh city parks under the guidance of Mr M'Hattie, and to the Scottish National Exhibition.

The CITY PARKS.—The parks visited were—The Meadows, Bruntsfield Links, Braid Hills, King's Park, Holyrood Palace, Regent Road Park, Calton Hill, Waverley Gardens, Princes Street Gardens, Inverleith Park and Raeburn Park. The party then inspected the Saughton Park Nursery. Mr M'Hattie kindly provided for the use of the visitors a fully detailed list of the city gardens, parks and open spaces, giving, so far as available, the area in acres, the cost of purchase and date of acquisition. It is interesting to note that the Meadows and Bruntsfield Links came into the hands of the City authorities as long ago as the year 1329. The list contains interesting details regarding the other parks. Calton Hill was acquired in 1724, and the others in various years dating from 1849, some being purchased and some gifted, while others





To face page 73.

are feued or rented. The list will doubtless find a place among the city records.

THE SCOTTISH NATIONAL EXHIBITION.—The exhibits in the Society's pavilion, which are elsewhere described (see p. 77), were first inspected, and the Members of the Society present were thereafter entertained to luncheon by the Magistrates and Town Council. Bailie Maxton, senior magistrate, presided over a company of about one hundred. Loyal and other toasts having been duly honoured, the party adjourned to the Concert Hall, where the General Meeting was held, and Sir Herbert Maxwell, Bart., read a paper (see p. 1 of the present issue) on "The Forest Resources of the United Kingdom." In the evening the Annual Excursion Dinner was held in the Carlton Hotel, Sir Kenneth Mackenzie, Bart., President, being in the chair.

## THIRD DAY.

The itinerary included Craigmillar Castle, The Inch; Messrs Dicksons & Co.'s Royal Nurseries, Craigmillar; Melville; Hawthornden; Rosslyn; and the Penicuik Estate.

THE INCH.—The party were conducted by Colonel Gordon Gilmour to inspect the ruined Craigmillar Castle, and he then led them to The Inch, where the gardens and some fine old trees were seen, including an ash and two sycamores. Colonel and Lady Susan Gilmour were thanked by Mr Buchanan on behalf of the Society.

THE ROYAL NURSERIES, CRAIGMILLAR.—The next visit was to the well-known nurseries of Messrs Dicksons & Co., which cover an area of 120 acres. Here the party were received by Mr Massie and Mr Welsh, and taken over their numerous beds and brakes of forest trees, ornamental trees, fruit trees, and shrubs. Many of the practical operations of the nurserymen's craft were demonstrated to the company, including the budding of roses on stalks of briar and manetti. It was noted that the area devoted to the cultivation of young forest trees is very extensive, and that the quality of the forest stock produced is maintained by a judicious alternation with agricultural root crops. Messrs Dicksons then entertained their guests to a sumptuous luncheon in a marquee pitched within the nurseries. In replying to the toast of "The Firm," Mr Massie stated that it had existed for 179 years.

MELVILLE.—Here the visitors were received by Lady Melville, and conducted over the policies by Mr MacKinnon, overseer. Many large specimens of oak, beech, elm, larch and Spanish chestnut were seen, together with examples of exotic conifers which have not yet come into general use. Among other trees measured was Rizzio's oak, which girthed 21 ft. 4 ins. A vote of thanks to Lord and Lady Melville was cordially carried.

HAWTHORNDEN, ROSSLYN, AND PENICUIK.—Passing through the finely wooded glen in the grounds of Hawthornden, and then through the Rosslyn glen, the party proceeded to Penicuik, where they were received by Sir George and Lady Clerk with a party of friends. Many large and interesting trees were seen and measured. It is interesting to compare some of these measurements with those made on the occasion of the Society's visit in 1880:—

	1880.		1908.	Increase.	
	ft.	ins.	ft. ins.	ft.	ins.
Silver fir,	ΙI	7	12 $8\frac{1}{2}$	I	$\mathbf{I}\frac{1}{2}$
Do.,	I 2	5	I 2 I I	0	6
Oak, .	10	3	11 $9\frac{1}{2}$	1	$6\frac{1}{2}$
Sycamore,	9	10	11 $5\frac{1}{2}$	1	$7\frac{1}{2}$
Elm, .	11	4	II 10 $\frac{1}{2}$	0	$6\frac{1}{2}$

After partaking of tea, during which the host and hostess were thanked for the kind and hospitable reception they had accorded to the Society, the party returned to Edinburgh.

### FOURTH DAY.

The last day of the Excursion was devoted to Raith, Donibristle and Fordell in Fife.

RAITH.—The party were met by Mr Munro Ferguson, M.P., and taken to visit some of the young plantations of spruce, Scots pine, and larch which are being raised for the production of pit-wood on a rotation of 40 years. They also inspected a nursery of hardwoods. Some experimental thinnings made by Mr Keir, the forester, in a 26-year-old mixed crop of Scots pine and larch were then examined and discussed. Dead branches to a height of 5 feet had been removed, but this plan has not been followed throughout the working-circle. An area of 30 acres was pointed out where a plantation had been burned two years

ago, the ground having now been restocked. Some examples of underplanting were then inspected; and in the richly wooded grounds surrounding Raith House some fine trees were seen, including one of the first Douglas firs introduced into this country some 70 years ago. This tree stands 110 feet high, and contains 305 cubic feet of timber. Some workmen's wooden, brick-lined bothies were then visited; one of them, designed to accommodate a single workman, had been erected at a cost of £50. A larger one had cost a little more than £100. Mr Ferguson stated that these sums represented about two-thirds of the cost of buildings of like sizes if constructed of stone.

The party were afterwards entertained to lunch by Mr Munro Ferguson, under a huge elm tree. A vote of thanks to Mr Ferguson, with cordial acknowledgment of his great services to the cause of Forestry, was proposed and carried by acclamation.

DONIBRISTLE AND FORDELL.—The party then visited the Raith Gardens and the Kirkcaldy Public Park, and after driving through Donibristle and Fordell, where they examined a good collection of conifers, they drove to Inverkeithing; and after partaking of tea in the Burgh Arms Hotel, they left for Edinburgh, thus concluding the Annual Excursion of 1908.

## ALPHABETICAL LIST OF EXCURSIONISTS.

R. C. Munro Ferguson, M.P., Hon. Secretary; David R. Adair, Edinburgh; Robert Allan, Polkemmet; James Barton, Hatfield; C. W. Berry, Edinburgh; Thomas Bond, Lambton Park; Dr Borthwick, Edinburgh, Hon. Cryptogamist; Henry Borthwick, Borthwick Castle; John Broom, Bathgate; Charles Brown, Kerse; W. R. Brown, Heckfield, Hants; Thos. Bryden, Ayr; Charles Buchanan, Penicuik, Convener; H. M. Cadell of Grange, etc.; Dr Cameron, Loanhead; Wm. Clark, Raith; James Cook, Arniston; Alex. Cowan, Penicuik; Robert Cowan, Erchless; R. C. Cowan, Inveresk; R. W. Cowper, Sittingbourne; John T. Cran, Coldstream; T. Alex. Crombie, Longhirst, Morpeth; Wm. Dick, Hamilton; A. Douglas, Scarborough; James Forbes, Overtoun; Robert Forbes, Kennet; James Forgan, Sunnybraes, Lundin Links; Robert Galloway, Edinburgh, Secretary; James A. Gossip, Inverness; P. D. Gow, Bonaly, Midlothian; David A. Graham, Edinburgh; J. L. Gray, Lasswade; George Halliday, Rothesay; Geo. Hannah, Ampton,

Bury St Edmunds; W. P. Hay, Loanhead; W. Henderson, Clonad, Tullamore; Sir Archibald Buchan Hepburn of Smeaton Hepburn; J. Smith Hill, Aspatria; David Inglis, Kirkcaldy; Wm. Inglis, Brodick; James Johnstone, Dalkeith Park; James Kay, Rothesay; James S. Keir, Raith; David King, Edinburgh; James Laird, Monifieth; George Leven, Auchincruive; A. M'Gregor, Penicuik; J. W. M'Hattie, Edinburgh; Wm. Mackenzie, Novar; George MacKinnon, Melville; W. H. Massie, Edinburgh; R. V. Mather, Kelso; John Methven, Blythswood; J. W. Millar, Loanhead; Alex. Milne, Edinburgh; Alex. Morgan, Crieff; A. B. Motherwell, Airdrie; Alex. J. Munro, Edinburgh; George A. Munro, Edinburgh; Andrew D. Page, Culzean; T. L. Patterson, Nisbet, Pencaitland; George Porteous, Lasswade; W. M. Price, Minto; W. Ralph, Corstorphine; A. D. Richardson, Joppa, Official Photographer; H. Rutherfurd, of Fairnington Craigs, Roxburgh; David T. Samson, Grantown; Thomas Sharpe, Monreith; James Shiel, Abbey St Bathans; John G. Singer, Culzean; John Smith, Peebles; A. Spiers, Edinburgh; William Stewart, Dalhousie; James Stoddart, Bonnyrigg; James Tait, Penicuik; James Terris, Dullomuir, Blairadam; J. Grant Thomson, Grantown; D. P. Wallace, Filleigh, North Devon; Rob. B. P. Wallace, Edinburgh; John Watson, Edinburgh; John T. Watson, Edinburgh; James W. Watt, Carlisle; James Whitton, Glasgow; James Whytock, Dalkeith Gardens; A. E. Wild, London; James A. Williamson, Edinburgh; John Williamson, Loanhead; William Wilson, Auchinleck; Edward Wiseman, Elgin.

13. Detailed Report on the Forestry Section in the Scottish National Exhibition, Edinburgh, organised by the Royal Scottish Arboricultural Society, 1st May to 31st October 1908.

(With Plate.)

By ALEXANDER M'RAE, the Society's Attendant.

Taking the exhibits in the order given in the last issue of the *Transactions* (Vol. XXI. p. 217), we shall deal first with specimens illustrating the rate of growth of trees.

Mr W. Steuart Fothringham of Murthly sends a fine transverse section of Douglas fir showing 58 annual layers, and measuring about 4 feet in diameter, as well as a compact section of Cedar of Lebanon showing 82 layers, and measuring over 3 feet. The Earl of Mansfield's exhibit comprises five sections of larch varying from 60 to 100 years old, grown on a variety of soils, at elevations of from 180 to 1100 feet above sea-level. The largest specimen gives a diameter of 4 feet, and the quality is excellent. The Earl of Mansfield also sends a fine section of cedar grown at Kenwood, and measuring about 4 feet in diameter; Scots fir, 120 years old, about 3 feet; and Menzies spruce, 55 years old, grown at 320 feet elevation, and measuring about  $3\frac{1}{2}$  feet. The Earl of Strathmore shows a section of Douglas fir 35 years old, with a diameter of nearly 3 feet. The annual rings are here very distinct.

Mr R. C. Munro Ferguson, M.P., exhibits from Raith cross sections of *Wellingtonia gigantea*, larch and Weymouth pine; also an interesting set of specimens showing the relative growth of larch and Scots fir, Douglas fir and Norway spruce, as they appear in the forest at 20 years of age. From Novar he shows a fine section of larch  $4\frac{1}{2}$  feet in diameter. This tree was felled in 1904 and realised £20. He sends also a section of Scots fir of fine quality, taken from 18 feet up the tree.

The Duke of Atholl exhibits a fine section from one of the parent larches at Dunkeld, which measures about 7 feet in diameter. This tree was planted in 1738, and when measured in 1888 the height was 102 ft. 4 ins., the circumference at 3 feet up 17 ft. 2 ins., and the cubic contents over bark 648 feet, without bark 532 feet. The section shows 160 very distinct rings, and is a fine object-lesson in annual increment. It has

attracted considerable attention during the Exhibition, and the rings have been counted by all classes of visitors. The section is accompanied by photographs showing the two parent trees as they stood.

Captain Cameron of Lochiel displays a very instructive set of specimens comprising six sections of larch, grown on various soils and situations, and varying in age from 20 to 40 years. He draws particular attention to the advantages of judicious thinning in the culture of larch, giving samples which have been grown 3 feet apart without thinning, and others from the same plantation which have been thinned, showing the superiority of the latter, both as regards increment and quality. He also emphasises the desirability of planting larch on suitable soils only, and illustrates this by two sections from plantations 23 years old. One gives a height of 37 ft. 3 ins., and girth over bark at 4 ft., 33 ins. The other measures 7 ft. 7 ins. in height, the girth over bark at base being 5½ ins. Two specimens of naturally grown Scots pine from Lochiel Forest are also shown, which are of splendid quality, and a section of naturally grown oak 80 years of age from a closely grown plantation, showing how the increment is retarded through lack of thinning. The collection is accompanied by a detailed report which gives full particulars of the exhibit, and is worthy of further consideration.

In the class showing specimens of different kinds of timber, we have a unique collection of 63 varieties from Murthly, polished and neatly mounted in a frame. The Marquis of Zetland, Kerse, shows a good cedar board,  $14\frac{1}{2}$  feet in length and over 2 feet in width. A section of this is polished. Scone is well represented in this class, showing a fine cedar plank from Kenwood, 12 feet long by  $3\frac{1}{2}$  feet in width, and a fine walnut plank 8 feet by  $2\frac{1}{2}$ . These have formed an attractive feature in front of the Pavilion. From the same exhibitor comes a set of boards in 7 feet lengths, including Scots fir  $2\frac{1}{2}$  feet in width, larch  $2\frac{1}{4}$  feet, both exceptionally clean, of good colour and of excellent quality; Menzies spruce over 2 feet, elm the same, and a nice piece of ash about  $1\frac{1}{2}$  feet wide.

Mr A. W. Inglis of Loganburn shows a good set of recently introduced timber, in 5 feet lengths. The top half is cut obliquely, and the boles are also cut longitudinally through the centre, thus giving every opportunity for studying the

growth of the trees, as well as the quality of the timber. The set includes-Abies cephalonica, Picea sitkensis, Thuya lobbii, Thuya borealis, Tsuga albertiana, and Populus canadensis, together with good boards of Abies nobilis, Abies grandis, Abies lasiocarpa, Wellingtonia gigantea and Mountain ash (yellowberried variety). These specimens were grown at an elevation of about 600 feet.

Glamis is represented by two very fast-grown boards of Douglas fir, 6 feet long, and giving a width of 21 feet for 35 years of growth.-From Novar we have a fine set of five Scots pine boards, 9 feet long, cut in thicknesses from \frac{1}{2} in. to 1\frac{1}{2} ins. and 21 ins. in width. These boards are exceptionally clean and of very good quality.—From Raith we have three boards of each of the following: - Weymouth pine, larch, Wellingtonia gigantea, Araucaria, sycamore and ash. The boards are cut in 7 feet lengths and are of good width. The oak boards are very good, showing excellent figure and quality; the others are a useful lot, but inclined to be a little coarse.—Dunkeld sends a fine board cut from the "mother larch," which measures 15 feet by 41, and makes a fitting companion for the cross section below it. The exhibit also includes a cross section of a branch showing remarkably one-sided growth.

The Marquis of Breadalbane sends from Taymouth Castle a set of 24 specimens of polished woods, including apple, Araucaria, ash, birch, cherry, beech, elm, elm root, gean, holly, hornbeam, larch, lime, laburnum, maple, oak, plane (oriental), plane, Scots pine (natural), Scots pine (planted), Spanish chestnut, spruce, walnut, yew. The specimens are cut into 2 feet lengths, and are nicely polished and varnished, showing the grain and quality very distinctly. The lower half of each sample is stained and the upper shows the natural colour.

The Duke of Wellington sends from Heckfield a most interesting set of 70 hand specimens of timbers, showing both the transverse and longitudinal section of each; while the Earl of Carnarvon, Highclere Castle, exhibits a splendid set of coniferous boards, 7 feet long by 2 inches in thickness, cut from mature trees, and including first two boards of Corsican pine 21 ins. wide, grown on dry sandy loam at an elevation of 400 feet. The tree was 73 years old, and contained 128 cubic feet of timber. The exhibit also includes two boards of Scots pine 26 ins. wide, grown on sandy loam at an elevation of

400 feet, age 108 years, cubic content 141 feet; two boards of Weymouth pine, grown on the same soil at an elevation of 300 feet, age 85 years, cubic content 204 feet; also two boards of larch, elevation 400 feet, age 73 years, cubic content 82 feet. The boards are in all cases remarkably clean, and the quality is excellent.

Viscount Powerscourt sends from Powerscourt a choice set of boards, cut in 5 feet lengths, with an average width of 1 ft. 4 ins., the following trees being represented:—Abies nordmanniana, A. webbiana, A. Douglasii, Larix europea, Pinus silvestris, Taxodium sempervirens (with cross section). He also sends a well finished set of ash felloes of excellent quality.

Mr D. W. Thomson, Nurseryman, Edinburgh, exhibits a 9 feet length of Salix alba (the cricket bat willow), also a sample bat made from another specimen, manufactured by Shaw and Shrewsbury, Nottingham. The log threw out a fine crop of healthy shoots, and has been a great source of interest to visitors. The descriptive label has been studied by a great number of visitors, especially by schoolboys.

Messrs A. & R. Brownlie, Timber Merchants, Earlston, sent a big larch tree, 33 feet long and 3 feet in diameter; while Mr Alex. Pollok, Tarbolton, exhibits two specimens of "burred" oak, suitable for veneering. An enormous beech, grown on the Marquis of Tweeddale's Yester estate, comes from Messrs Souness & Spiers, Warriston Saw-mill. The log sent is about 11 feet long, girth 15 ft. 3 ins., content 160 cubic feet, and weight about 7 tons. The tree was about 300 years old, grew at an altitude of 400 feet, and was estimated to weigh about 35 tons.

Mr James Whitton, Superintendent of Parks, Glasgow, has a very fine display of timbers used in shipbuilding. The specimens measure 12 ins. by 6 ins., and number 48. They are very neatly mounted in four handsome frames. One half of each specimen has been varnished and the other half is left in the natural colour. They include a good selection of mahogany, walnut, and the various hard, soft, and ornamental woods of commerce, the chief sources of the different kinds being indicated. The exhibit has proved most attractive and instructive.

Mr George Cadell (late Indian Forest Department) sent a beautiful board of oak grown in Somersetshire, age about 160

years, which had been grown on light sandy loam. The tree is cut into 1 in. boards, and has produced about 1100 square feet. The figuring and colour are excellent.

Messrs James Jones & Sons, Ltd., Larbert Saw-mills, have an extensive exhibit of fine commercial timber in the round, the oak from Yester being one of the attractions of the Exhibition. It was about 300 years old, and had been grown on Old Red Sandstone, at an altitude of 400 feet. The log shown is 20 feet long, gives a mean girth of 13 ft. 8 ins., contains 233 cubic feet, and weighs about 91 tons; the whole tree, including tops, is estimated to weigh about 30 tons. Messrs Jones's collection also includes—a good larch from Darnaway, 100 years old, grown at an altitude of 550 feet; larch from Sluie Estate, about 100 years old, and grown at 300 feet elevation; larch from Riddell Estate, about 110 years old, and grown at an altitude of 540 feet; beautiful Scots pine from same estate, age about 110 years, grown at 500 feet; Scots pine from Gask, about 110 years old, grown at 400 feet elevation; very large Scots pine from Gordon Castle, age about 175 years, grown at an elevation of 200 feet; plane tree from Gask, of good size; splendid specimen of beech, and two excellent oaks from Mertoun Estate, all grown at an elevation of 400 feet, and about 165 years of age; good specimens of ash and elm about 110 years old, grown on the Riddell Estate at an altitude of 540 feet. The collection is of excellent quality and size, and gives a fine representation of Scotch-grown commercial timber.

Mr H. J. Younger of Benmore sends an interesting classroom set of hand specimens, showing 106 varieties of trees grown on Benmore Estate. The specimens are neatly got up and labelled, and are accompanied by two catalogues in frames, giving the number, the botanical and the common name of each specimen. The Earl of Rosse exhibits a useful collection of ash handles, 14 in number, as manufactured in the saw-mill on Birr Estate. They are neatly finished and of splendid quality.

Sir Duncan E. Hay, Bart. of Smithfield and Haystoun, shows a very good set of nine boards, cut into 7 feet lengths, including oak, elm, plane, beech, ash, poplar, Scots pine, spruce and larch. The trees were grown at altitudes of 700, 600, 650, 800, 950, 550, 550, 850 and 900 feet respectively, on sandy or gravelly soils, and are fine practical examples of what can be

done in the production of useful timber of different varieties at the higher altitudes in Scotland.

Messrs Alex. Jack & Co., Ltd., Maybole, show a choice representative set of wheel woods, comprising ash felloes, elm naves, and oak spokes, all of different patterns and sizes, as used in the manufacture of their carts, vans, and lorries, etc. The timber was grown in the vicinity of Maybole, and is of first-class quality. The various articles are well finished, and the whole forms an instructive industrial exhibit.

Mr F. R. S. Balfour of Dawyck sends a section of bark and a piece of board cut from a *Sequoia gigantea*, in the Giant Forest, Sierra Nevada, California. Also two very large sections of Douglas fir from British Columbia, measuring about 10 feet in diameter.

Messrs J. & M. Smith, Peebles, send a fine set of mounted veneers, showing splendid marking and quality, and also two good specimens of "burred" oak.

The Duke of Roxburghe, Floors Castle, exhibits a splendid stand of specimens, illustrating the growth of larch at elevations varying from 50 feet to 1000 feet above sea-level. The sections are staged so as to revolve, and are cut longitudinally through the centre in 5 feet lengths. One example is given for every 50 feet rise up to the 1000 feet. The quality is in all cases excellent, and the exhibit has attracted the notice of visitors generally.

The Duke of Northumberland, Alnwick Castle, sends a most interesting series, showing the gradual evolution of a Scots fir crop. We have, first, examples of stems taken from plantations 20 years old, No. 1 planted at 3 feet apart, No. 2 planted at 4 feet apart, illustrating the difference in branch suppression; also boards and diagrams giving the quality of timber which may be expected from crops planted at these distances. The 3 feet apart crop give decidedly the best results. Full length specimen stems from a plantation 30 years old are also shown: these give a volume of 1741 cubic feet per acre, or an annual average increment of 58 cubic feet on a total of 1684 stems. The exhibit is further supplemented by transverse and longitudinal sections of a mature tree 115 years old. The trees stood 420 to the acre, and measured 8100 cubic feet. A section of a spruce tree 45 years old, from a wood now containing 632 trees per acre, with content of 6000 cubic feet, is

· also displayed, showing the advantages of deferred thinning in the culture of common spruce.

Mr R. M. Macdonald of Largie sends two boards of *Cupressus* macrocarpa showing very fast growth, the tree giving a girth of  $7\frac{1}{2}$  feet at the age of 35 years.

In the section for "Gates, Fencing Material, Railway Timber, etc.," we have from Murthly a Douglas fir sleeper (not creosoted) used on the Highland Railway for about seven years, showing splendid wearing qualities; also two posts of Douglas fir (not creosoted) in use for fourteen years in dry gravelly soil, and still in perfect condition. Scone is well to the front in this class, showing a very fine five-barred gate and wicket, made from larch of really superb quality. The design here is very pleasing, and the mechanical arrangements for hanging and fastening very effective. A split-oak hunting wicket, made on the self-closing principle, is also exhibited, and is a useful article for a hunting country. A good representative set of creosoted fencing posts, cut from a variety of timbers, is also sent. Each specimen is cut and hinged, thus showing the extent of the absorption, and the difference in regard to this in the case of seasoned and unseasoned posts.

From Floors Castle comes one of the Scots pine gate sets used on the estate; also an interesting stand of fencing posts of various sizes, cut from sap-wood and heart-wood of Scots fir. These have been all treated in the estate creosoting plant at a pressure of 150 lbs. Each specimen was weighed before and after seasoning, also after treatment, and the results are neatly tabulated, so that the whole form a most interesting and instructive exhibit. Six posts which have been in use for eight years are also shown. These are perfectly preserved, and prove the economic advantages of using creosoted Scots pine for fencing purposes, and thus saving more valuable timber for the market.

From Novar we have three field-gates made of larch and treated with sideroleum. They are of light, medium, and heavy pattern, and are good serviceable articles for general field-work. Creosoted hand specimens of Scots pine straining and fencing posts, of Douglas fir fencing posts, showing the extent of absorption, are also shown.

The Economic Fencing Co., Ltd., London, sent a quantity of their well-known "Peignon" chestnut fencing, sufficient

to enclose the Society's exhibit, also a wicket-gate to match.

Mr James Kay, Forester, Bute, exhibits his universal straining pillar for use in wood fences.

Colonel F. Bailey, Edinburgh University, sends five sections of pine telegraph posts, prepared as samples by the General Post Office. From Benmore we have a neat wicket-gate and posts made from *Thuya gigantea*.

Messrs Major & Co., Ltd., Hull, exhibit two nice showcases, showing the value of solignum as a preservative, and also its protective qualities against the ravages of white ants.

Mr Geo. Leven, St Quivox, Ayr, sends thirty-three hand specimens of fencing posts, cut from various woods, and treated with creosote, showing the difference in the extent of absorption.

We have also an interesting special fencing exhibit from Loganburn, viz., several specimen lengths of neat fencing, 2 yards each, of different designs, made from branches of Albert spruce, showing method of utilising otherwise waste material. The fencing is accompanied by specimen plants of Albert spruce, also seedlings, branches, cones and seeds, of the same tree.

An interesting set of specimens from Alnwick Castle illustrates the art of pruning, some of the examples showing the injury caused to timber through pruning being neglected or badly done, others showing how the work ought to be done, and the beneficial effects of good pruning, showing the gradual healing over of the wounds when properly treated.

In the section of "Abnormal Growths" we have, from Scone, a peculiar swelling on the trunk of small oak, and a growth on an elm branch. Glamis sends an enormous formation on the trunk of a young oak. From Raith we have very large specimens of witches' broom on ash, larch, and Scots pine; and a peculiar one-sided growth of oak from Lochiel. Lord Leith of Fyvie sends specimens of Scots pine trunks distorted by the weight of snow. Mr Kay sends a very distinct growth on an ash branch 30 years old; the branch gives a circumference of 11 inches only, while the swelling girths 3 ft. 7 ins.

The next class is a most interesting one, and deals with the damage done to trees, etc., by insects, animals, birds, fungi, or other causes.

Dr Stewart MacDougall presents a magnificent display illus-

trating the damage done by insects. The specimens are mounted in handsome cases, and show the various insects just as they are found in their natural environment. They are accompanied by numerous enlarged photographs, plates, and paintings, and make a most comprehensive and instructive exhibit. To the student of Forest Entomology the exhibit furnishes a good opportunity for the study of this important subject. The chief features of the exhibit are cases showing the lifehistory and work of Hylesinus fraxini, H. crenatus, H. piniperda, H. menor, H. poligraphus, Tomicus chalcographus, Scolytus Ratzeburgii, Jan., Neoclytus caprea, Callidium luridum, Saperda carcharias, Gnorimus nobilis, Melolontha vulgaris, Otiorhynchus picipes, Hylobius abietis, Megastigmus spermotrophus, Sirex gigas, Vespa crabro, Gastropacha pini, Cossus ligniperda, Porthesia dispar, Cryptococcus fagi, and many others. There is also a most interesting supplementary set illustrating protective mimicry among insects, which has been a source of interest and pleasure to thousands of visitors, attracting the notice of all ages and classes.

Captain W. B. Rankine of Cleddans forwards a good case showing the damage done by the pine sawfly, willow moth, and pine beetle.

From Scone we have a well-mounted collection in case, showing the ravages of pine beetle, pine weevil, spruce gall, Fomes annosus, Peziza willkommii "on common and Japanese larch," and Peridermium strcbi.

Good examples of *Cossus ligniperda*, showing the wonderful workings of the larvæ in an oak stem, and of *Sirex gigas* come from Murthly.

Mr George Anderson, Braehead, Cumbernauld, shows an interesting set of specimens showing the damage done by frost, Nectria ditissima, Peridermium pini, Peziza willkommii, witches' broom on various trees, etc.

Dr A. W. Borthwick exhibits a very complete collection of useful and of injurious insects. These are beautifully mounted in hand-cases, and form a fine reference or class-room set. He also shows a most interesting range of cases illustrating the damage caused by fungi, showing the fructifications of the various species exactly as they appear in nature. The collection embraces specimens of *Peziza willkommii* on European and Japanese larch, and also several other species of *Peziza*.

Various species of *Polyporus* and *Nectria*, etc., are shown, and also specimens of *Peridermium pini corticola* and *P. pini acicola*, *Agaricus melleus*, *Trametes radiciperda*, *Curcurbitaria pithyophilia*, *Phoma pithya*, with many others. His specimens illustrating the damage done by squirrels, rabbits, etc., are very typical cases, and the whole forms a representative collection, such as British foresters at anyrate rarely have the opportunity of studying.

From Novar we have examples of damage done by squirrels, black game, deer, and honeysuckle; also specimens of the goat moth; of the injurious results in root formation from bad methods of transplanting, etc., etc.

The exhibit from Benmore calls attention to the injurious effects of improper tying.

In the class illustrating Forest Botany, Dr Borthwick has forwarded a magnificent collection of foliage, flowers, fruit, cones, etc., showing the life-history of coniferous and hardwood trees and shrubs. The cases showing the gradual evolution of the plant from the seed, with its growth and development, are intensely interesting, and are object-lessons in Nature's wonderful work. The specimens are neatly mounted in convenient hand-cases, and are most instructive.

Mr Steuart Fothringham shows a very complete collection of seeds belonging to 167 varieties of trees and shrubs. They are very nicely mounted in oak frames, divided into compartments, and glazed over. The Earl of Mansfield also sends a very good collection of cones and seeds, neatly displayed in a glass case.

Mr F. R. S. Balfour sends specimens of some very large cones of *Pinus lambertiana*, *P. Jeffreyii*, and *Sequoia gigantea* collected by him during his recent American tour.

Mr S. Bosenworth shows a fine cluster of cones of *Pinus Pinaster* cut by him in New Zealand.

Messrs Robert Sorby & Sons, Ltd., Sheffield, send a very complete showcase of edged tools used in forestry operations—they are well arranged, and make a good display; while Novar gives samples of pruning tools, and dibbles, etc., for seedling transplanting.

Mr Kay shows a well-finished model of his transplanting-machine; and Colonel Bailey gives examples of useful pruning tools, and Schlich's pattern spade for vertical notching. Notching-spades are also shown from Scone and Comlongan.

We have a good display of working-plans, maps, etc.

Mr R. Campbell, B.Sc., gives a geological map of the Inverliever Estate; Professor Schlich shows the new working-plan which has just been arranged for the Ardross Woods; Colonel Bailey gives the working-plans arranged for the Novar and Raith Estates; Mr S. J. Gammell shows the plan worked out for his estate of Drumtochty.

Mr J. G. Bartholomew, The Geographical Institute, Edinburgh, exhibits six very interesting maps, well mounted and framed. These are—Botanical Survey of Scotland; Naturalists' Map of Scotland; Botanical Survey of Edinburgh District; Geographical Distribution of Vegetation in the Basins of the rivers Eden, Tees, Tyne, and Wear; Geographical Distribution of Vegetation in Yorkshire; and Vegetation and Agricultural Maps of England.

Mr Alex. Pollock, Tarbolton, gives a very good display of rustic work, including seats of various designs, entrance-gates and pillars, wicket-gates, with samples of rustic fencing, etc.; also a very artistic suite of rustic oak furniture, "Staghorn" registered design, which furnished the Members' room in the Pavilion.

In the class for pictures and photographs, the Society's series of enlarged photographs of American conifers grown in Scotland make a good show, as do also various excursion groups, etc.

The Earl of Mansfield sends a good mounted collection of photographs, showing some of the very interesting features of his estates; and the Duke of Roxburghe shows a complete mounted set of enlargements illustrating the appliances, etc., used on his estate for the transit, conversion, and preservation of timber.

Mr Munro Ferguson gives illustrations of underplanting of larch at Novar. Messrs J. & M. Smith, Peebles, show their well-known instrument for measuring the height and diameter of trees; while three types of pocket dendrometers, viz., "Brandis," "French Official," and "Indian Extemporised," are sent in by Colonel Bailey. Mr Kay also exhibits his well-known dendrometer with descriptive leaflet.

The British Dyewood and Chemical Co., Ltd., of Glasgow, show a good selection of tanning and dyeing substances derived from forest produce.

Messrs Thomas Tait & Sons, Ltd., Inverurie, have a most interesting exhibit, viz., a series of glasses whose contents show the various stages in the process of reducing imported wood to bleached pulp, ready for the manufacture of paper. Messrs Tait also show samples of their paper, and remind us that all fibre used by them might be produced in Britain, but at present they are "compelled" to go to Russia for their supplies.

Among other objects of interest, we have curiosities from Murthly, Raith, and Scone.

Mr James Rodger, Athy, shows an interesting section of bog pine in good preservation; it was found on the "floor of bog," from which a deep cutting of peat had been taken many years ago.

Mr John Thomson, Balmoral, sends four very handsome "carved" walking-sticks. They are made of maple grown on the Balmoral Estate, and are very fine examples of hand-carving.

Messrs J. & M. Smith, Cabinetmakers, Peebles, exhibit a well-finished copy of Burns's chair, also a neat Yorkshire table; both articles are made of choice "burred" elm grown in Peeblesshire. Mr Wm. Elliot, Builder, Edinburgh, sends two interesting sections, cut from "elm" water-pipes, unearthed in West Register Street. Specimens of bog oak, with photos, are shown from Mr Aird, Woodend, Muirkirk.

Colonel Bailey shows interesting examples of timber felled by beavers, also some preserved specimens of wood found in the Roman Camp at Newstead.

Messrs Blackwood & Sons send copies of *The Forester* (2 vols.) by Dr Nisbet, also a copy of *Forest Entomology* by Mr A. T. Gillanders. The Royal Scottish Arboricultural Society display copies of the *Transactions* and other literature.

Four handsome stag heads, three of them Royals, have been kindly lent; these form a very attractive feature in the decoration of the Pavilion.

Messrs Dicksons & Co. send five well-furnished hanging baskets, which give a remarkably pleasing appearance to the front of the exhibit, also some specimen conifers. Mr D. W. Thomson sends a very fine collection of flowering and decorative shrubs for the plot in front of the Pavilion, which has been supplemented by a contribution of ornamental shrubs, etc., from Mr M'Hattie. Captain Leyland, Haggerston Castle,





exhibits a good collection of Coniferæ in pots, consisting of 86 varieties.

The Duke of Atholl sends six varieties (in tubs) of larch grown at Dunkeld. The front of the Pavilion is further adorned by three very fine garden chairs (two oak, one larch) from Scone Palace. Viewed from the main avenue, the Pavilion presents a very pleasing and attractive appearance. The Pavilion has been visited by thousands of visitors of many nationalities, who have shown marked appreciation and interest in the various details. Without doubt, the Forestry Section has proved to be one of the educational features of the Exhibition, and to thinking people it has been a source of pleasure and enlightenment.

The Royal Scottish Arboricultural Society may congratulate itself on the success of its efforts.

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

By A CORRESPONDENT.

The eighth Annual Forestry Exhibition was held in the Showyard at Aberdeen on 21st July 1908. The Directors of the Highland and Agricultural Society kindly voted, as in previous years, the sum of £20 for prizes to be awarded for home-grown timber, and the Royal Scottish Arboricultural Society also gave prizes for timber produced in the local district, viz., in the counties of Aberdeen, Banff, and Kincardine. They also gave medals or other awards for interesting exhibits not sent in for competition. For the complete Prize List, see under Proceedings of the General Meeting in 1908.

It may be noted that the Exhibits were not so numerous as on several former occasions, no doubt largely owing to the support accorded to the Scottish National Exhibition in Edinburgh. But in point of quality they were quite equal to those of former years. Naturally, timber of the broad-leaved trees did not bulk largely in the competitions. The district, however, is capable of producing, and has produced, coniferous timber of the highest quality. Here, also, the valuable exotic conifers have been used for general planting, perhaps more freely than in most other parts of the country. These special features were well brought out in the Exhibition.

Among the articles not for competition, the Duke of Richmond

and Gordon showed some interesting cross sections of Scots pine, larch, and Norway spruce from the Huntly district. The object of this exhibit was to demonstrate the natural taper of the tree, which is a very important point in the valuation of timber.

Mr Gammell of Drumtochty exhibited an implement known as the "Forest Devil," which has for long been in use in Switzerland and Germany for extracting roots, or for pulling trees out of hollows.

Messrs Thomas Tait & Sons, Ltd., Inverurie, exhibited specimens of wood and pulp for paper-making in various stages, with samples of paper made from Aberdeenshire wood.

A very interesting exhibit was that by the Earl of Aberdeen, demonstrating the variations in form of plants which may be produced from the seeds of a parent plant, which is itself a sport. Thus, of three beech plants 5 years of age, grown from seed taken from a fern-leaved beech, one plant had the foliage of the common beech, another had purple leaves, and the third had fern leaves, like the parent.

Another very interesting exhibit was that of His Majesty the King, per Mr John Michie, viz., two Scots pine logs with two dressed boards of the timber, and two jars containing sections of soil in which the trees were grown.

Mr Baird of Durris exhibited six spars of exotic coniferous trees grown in close plantation, and this exhibit was very much appreciated. It clearly showed the influence of favourable locality and correct silvicultural method on the growth of some of the newer Coniferæ. The examples shown were Sitka spruce, Thuya gigantea, Cupressus Lawsoniana, Abies nobilis, A. grandis, and A. Nordmanniana. The "spars" (a local term for trees of a certain size) were excellent examples of well-grown trees, straight and without knots, but it does not necessarily follow that those species will do as well where the climatic conditions are different. The Durris experiments might well be repeated in many other parts of the country.

The arrangements connected with the Exhibition were efficiently carried out by the Exhibition Committee, a great deal of the work being done under the personal superintendence of Mr C. S. France. The judges were Mr A. T. Gillanders, Alnwick; Mr J. F. Annand, Armstrong College, Newcastle; and Mr Donald Munro, timber merchant, Banchory.

After a Council Meeting had been held in the Showyard, Mr A. T. Gillanders, woods manager to the Duke of Northumberland, gave a lecture on the "Educational and Economical Value of Forestry Exhibitions."

Mr Gillanders, having been introduced by the Chairman, expressed pleasure at having been called upon to give an address to the Aberdeen Branch of the Society in the district where he had been born, and within the favoured twelve miles' limit of which he had received his training. He was to deal with "The Economic and Educational Value of Forestry Exhibitions," and it was important to notice that all forestry exhibitions were primarily intended for educational purposes. He held that agricultural shows were the best places for giving such exhibitions, because agriculture was closely associated with forestry, and might be compared, to a certain extent, with arboriculture, and at agricultural shows they met all classes of people who ought to be specially interested in forestry. It must be particularly gratifying to foresters to see that the landlords of the district of Aberdeen had taken such a deep interest in the exhibition. Mr Gillanders went on to say that as agricultural shows improved the education of the farmer, so forestry exhibitions ought also to improve his education, although there was greater difficulty in getting up those exhibitions, because of the migratory character of the shows, but on that account they were the more valuable. He advocated that all exhibits should be of a practical nature, so as to bring out information regarding the different problems suggested by forestry, namely, trees treated commercially, trees treated for shelter, trees treated for landscape effect, and so on. He maintained that much could be done for forestry by laying out experimental plots on large areas. He said he did not presume to dictate to the Highland and Agricultural Society, but he thought it would be very satisfactory if that society could get a shed after the manner of the Royal Agricultural Society, and associate in it the college exhibits, the nature study exhibits, and the forestry exhibits, either under one roof or in buildings adjacent to one another. Then they would bring together a large class of persons who were especially interested in such studies. Arising from the study of such exhibits, they would have to deal with various problems which scientific men were now considering, as, for

instance, the question of Mendelism in regard to the crossing of peas, as now being worked out at Cambridge. A study of Mendelism showed that, in regard to crossing, there was a law of Nature running throughout, and that suggested to the forester the value of the selection of the proper seeds. Proceeding, Mr Gillanders referred to the principal exhibits in the Aberdeen exhibition, and made interesting comments regarding He specially commended those which practically illustrated the principles of forestry. He did not favour the exhibition of freaks or abnormal specimens, or exhibits which might only be a source of interest to the curious. exhibits ought to teach the practical benefits of forestry, on the same lines as agriculturists endeavoured to teach practical points regarding the raising of crops or the breeding and rearing of stock. On some points they might have a difference of opinion, but he held that difference of opinion was the soul of progress, and that if they strove earnestly after the best results they would meet with success.

After some remarks by Mr France, a vote of thanks to the lecturer was moved by Mr Michie and was carried unanimously. The meeting then terminated.

# 15. The Forestry Exhibition at the Newcastle-upon-Tyne Show of the Royal Agricultural Society of England.

## By A CORRESPONDENT.

The Forestry Exhibition, which has now become quite a standing feature of the show, was again under the personal supervision of Mr George Marshall and other members of the Royal English Arboricultural Society.

As in former years, the exhibits were either housed within the shed which contained other educational exhibits indirectly associated with Forestry, or were placed immediately outside it, and they were divided into two classes—competitive and non-competitive.

This is the fifth time such an exhibition has been held, and there is no doubt the interest is increasing year by year.

In the competitive section, two classes may be specially mentioned, Class VI. and Class VIII. The former included "Specimens showing comparative Quality of any Timber grown on different Soils and Situations, and the respective Ages at which it reaches Marketable Size and Maturity. Exhibits to be accompanied by a short descriptive statement."

This class was certainly a very important one, inasmuch as it professed to give an epitome of the life of the wood from a commercial point of view, and to indicate the age at which certain crops may, under varying conditions, be cleared off the ground. The value of the exhibit was, however, considerably reduced in consequence of there being no guarantee that the sample exhibited, and the statement given, were a correct representation of any particular crop. It is to be hoped, therefore, that future exhibitions in connection with this class will demonstrate, or suggest, further points on which information is desirable.

Class VIII. included "Specimens of Stems, and of Boards cut from them, not exceeding 6 feet in length, illustrating the effects of Dense and Thin Crops in Branch Suppression, and in the Quality of the Timber."

In this class both the prize exhibits were very much admired, and received a considerable share of attention. The various specimens showed that, in order to get valuable timber, the plantations must be grown as dense crops throughout the whole period of growth, but more especially in the younger stages. It is no exaggeration to say that the poverty of prices and the apathy of demand at present are due to the results of overthinning young plantations.

In the division on articles for Exhibition Only, the majority of the exhibits were outside the building, but one very interesting lot was exhibited inside, viz., that from the Armstrong College, Newcastle-on-Tyne, per Mr J. F. Annand, Lecturer on Forestry. This was certainly a very interesting stand. and displayed a large variety of articles such as seeds, cones, and fruits of Forest Trees, in bottles; a number of specimens illustrating various tree diseases; leaves, buds, and twigs of Forest Trees; sections of woods, timber transparencies, etc., in addition to those which were used in class-room demonstration. The stand showed that those in charge of

Forestry education at the Armstrong College are doing their utmost, not only to teach sound scientific forestry principles, but to make their work of real practical benefit to those connected with the management of woodlands in the north of England.

Professor Potter, Armstrong College, showed samples of fungi injurious to forest trees.

In addition to the exhibits just referred to, the Armstrong College showed photographs from Cockle Park of Tree Plots illustrating—(1) the comparative growth of Japanese and European Larch, as well as Scots Pine and Spruce; and (2) the results of the different methods of planting, etc.

The Earl of Yarborough showed a very fine set of exhibits within the building, being a splendid collection of boards, 7 feet long, of 83 different species grown on his estates. The same exhibitor also showed a set of photographs illustrative of the entire range of Forestry, from the seedling in the nursery to the manufacture and creosoting of timber, together with detailed tables, stating the comparative amount of creosote special timbers will absorb.

The Earl Egerton of Tatton, Cheshire, exhibited planks, 6 feet in length, of several kinds of timber grown in Tatton Park.

Mr John Patten, jun., Park Farm, Alnwick, had a very beautiful exhibit showing "Specimens of the Fruits of Trees and Shrubs, together with drawings and photographs illustrating the Fructification of each particular Species." This exhibit was very much admired, and it is one which is capable of considerable development.

Coloured maps illustrating Working-Plans were shown by Mr Gillanders and Mr Annand.

Outside the shed a series of exhibits were placed. Messrs Richard Smith & Co., Ltd., Worcester, and Messrs Little and Ballantyne, Carlisle, exhibited plots of coniferous and other trees suitable for ornamental planting. Messrs Joseph Robson & Son, Hexham, exhibited a very well-grown and beautifully arranged set of trees and shrubs, etc., suitable for seaside, town, and inland planting respectively.

Mr J. C. Leyland, Haggerston Castle, Northumberland, exhibited a very fine set of conifer seedlings and transplants which had been raised in his own estate nursery.

In addition to several interesting exhibits from the gentlemen

already mentioned, two exhibits by the Duke of Northumberland may be mentioned. One was—

"Exhibit illustrating process of Creosoting:

- (a) Samples of Creosote Oil and its definition.
- (b) Methods of application to wood.
- (c) Structure and constituents of wood.
- (d) Advantages of the application of Creosote."

The Duke of Northumberland also exhibited a plot divided into sections, demonstrating the "Progressive Stages of a Pure Scots Pine Wood."

As this exhibit was very much admired, it may be well to give the following description, which is a copy of the printed instructions placed on the respective plots:—

- No. 1. This plot represents typical moorland soil after first year's planting. 2-yrs.-2-yrs. plants are used, and planted by careful notching.
- No. 2. This plot shows the plantation at 13 years old. In this case good "canopy," or covering, the result of thick planting, has been attained, and the rough herbage is being converted into humus.
- No. 3. This plot shows the plantation at 25 years old. In this case the treatment has simply been thinning by cutting out the dead and heavily suppressed trees, and pruning the dead branches off the stems up to 7 or 8 feet in height, at a cost of 17s. per acre. Thus branch suppression, which is essential for producing good timber, and the protection of the soil against the consumption of nutriment by noxious grasses and weeds, together with the prevention of evaporation of essential moisture in the soil, have been maintained by the close overhead canopy.
- No. 4. This plot shows the average thickness of stems at 50 years of age. In this case the heather is reappearing on the soil in consequence of overhead canopy being too much broken. In a pure Scots pine wood the leaf-canopy cannot well be maintained from 25 years old to 50 years of age. To attempt doing so would be to carry the pole-stage too far, and produce a crop of poles.

Up to 25 years old the trees must be considered collectively; after 25 years, the trees must receive a certain amount of judicious individual consideration.

No. 5. Photographs showing the felling of the final crop, and the manufacture of the timber on the spot.

A movable saw-mill with a plough traction engine is used. The timber is drawn to the saw-mill by means of a steel rope of 450 yards length, and winding drum. Snatch-blocks are fixed at various points so that the timber may be drawn at any angle, and when the limits of the rope are reached the saw-mill is removed to another part of the wood.

No. 6a. This plot shows the condition of the soil after the removal of the crop. To attempt replanting in this condition would involve considerable expense, and a large proportion of the young trees would die off. The fresh condition of the bark on the tree-stool is an example of suitable breeding-places for the larvæ of the pine weevil (Hylobius abietis).

No. 6b. This plot shows the condition of the soil after pasturing three years with cattle and sheep. It will, therefore, be obvious that the ground can be more cheaply and successfully replanted. The bark on the tree-stools has been dislodged, and the conditions favourable to the reproduction of the pine weevil diminished in amount.

It should also be noted that, as a result of pasturing, the "spongy" layer underlying the rough turf disappears. This is a great improvement to the soil, inasmuch as the spongy layer is acid in reaction, and contains nitrogenous matter derived from the decayed plant residues of which it is composed. In the rough state the nitrogenous matter, however, is not directly available as a plant-food, but must be converted into a soluble and available form by the action of the nitrifying organisms always present in the soil.

It should be noted that this treatment only applies to pure Scots pine woods.

# 16. British Forestry.1

The Government has now made a start in promoting the establishment of scientific forestry among British industries, by establishing demonstration areas and making grants to educational bodies for purposes of instruction. The exhortation to "Go on!" which for the space of a generation was all the response that could be got out of our rulers by those who tried to rouse them to a sense of the necessity for action, has now been exchanged for the far more exhilarating "Come on!" A beginning has been made in the right direction; but before the Treasury can be persuaded to sanction further outlay, and before private owners will be inclined to regard tree-planting as an investment instead of a luxury, they must be satisfied as to the reason why the existing woods of the United Kingdom, taken as a whole, are unremunerative; nay, more—why the outlay on the Crown forests, and on most privately owned woodlands, largely exceeds the revenue. If there be a heavy deficit on the three million and odd acres now growing trees of sorts in the United Kingdom, what might it not amount to were that area of plantations doubled or trebled?

The objection most commonly raised against forestry enterprise in the United Kingdom is based upon unsuitability of climate, owing to the storms which sweep over these islands; yet it cannot be shown that atmospheric disturbance is more violent or frequent here than it is in the United States, Canada, Scandinavia, and other timber-producing countries. It is true that we have an exposed seaboard, whereon profitable forestry is impossible, in greater proportion than these countries; but all our inland and mountainous regions, up to the 1500 feet level, were once covered with dense primeval forest, which was cleared away to make room for pasture and agriculture. It is also true that British woodlands, such as they are, suffer more from wind damage than Continental forests do, not because our gales are more frequent or furious than elsewhere, but chiefly for three reasons:—

1. Our woods are almost invariably laid out in comparatively

<sup>&</sup>lt;sup>1</sup> Reprinted by permission from the Times.

small masses, in blocks of a few acres, or in strips or clumps, planted for game, ornament, or shelter. In most counties it would be impossible to show 100 acres of high-forest in a single block; yet a thousand contiguous acres of forest will offer far better resistance to storm than 1000 acres distributed in patches and strips over an estate of 10,000 acres.

- 2. The last sentence requires a proviso, which leads us to the second cause whereby wind damage is invited. The trees on the thousand contiguous acres must be grown in close canopy, offering an unbroken surface to the storm. This is precisely what British landowners have been taught during the last 250 years to avoid. "I conceive," wrote John Evelyn in his inimitable Silva (1664), "that it were better to plant trees at such distances as they may least incommode one another. For timber-trees I would have none nearer than 40 feet where they stand closest, especially of the spreading kind." Now Evelyn was writing for southern and midland England, where the natural tree-growth was oak and elm; of the more northerly parts of the island he knew nothing except by report. In his day, and long after it, the timber most in request was oak, and that not in clean straight boles, such as good foresters aim at now, but crooked stuff for shipbuilding. It took 2200 mature oaks of this description to build a single 74-gun ship, or the entire mature crop of 44 acres, reckoned at 50 trees per acre standing 30 feet apart. This was the origin of the old-fashioned forester's rule of thumb, followed by most British landowners to this day, that the distance from tree to tree should be one-third of their height. The consequence has been ruinous and almost universal over-thinning, even where the chief crop is not oak: country gentlemen, who generally take much pride and interest in their woods, dread nothing so much as that their trees should be drawn up by overcrowding. Trees treated in this manner, encouraged to form spreading heads and to grow branches instead of boles, may be smashed or overturned by a storm which would be lifted harmlessly over a wood presenting a close canopy.
- 3. Down to the close of the nineteenth century it was almost impossible to point to any woodland, other than coppice, in the United Kingdom managed according to a fixed working-plan and in regular rotation. Woods were felled when they

were ripe, or not felled, according to the caprice or pecuniary requirements of the owner. Timber for estate purposes was cut quite without regard to the main crop; very often the squire himself, wholly without technical training in silviculture, amused himself by marking the trees to be felled in his woods. The prevailing practice was hand-to-mouth, modified by local custom and individual caprice.

The reader may wonder why this statement is put in the preterite, not being aware of any revolution affecting British woodcraft in the last ten years. It is true that the aspect of our woodlands has not undergone any marked change; but it is also true that landowners are awakening to a sense of lost opportunities, and that many of them have already taken advantage of the skilled instruction which has been provided, under which guidance working-plans have been drawn up and initiated on several large estates. This step, however, has brought us face to face with a difficulty which, in many cases, can only be overcome by co-operation between neighbouring proprietors. Woods must not be felled without regard to the effect of the clearance upon adjacent woods; for storms visit such indifference with disastrous effect. Turning to German forestry management as the most highly organised in Europe, one finds this contingency amply provided for. Not only are the annual fellings upon each estate, Crown or private, carefully planned so as to avoid exposing growing wood on the same estate to the dangerous wind-quarter, but the law compels every owner to regulate such fellings with due regard to their effect upon the forest of adjoining proprietors.

The causes, then, of the greater damage inflicted by storms upon British woodland than upon Continental forest may be summed up as faulty design in planting, mismanagement during growth, and want of management at maturity. On the whole, the British climate must be regarded as exceptionally favourable to tree-growth, being temperate and humid—conditions which render necessary a certain modification in forest management as practised on the Continent, where the winter is colder and the summer hotter than with us.

Before considering these modifications, it must be shown that planters may proceed to regenerate their woodlands with a reasonable certainty of finding a profitable market for their

produce. At present, despite the incessant and increasing demand for timber, the complaint is commonly heard from British landowners that they cannot dispose of fine timber even when it is offered. I saw not long since in the north of Ireland a felling of several acres of superb Scots pine, about 100 years old, for which the owner had been unable to get more than 3s. 6d. a ton. Now a ton of mature Scots contains from 28 to 30 cubic feet; so here was timber of the finest quality being given away at 11d. a foot, which in a fair market should have brought from 6d. to 8d. Transport was not the cause of such an unsatisfactory price, for there are a railway station and a seaport within two or three miles of this woodland, and an excellent road to both. The real reason is not far to seek. My friend had established no regular business connection, without which no productive industry can be carried on at a profit. Purchasers must have steady sources of supply; they cannot suit their requirements to the convenience of producers, and the landowner who has 50 tons of timber to offer one year, 5000 tons the next, and none in the third year, must not expect to obtain good terms except by a lucky chance. It is only from woodland managed on a fixed working-plan, planted, grown, and felled in regular rotation, that a regular annual quantity of timber, uniform in quality, can be put upon the market; and until such a system prevails in the United Kingdom, timber merchants will deal with those countries where these conditions are fulfilled.

It was stated in a former article that the German Empire, whence we used to draw considerable supplies of coniferous timber, has now ceased to export it, requiring all she can grow for her increased industrial wants. Owners of forest in that country, where woodcraft has been practised on sound economic principles longer and more extensively than anywhere else, have derived full advantage from the advance in prices.

The following Table, taken from Weber's Handbuch der Forstwissenschaft (1903), shows the steady increase in the revenue derived from the principal State forests during twenty years. By far the greater part of the land under forest is either mountainous, and otherwise wholly unproductive, or of such poor, sandy soil as would hardly bear a rent of 1s. an acre.

	Stat	State Forest.			. ::	Extent in	Average Net Income per Acre per Annum, in Shillings.			
						, , , , , , ,			1887-91.	1892-96.
Prussia,						6,250,000	3.7	4. I	4.9	5. 1
Bavaria,						2,100,000	5.6	5.8	7.0.	8:3
·Wurtembe	erg,					500,000	10.2	10.8	12.5	12.5
Baden,						254,000	9.8	10.5	11.9	14.0
Saxony,						374,000	14.2	17.6	18.5	17.1
Alsace-Lo	rrair	ne;		•		370,000	8.3	7.7	8.6	10.0

From this it appears that the average annual profit per acre from German State forests had risen to 11s. twelve years ago, thoroughly justifying the policy of the Government in buying up, as it continues to do, all the suitable land that can be had for planting. Between 1867 and 1892 the Prussian Forest Department bought 329,850 acres, at a cost of about £1,125,000.

British Crown lands reckoned as forest are as follows:-New Forest, 64,834 acres; Dean Forest, 18,710 acres; Windsor Forest and Park, 15,175 acres; other woodlands, 16,574 acres; Inverliever (acquired in 1907), 13,000 acres; total, 128,279 acres. Any comparison between these lands and German State forests is vain, because they have never been submitted to right forest treatment. An attempt was made in 1851 to put the New Forest under systematic management. Parliament passed a Deer Removal Act, and directed that 10,000 acres should be enclosed and planted; but the cry was raised of "vandalism"; fussy people agitated against interference with the landscape; so Parliament passed another Act in 1877, putting a stop to planting when only 5000 acres had been enclosed, and decreeing that only those plantations formed since the year 1700 should be treated as under rotation. So now, of this fine tract of 64,834 acres, only 17,670 acres are under growing woods, the remaining 47,164 acres being kept as a combination of common pasture, deer park, and picnicking ground. Meanwhile. the ancient forest must disappear bit by bit; for even oaks are not immortal, and regeneration by seedlings is impossible on land so closely grazed.

It may be hoped that we are on the dawn of a more provident era, and that the State, having made a start by setting the Forest of Dean on a sound system, and having purchased land in Scotland and Ireland, will pursue the course which has been followed with such profitable results in Continental States. It is not good to rely too much on the State for the development of the natural resources of the land. In ordinary commercial enterprise private capital is freely forthcoming; but in forestry the State enjoys such manifest advantage over individuals that the only hope lies in the Government taking the lead. Besides having command of capital and the means of foregoing interest thereon during the period of unproductive growth, Government pays no death duties on property administered for the Crown. A quotation from the Report of the Departmental Committee on Forestry of 1902 shows how inequitably the present system of assessing these duties tells upon the owners of poor land, such as may be most profitably devoted to planting:-

"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 the richer districts, where land is valued up to this amount, the [growing] 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 16 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 25 years' purchase thereby becoming, in those cases where an estate is sufficiently wooded, the minimum basis. It is, therefore, conceivable that duty calculated on 9 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 land 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."

It requires but moderate acquaintance with land management

and the financial position of landed proprietors in general to realise that private enterprise in planting on any considerable scale is out of the question under existing conditions. Very few are the landowners who, even if they possess unemployed capital, can afford to lock it up during the non-productive period of tree-growth, and to pay tithe, rates, and taxes upon land from which, perhaps, no return can be expected during the lifetime of the planter. If Parliament ever comes to recognise the national importance of a steady supply of home-grown timber, it will have to follow the example of certain foreign Legislatures in lightening the burdens upon young woodland during the years in which it yields nothing, and in encouraging planters by supplying them with seeds and seedlings from State nurseries.

Meanwhile, what woodland owners have to consider is the best means of restoring to a productive state existing woods which have been deteriorated by neglect or drastic overthinning.

[Note.—We are unable to agree with the writer that trees grown in close canopy enjoy any degree of immunity from damage by storms by reason of their density. Their root-system is restricted, while at the same time they are tall, and their centre of gravity being high, the wind exercises a strong leverage on them. Such trees withstand storms solely through the protection afforded by the stunted marginal trees. Should these latter be carried away, the former would topple over like ninepins, those nearer the wind carrying their leeward neighbours with them in their fall. Neither is the depth nor extent of the forest a protection against wind; the deeper it is the greater the loss, should the wind reach the interior. Thinned crops (of small area), though yielding less valuable produce, stand at less risk from storms. Hence a belt of forest on the windward side should be thinned from an early age, the crowns of the outer trees being lopped if necessary, so that they may stand as a barrier in defence of the valuable close-canopied crop within. For full information on this subject cf. Schlich's Manual, iv. pp. 531-551.—Hon. Ed.]

### NOTES AND QUERIES.

### SILVICULTURAL NOTES.

- I. Planting on Moor-pan.—A young plantation, which the writer planted five years ago, had in the centre a patch about 2 acres in extent, where the soil was very light in texture and of a black colour, was only some 6 to 8 inches deep, and lay upon a bed of moor-pan, as hard as cement and several inches thick. During the first three years after planting, the summers were very dry, and as the plants could not obtain any water through the pan, they nearly all died. Scots pine was the species which did best. It was therefore decided to dig through the pan, and plant nothing but Scots pine. For this purpose crowbars were used, and by their aid holes were dug to a depth of about 18 inches. These holes passed through the pan and reached a layer of sand below. The turf and soil from the top were placed in the bottom of the hole, and were firmly trodden down. The trees planted in this way have done well, and will probably repay the extra trouble.
- 2. Planting on Clay.—When planting is done on clay land, the necessary holes should be dug some weeks before the planting is to be done. This saves much extra expense, and permits the plants to establish themselves much more quickly, owing to the mellowing and weathering of the soil. A few night frosts greatly assist the mellowing process. When the soil turned up has become sufficiently fine, and planting begins, the plants should be trodden in very firmly, and the turf should be replaced with the grass side up. This helps to prevent the soil from cracking, as it sometimes does in summer, when it may open down to the roots of the plants. Another means of preventing cracking is, when brushing round the plant, to draw all the cut grass close to it so as to protect the roots from the heat of the sun.
  - 3. A Cheap Tree-guard.—When horses are grazed in parks,

they destroy many valuable trees by eating the bark, and it is thus necessary to have recourse to tree-guards. Iron guards are expensive, and if wood is employed, there is not only the initial expense, but repairs are always wanted after a few years. A very inexpensive and yet permanent tree-guard may be constructed in the following way:—Make a circle of stones round the tree about 4 to 6 feet from the bole, placing the largest stones outside in the fashion of a curbstone, and the smaller ones inside to fill up. Neither horses nor cattle will mount upon this, and after the stones have been in position for a time the fresh appearance wears off, and the guard looks like a part of the tree. The park at Hornby Castle, belonging to His Grace the Duke of Leeds, which extends to over four hundred acres, and is well wooded, has every tree guarded in this manner.

- 4. How to extract Seed from Cones.—This season I have gathered a considerable number of cones from spruce, larch, and Scots pine, with the intention of sowing the seed as an experiment. My method of extracting the seed is as follows:—The cones are placed over night in a moderately hot oven, and in the morning the scales are wide open. A sharp knock on the small end will then bring out all the seeds, especially those from spruce and Scots pine, which are very easy to manage. Larch seeds are not so easily extracted.
- 5. Planting Trees Suitable for Paper-making-At the present time there is a demand in the market for wood to make woodpulp for paper-making, etc., and this might be a profitable way of planting land that is suitable to the species most in demand for making the pulp. Poplar and white spruce are most prized for the purpose, and grow easily on suitable land, especially the poplar, which is a rapid grower. On several estates in Yorkshire large tracts of wet land were planted with poplar about twenty years ago, as there was a demand for it in the market at that time for making gunpowder. A change in the market deprived it of its value for this purpose, and the plantation has for several years been regarded as nearly useless. Now, however, it would seem that it may turn out very profitable in the near future. Poplars are easy to grow, but should be kept dense and should be sheltered on the north and north-west by trees which stand wind, for they are easily blown down by high winds, which sometimes causes them to grow bent at the bottom.

WILLIAM HALL.

### THE SILVER FIR.

At the October meeting of the Society disparaging remarks regarding the silver fir and its timber were made by several speakers; and as it may be interesting to them and to others to note the estimation in which this tree is held by French foresters, the following information on the subject has been extracted from the late M. Boppe's Traité de Sylviculture and his Cours de Technologie.

The silver fir is, he says, exclusively a tree of the mountains. It does not appear spontaneously at low altitudes (200 to 250 metres = 650 to 820 feet) except on slopes at the foot of mountains, in the climate of which they participate. In the Vosges it prospers up to an altitude of 1200 metres (3936 feet); in the Jura, up to 1500 metres (4920 feet); on the Central plateau, up to 1700 metres (5576 feet); in the Alps, up to 2000 metres (6560 feet); and in the Pyrenees, up to 2100 metres (6888 feet). It cannot be raised successfully above or below the zone of its natural habitat as above indicated, being, in this respect, one of the least accommodating of forest trees. It is indifferent to the nature of the mineral constituents of the soil, provided that the soil be sufficiently light, deep, and moist.1 It is essentially a shade-bearer, and excels all other species in its power to shoot up, after long suppression under a dense canopy. Although it stands severe winter frosts well, yet in youth it is very sensitive to spring frosts. Unmixed with other species, it forms good forests, but it is preferable to associate it with others, especially with beech and spruce.

Grown in France, under the above conditions, the silver fir yields timber of the highest quality (premier ordre) for building as well as for industrial uses. It is, indeed, one of the timbers most in demand for building, its large size, high elasticity, and other good qualities rendering it particularly suitable for rafters, joists, planks, and battens. Enormous quantities of it are used for these purposes, as well as for the masts of ships. But when quickly grown at low altitudes, where the tree forms wide annual rings, the timber loses all its good qualities; it there becomes, says M. Boppe, soft and spongy, and possesses but little durability.

<sup>&</sup>lt;sup>1</sup> Dr Schlich, however (*Manual*, vol. ii. p. 354), says that the tree requires a "deep, fresh, and fertile soil, rather binding than loose."—F. B.

Let us now consider how the above facts may bear upon the cultivation of the tree in Scotland.

The maximum limit of spontaneous growth, which extends to 2100 metres in the Pyrenees, is reduced gradually by 900 metres to 1200 metres in the Vosges, where forests of this species were visited by the Society in 1904. It is, of course, a well-known fact that the variations of temperature due to changes of latitude have the effect of raising or lowering the vertical zone of spontaneous growth, and of profitable cultivation; and as Perthshire is about as far north of the Vosges as that mountain range is north of the Pyrenees, it may not be an unreasonable assumption that, other conditions being equal, the maximum limit of the zone of profitable cultivation might be lowered to 300 metres (say 1000 feet); while, at the same time, its minimum limit might be reduced considerably below 650 feet.

To what extent do our "other conditions" differ from those of the great French silver fir forests? It seems probable that the essential conditions are at least as favourable here as there, and that in the all-important matter of moisture we have the advantage. In regard to this question, M. Boppe writes (Transactions, Vol. XI. p. 196): "We were struck by the wonderful aptitude of the soil (of Scotland) to forest vegetation, favoured as it is by a regular climate and the constant humidity of the atmosphere."

If the silver fir were here grown under the conditions most favourable to its development, there is, apparently, no reason why it should not yield a very useful and valuable timber, rendering its cultivation profitable. The necessary conditions would appear to be:—

- 1. Zone of Altitude.—Between, say, 300 or 400 and 1000 or 1200 feet above sea-level.
- 2. Aspect.—Northerly, where the young trees would suffer less than elsewhere from spring frosts, but where, as on other aspects, they should be raised under "nurses" if necessary.
- 3. Density.—The stock should be kept dense at all stages of growth, in order to suppress side branches, and to produce long, clean, and straight stems with little taper.
- 4. Mixture.—The stock should, preferably, consist of silver fir, mixed with beech or with spruce according to local

circumstances, beech being the better should the locality suit it.

The above conditions have, probably, all been fulfilled on some estates. Communications on the subject from the owners or foresters of such estates would be very interesting.

F. B.

### THE APPIN WOODS.

In a booklet of 18 pages, with an excellent Map, is found a general description of the woods on the Appin Estate, in Argyllshire, the property of Mr J. R. Macalpine-Downie. It is the work of Mr John Sutherland, factor, Oban, who writes as follows:—

"In consequence of the proximity of the lands to the sea, it is seldom that heavy or permanent falls of snow are experienced, and the winter frosts are not of long duration or at any time very severe. The adaptability of the soil for timber has been well proved, and it is intended to grow trees in a systematic manner and in accordance with the methods which appear to be best suited to the estate, but always with a view to raising wood of marketable value. While taking every means of testing the timber and money-producing qualities of the various conifers from time to time recommended by the authorities, it is at present felt that of all the trees best suited for profitable result, larch is the one to be most extensively used where the soil is adapted to it. The intention is to plant yearly an area extending to from 20 to 30 acres, until the Policy Hill and Dallens Hill are completely cropped. While doing this the old belts of larch will be gradually cleared, and these will be replanted after a period of rest varying from 8 to 12 years. So far, general immunity from disease in old and young trees encourages the belief that by careful selection of seed and plants there is reason to hope for healthy crops, but a careful watch will be kept upon the woods, and every precaution will be used to prevent destruction of the young plantations. The woods will be from time to time inspected by the forestry staff of the West of Scotland Agricultural College, and, under the direction of the College, such experiments will be conducted as may have the sanction of the proprietor. The general information given in these pages of the past returns, and present and future expenditure, is supplied in the hope that it may be of public utility, and any criticism or suggestions and advice will be welcomed by the owner from those interested in the utilisation of waste and other lands for silviculture. So far the work has only been carried out experimentally in a moderate way, but it is hoped that the information from time to time recorded will be of service to others who intend to rear trees in the West of Scotland."

Then follows a detailed description of each of the woods, which, with 31 acres of timber-land cleared but not yet restocked, cover about 380 acres. The advisability of giving a period of "rest," varying from 8 to 12 years, before replanting ground cleared of old larch woods appears to be open to question. But it is encouraging to learn that, on this estate, the larch enjoys general immunity from disease; the conditions of any locality of which this can be said demand the close attention of all who are interested in the growing of larch woods.

The proprietor cannot be too cordially congratulated on his public spirited acts in permitting the use of his woods by the West of Scotland College of Agriculture for experimental purposes, and in publishing this account of them in the public interest. Some day, no doubt, a working-plan will be prepared for these woods, and for this the data now given will prove of great utility. Mr Sutherland is also to be congratulated on the excellent report he has drawn up.

F. B.

### Coniferous versus Broad-Leaved Forests.

The volume of Forest Statistics, prepared for the Paris Exhibition of 1878, and giving results in the forests of France up to the year 1876, records that, in the case of high-forest, the areas under coniferous trees had yielded a much higher revenue than those under broad-leaved species, chiefly on account of the form of their stems, which enables a very large proportion of sawn timber to be obtained from them; but partly also on account of the greater value of the thinnings made during the early stages of growth—in the form, for example, of telegraph-posts, hop-poles, etc.

F. B.

### REAFFORESTATION IN ITALY.

According to a note in the Times, the Italian Ministry of Agriculture has just published its report upon the work of reafforestation which has been carried out in Italy during the last forty years, and more particularly during the year 1907. Under the law of 1877, twenty-five committees were appointed to superintend the work in the following provinces:-Aquila, Belluno, Bologna, Brescia, Campobasso, Caltanisetta, Catania, Cosenza, Cuneo, Florence, Forli, Genoa, Messina, Novara, Parma, Perugia, Piacenza, Reggio Emilia, Sondrio, Teramo, Turin, Treviso, Udine, Verona, and Vicenza. The total area which has been replanted in these districts amounts to about 122,000 acres, of which 69,000 were replanted during last year. The area still to be dealt with amounts to about 36,000 acres. In addition, over 130,000,000 young trees have been distributed during the last forty years, and more than 108,000 kilos of seeds. The cost of last year's operations amounted to the considerable sum of £382,484. Forest fires still continue to be the cause of heavy damage, and were more numerous last year than in the year before. There were 1294 reported in 1907, with an estimated loss of some £,40,000. Of these fires it is noted that 94 were due to criminal design, 267 to culpable negligence, 132 to accident, and the rest to unknown causes.

This official report shows, at any rate, that the need for reafforestation is appreciated by both the Government and the local authorities; but it leaves out of account a tendency towards forest destruction which almost threatens in some places to keep pace with the making of new plantations. Fire is far from being the only enemy of the Italian woods. small landholder still fells recklessly, and sometimes with good excuse, when the heavy land taxation tempts him to realise upon every stick of his property, and to leave only the bare soil to the exactions of the State. Large tracts which used to be covered by a thick growth of chestnuts-notably the slopes of Monte Amiata in Tuscany—have, even during recent years, been stripped of every tree. The Italian Government has still to find some effective means of staying this work of destruction, for the law which exists on the subject is too often and too easily evaded.

### RAILWAY FIRES ACT, 1905.1

The following leaflet has been recently published by the Board of Agriculture and Fisheries:—

"The Board consider it desirable to draw the attention of farmers and others to the provisions of the Railway Fires Act, 1905, which deals with damage by fires caused by sparks or cinders from railway engines.

"The Act, which came into operation on the 1st January 1908, provides that when damage is caused to agricultural land or to agricultural crops by fire arising from sparks or cinders emitted from any locomotive engine used on a railway, the fact that the engine was used under statutory powers shall not affect liability in an action for such damage, but this provision does not apply in the case of any action unless the claim for damage is £100 or less.

"The expression 'agricultural land' includes arable and meadow land and ground used for pastoral purposes or for market or nursery gardens, and plantations, woods and orchards, and also includes any fences on such land, but does not include any moorland or buildings; and the expression 'agricultural crops' includes any crops on agricultural land, whether growing or severed, which are not led or stacked.

"Section 2 provides that a railway company may enter on any land and do all things reasonably necessary for the purpose of extinguishing or arresting the spread of any fire caused by sparks or cinders emitted from any locomotive engine.

"It also provides that a railway company may, for the purpose of preventing or diminishing the risk of fire in a plantation, wood, or orchard, enter upon any part of the plantation, wood, or orchard, or on any land adjoining thereto, and cut down and clear away any undergrowth, and take any other precautions reasonably necessary for the purpose; but they must not, without the consent of the owner, cut down or injure any trees, bushes, or shrubs.

"A railway company exercising powers under this section must pay full compensation to any person injuriously affected by the exercise of those powers, including compensation in respect of loss of amenity.

"The Act does not apply in the case of any action for damage

<sup>&</sup>lt;sup>1</sup> Published by permission of the Controller of H.M. Stationery Office.

by fire brought against any railway company unless notice of claim and particulars of damage, in writing, shall have been sent to the railway company within seven days of the occurrence of the damage as regards the notice of claim, and within fourteen days as regards the particulars of damage.

"Light railways and tramways worked by steam power are within the scope of the Act."

In connection with the above circular, it may be interesting to note the provisions of the French Forest Code for the protection of woods and forests, including those privately owned, from damage by fire.

Section 148 of the Code reads thus:—"It is forbidden to carry fire or to light a fire in the interior of, and within a distance of 200 metres from woods and forests, under penalty of a fine of from 20 to 100 francs (16s. to  $\pounds_4$ ); without prejudice, in case of a conflagration, to other penalties which may be incurred under the Penal Code, and to liability for damage done, if any."

F. B.

### THE DOUGLAS FIR IN GERMANY.

We have received from Mr John Booth a short note on the Douglas fir in relation to root-destroying fungi (Mitteil. d. Deutschen Dendrologischen Gesellschaft, 16, 1907). In June 1907 the Minister for Agriculture, Woods, and Forests (Landwirtschaft. Domänen u. Forsten) in Germany drew the attention of foresters to the value of the Douglas fir, and the desirability of planting it more extensively. This recommendation was based especially upon the value of the wood, but the object of the note referred to is to call attention to the value of the tree from another point of view also. In the first place, a comparison of Douglas fir and Scots pine grown together on very poor ground at the experimental Station of Sülldorf, Holstein, shows that the former is much more resistant to unfavourable soil conditions than the latter, and that it also ameliorates the soil of moors, by inducing an active bacterial growth, not produced by the action of the pine on the same substratum. Further, in the Lüneburger Heide, the Douglas fir develops a perfect root-system in ground where both Scots pine and Weymouth pine show root-rot, and at Sülldorf perfectly sound specimens of the Douglas fir occur in a plantation of Scots pine dying of root-rot, in soil which is apparently swarming with the rot-producing organism. The text of the note, which is of a preliminary nature, is illustrated by some striking photographs.

M. I. N.

[We regret to record the death of Mr Booth, which occurred at Berlin on 5th February (see Obituary, p. 120).—Hon. Ed.]

REMAINS OF ANCIENT FORESTS IN SCOTTISH PEAT-MOSSES.

Mr Francis Lewis has been engaged for some time in the investigation of the plants found in the Scottish Peat-Mosses. His last paper (Trans. Roy. Soc. Edin., xlvi. 1), which gives a general summary of his results, includes an interesting account of the remains of ancient forests represented in the peat deposits. Mr Lewis finds two forest beds in the peat. The older, the lower forest bed, occurs alike in the Southern Uplands, in the Hebrides, as well as in the Highlands generally, so far as investigated, and in the Shetland Islands. In this deposit Scots pine does not occur, the trees being birch, hazel and alder. Very striking is the occurrence of this buried forest in western Shetland, where now no trees will grow without artificial shelter, in consequence of the blasts from the ocean. The upper forest bed is confined to the mainland of Scotland, from the lowland mosses of Wigtownshire to the valley of the Dionard, south of the Kyle of Durness. In the south of Scotland this forest consists of Scots pine, except on Tweedsmuir, where birch replaces pine. In the Highlands, towards the north, and at great elevations, birch also replaces the pine. An interesting point is that while at the present time the 2000 feet contour-line forms the upper limit of woods (pine and birch), a limit which is not often reached, the trees in the Upper Forest period occurred at elevations up to 3000 feet and probably beyond this, suggesting that the climatic conditions were then more temperate than at present. The absence of the Scots pine in the lower forest bed, and its peculiar distribution in the upper bed, suggests also that this tree is a recent immigrant into the British area. M. I. N.

### LARCH DISEASE IN IRELAND.

Mr Robert Macintosh, writing from Co. Wicklow, Ireland, gives some observations on larch disease and its causes, based VOL. XXII. PART I.

upon his own observations in woods there. In this county larch is grown in pure plantations, and also mixed with birch, oak, Scots fir, and in some cases spruce, on various aspects, at elevations varying from 100 to 1000 feet above sea-level. The canker is to be found in all these woods on the underside of suppressed branches, or on suppressed trees, wherever there is little circulation of air and a constantly damp atmosphere. A healthy tree which was planted for purposes of experiment in an unfavourable situation, i.e., in one permanently shady and moist, was very severely attacked by the disease. In another case a larch growing beside a clump of rhododendrons, and with its branches suppressed on the shaded side, was found to have these suppressed and the shaded branches attacked. Again, the author finds that wounds caused by rabbits and squirrels are not attacked by the fungus, unless the vitality of the tree has been reduced by too dense shading, or by attacks of larch aphis. In general, Mr Macintosh emphasises the necessity for abundant air and light, and the danger of mixing larch with Scots fir, spruce, or birch, unless as a very temporary expedient followed by speedy removal. The later-leafing hardwoods seem to him to be a less dangerous admixture.

### SIR WALTER SCOTT ON THINNING.

Extract from a letter written at Abbotsford by Miss Edgeworth on 9th August 1823.1

"You would like him (Sir Walter) for his love of trees; a great part of his time out-of-doors is taken up in pruning his trees. I have this hour heard a gentleman say to him, 'You have had a great deal of experience in planting, Sir Walter; do you advise much thinning or not?"

"I should advise much thinning, but little at a time. If you thin much at a time, you let in the wind and hurt your trees."

### APPOINTMENT.

Dr John Nisbet, D.Œc., has been appointed Lecturer in Forestry at the West of Scotland Agricultural College, Glasgow, in succession to Mr W. F. A. Hudson, M.A., who has been compelled to resign owing to ill health.

<sup>&</sup>lt;sup>1</sup> The Gentlest Art, by E. V. Lucas, p. 233.

### REVIEWS AND NOTICES OF BOOKS.

Sylva: A Discourse on Forest Trees. By John Evelyn, F.R.S., with an Essay on the Life and Works of the Author by John Nisbet, D.Cc. A Reprint of the Fourth Edition in two Volumes. cxv+620 pp., with two Illustrations, including Portrait of John Evelyn. Arthur Doubleday and Co., Ltd., London. 21s. net.

Although this great classic of the Restoration has now lost its value as a planter's guide, we extend a hearty welcome to the two attractive volumes that have recently been issued by Dr Nisbet as a twelfth edition. The editor has wisely—as it seems to us-selected the last edition, the fourth, that was revised by the author, and has presented it without notes or explanatory references. There is therefore nothing to detract from the perusal of Evelyn's quaint and dignified Discourse, which is as fit to rivet the attention to-day as when it appeared in 1664. What Dr Nisbet has to say, he says well and aptly in an Introduction that gives us a good view of the life and character of Evelyn, and of the times in which he worked and wrote. Evelyn's great "Treatise on Forest Trees" was preceded, by fifty years, by a pamphlet written by Arthur Standish, which is specially interesting at the present time, in as far as it shows that even three hundred years ago an attempt was being made to ascertain the extent of the waste land in the kingdom, and the area that might be economically afforested. Of this pamphlet, however, Evelyn seems to have known nothing. His concern was to show how the national supplies of oak might be maintained and increased, in order that the wants of the navy might be fully satisfied. A few years after the publication of his Sylva, we find him claiming that, as a result of his advice, many millions of useful trees had been planted. These trees would be maturing at the time of the Napoleonic wars in the end of the eighteenth and early part of the nineteenth centuries, and in this way they must have had no small influence on the naval shipbuilding of the time. It is therefore not too much to say that the labours and teaching of Evelyn

in the seventeenth century may have had much to do with determining British supremacy at sea at a time when the fortunes of this country were in a most critical condition, and it is well that his name should be kept green in our grateful memory. If, as seems not unlikely, it was indirectly due to Evelyn that the Grande Armée could not summon up courage to sail from Boulogne in 1804, we would appear to be justified in acclaiming him as the saviour of his country.

At a time when officials were corrupt and courtiers were unclean, Evelyn lived the life of a high-principled English gentleman. His modesty carried him so far as to prevent his putting his name on the title page of the first edition of his great classic, which merely purported to be by "J. E., Esq." It is probable, however, that the authorship was well known; at all events, after the first edition Evelyn's name appears in full on the title page.

The order in which Evelyn treats his subject is a strictly logical one. He begins by describing the soil and seed, and then proceeds to give directions for nursery treatment. It is curious to find that he attaches as much importance as other old writers to carefully regulating the sowing to the state of the moon. "Into these furrows (about the new or increasing moon) throw your oak, beach, ash, nuts, all the glandiferous seeds," etc. Elaborate directions are given as regards sowing, earthing-up, watering, and transplanting, and he recommends that when oaks are set out in the wood they should be cut over close to the ground. "Some repeat the cutting we spoke of the second year, and after March (the moon decreasing) recut them at half a foot from the surface; and then meddle them no more." Having dealt with nursery work, the author proceeds to discuss the forest treatment of the individual trees. In the light of our present knowledge, it is interesting to note that he regards the spruce as the male of the silver fir, though he says that he finds "botanists not unanimously agreed about the sexes of trees." In his solicitude for the requirements of the navy, he casts longing eyes on the forestal riches of Scotland. "In the Scottish Highlands are trees of wonderful altitude . . . which grow upon places so inaccessible, and far from the sea, that (as one says) they seem to be planted by God on purpose for nurseries of seed. . . . Did we consider the pains they take to bring them out of the Alps, we should less stick at the difficulty of transporting them from the utmost parts of Scotland. . . . I am persuaded the pine, pitch, and fir trees in Scotland, might yield His Majesty plenty of excellent tar, were some industrious person employed about the work." The larch was well known to Evelyn, and the durability of its wood was highly extolled. "That it flourishes with us, a tree of good stature (not long since to be seen about Chelmsford in Essex) sufficiently reproaches our not cultivating so useful a material for many purposes."

It is impossible even to indicate the many points of interest that crop up in these entrancing volumes, but one turns with curious expectation to Chapter VII., "Of the infirmities of trees, etc.," to see what the position of vegetable pathology was two hundred and fifty years ago. The list of diseases is a very long one, and includes "pestiferous air, tumours, distortions, fungosities, gangreens, lacrymations, gouts, carbuncles, ulcers, crudities, and an army more." His treatment of fern is to strike off the heads "with a good wand or cudgel . . . in the spring, and now and then in summer." "But most infallibly" its eradication is best secured by pasturing with Scotch sheep, which eat it down "at its spring." The experience of the present day, when the bracken plague is attracting much attention, is hardly confirmatory of this recommendation, but perhaps the Scotch sheep of Evelyn's time were a less fastidious breed. The caterpillar of the goat moth, "and other worms, lying between the body and the bark," have special prescriptions meted out to them; and as for millepedes and wood-lice, it is recommended that they be collected and "dry'd and reduc'd to powder, and taken in drink," when they "are an admirable specific against the jaundies, scorbut, etc., to purify the blood, and clarifie the sight"! Many other quaint directions are met with in this chapter, as, for instance, when brandy administered by a hole bored in the stem is recommended for lousiness, which commonly succeeds "the measels." This lousiness is probably nothing else than our old friend the Coccus of the beech, which the late Lord Ridley treated in his woods at Blagdon by similar methods except that he used sulphur instead of brandy.

But Evelyn's advice is often thoroughly sound, and his remarks are generally suggestive. For imparting interest to an idle hour, his *Sylva* can be strongly recommended.

Wald und Forstwirtschaft. Vom Kgl.-Forstmeister Dr A. Schwappach. Deutsche Verlagshaus Bong u. Co., Berlin. With Map and many beautiful Illustrations.

This treatise, entitled "Woods and Forestry," comes from the pen of Professor Schwappach, whose name is a guarantee of the The history of Forestry in Germany is quality of the work. first dealt with, the author describing the gradual destruction of the forests, on what was once a thickly-wooded area, by an increasing agricultural population. These latter chiefly confined themselves at first to the more fertile spots, and consequently the hardwoods suffered more than the conifers. Prohibition orders regulating the felling were in force as early as the fourteenth century, and were rendered necessary by the increasing scarcity of timber; the small facilities for carriage at that period rendering a supply of home-grown stuff a necessity. Owing to human interference, conifers are largely replacing hardwoods, and to-day about 65 per cent. of the German woods are composed of conifers, whereas it is stated that in the twelfth century only a little over 30 per cent. represented the proportion of conifers.

The work gives an excellent account of Forestry as a whole, and the subject matter is of a nature rendering it unfortunate that it is not at the disposal of those who are ignorant of the German language. The work is beautifully illustrated.

W. F. A. H.

Neudammer Förster-Lehrbuch. By Several Authors. J. Neumann, Neudamm. Third Edition, 1907. Price 10 marks. 203 Illustrations, including 6 Coloured Plates.

The Neudammer Förster-Lehrbuch is intended for the instruction of Foresters in Germany, and there is, unfortunately, no English translation of the work. It is, however, just the kind of book which a great many English readers wish to have.

After an Introduction by Professor Schwappach, forest botany is dealt with systematically, and with wonderfully few technical expressions, by E. Herrmann. Zoology is taken up by Dr Eckstein, who can speak with great authority on the economic

aspect of this subject. Naturally, insect pests occupy an important place; and the coloured plates, which accompany Dr Eckstein's account, add greatly to the value of the text-book. From these plates, which are exceptionally good, it is possible to recognise at a glance the principal forest insects.

The part of the book which the majority of foresters will regard as the most important is that upon silviculture, by Schwappach. All matters connected with soil and climate in their relation to tree-growth; the establishment of woods by planting, sowing, and natural regeneration; the thinning of plantations and the treatment of the most important forest trees, are dealt with in this section. There is a useful chapter upon the fungi which attack trees, and the protection of woods against these and other dangers is fully gone into. Divisions of the book, treating of such subjects as the demarcation of boundaries, and regulations affecting the insurance of forest workmen, will have less interest for British foresters; but it would be most ungrateful to grumble at the small proportion of what may appear to some of us to be superfluous matter, because the book, as a whole, is so full of concise, reliable information.

To those who can read German, the book can be thoroughly recommended as a safe compendium—a short treatise dealing scientifically and technically, but not too minutely, with practically every aspect of economic forestry. That a third edition of the book should be required in less than nine years after the publication of the first edition is itself a proof of the book's popularity. In the new edition every subject has been brought up to date, and besides being considerably enlarged, the book has been much improved by the re-writing of the more important parts. A so-called "Repetitorium" accompanies the text-book, and will be found serviceable to students of forestry.

F. S.

Schlich's Manual of Forestry. Vol. V. "Forest Utilisation." By W. R. FISHER, M.A. 2nd Edition. xxii+833 pp., with numerous Illustrations and an Index. Bradbury, Agnew and Co. 125, net.

In his Preface the author states that this work, like the first edition, follows the general lines of Karl Gayer's well-known

treatise, and reproduces many of his plates. The text has been increased in length by 59 pages, and the number of illustrations within it has risen from 329 to 402. There are four full-page plates instead of three. The new edition of this exhaustive work will be much appreciated by all wood owners and wood managers, as well as by teachers of Forestry.

### OBITUARY.

Јони Воотн, 1836-1908.

John Booth, who died at Berlin in February last, was of Scottish descent, his grandfather being a Scotsman who established a nursery garden near Hamburg. This nursery was extended by Mr Booth's father, who was the first to plant and propagate the Douglas fir in Germany. Mr Booth received a careful training in botanical and arboricultural work, and for many years carried on the nursery, at first in company with his brother and afterwards alone. After retiring from business in 1884, he devoted himself largely to scientific work, and especially to encouraging, by every means in his power, the growth of exotic trees in German forests. He especially interested himself in the Douglas fir, and owing to the fact that he early gained the interest of Prince Bismarck, he had opportunities of putting his views into practice on a considerable scale. At first, at least, Mr Booth's views met with considerable opposition from German foresters, an opposition which was fanned by some early failures. Before his death, however, Mr Booth had the satisfaction of knowing that the cause which he represented had triumphed. and that his work had definitely and decisively benefited German forestry. Mr Booth was the author of a considerable number of publications. An article from his pen appears in Vol. XVII. of these Transactions, and in the present issue we give an abstract of one of his papers sent to us not long before his death. Mr Booth was a member of the Royal Scottish Arboricultural Society from 1876 until his death.

## TRANSACTIONS

OF THE

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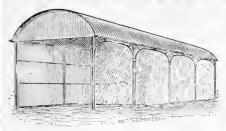
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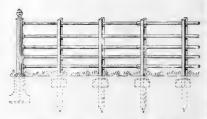


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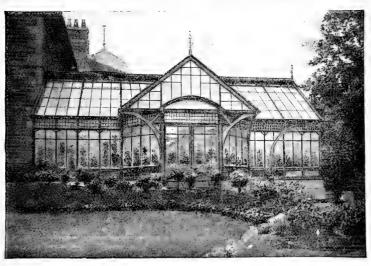
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### 19 CASTLE STREET, EDINBURGH,

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A room has been secured there for the accommodation of the Society's books and papers; and donations of books on forestry subjects for the Library will be gladly received and acknowledged by the Secretary.

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### NORTHERN BRANCH.

President-Lord Lovat. Hon. Secy .- ALEX. FRASER, Solicitor, 63 Church St., Inverness.

### Membership.

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

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

which accompanies this Memorandum.

### The Principal Objects of the Society,

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

Meetings.

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

### Prizes and Medals.

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

### School of Forestry, Afforestation, Etc.

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

Edinburgh in 1884.

As a further step towards the end in view, the Society, in 1890, instituted a Fund for the purpose of establishing a Chair of Forestry at the University of Edinburgh, and a sum of £584, 3s. 1od. has since been raised by the Society and handed over to the University. Aided by an annual subsidy from the Board of Agriculture, which the Society was mainly instrumental in obtaining, a Course of Lectures at the University has been delivered without interruption since 1889. It is recognised, however, that a School of Forestry is incomplete without a practical training-ground attached to it, which would be available, not only

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

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

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

### Excursions.

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

### Exhibitions.

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

### The Society's Transactions.

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

### Honorary Consulting Officials.

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

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

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

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

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

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

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

### Local Branches.

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

### Local Secretaries.

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

Register of Estate Men.

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

### LOCAL SECRETARIES.

### Scotland.

Counties.

Aberdeen, . John Clark, Forester, Haddo House, Aberdeen.

JOHN MICHIE, M.V.O., Factor, Balmoral, Ballater.

Argyle, . . John D. Sutherland, Estate Agent, Oban.

Ayr, . . Andrew D. Page, Overseer, Culzean Home Farm, Ayr.

A. B. ROBERTSON, Forester, The Dean, Kilmarnock.

Berwick, . Wm. Milne, Foulden Newton, Berwick-on-Tweed.

Bute, . . Wm. Inglis, Forester, Cladoch, Brodick.

JAMES KAY, Forester, Bute Estate, Rothesay.

Clackmannan,. ROBERT FORBES, Estate Office, Kennet, Alloa.

Dumbarton, . ROBERT BROWN, Forester, Boiden, Luss.

Dumfries, D. CRABBE, Forester, Byreburnfoot, Canonbie. East Lothian, W. S. Curr, Factor, Ninewar, Prestonkirk.

Fife, . . Wm. Gilchrist, Forester, Nursery Cottage, Mount Melville, St Andrews.

EDMUND SANG, Nurseryman, Kirkcaldy.

Forfar, . . JAMES CRABBE, Forester, Glamis.

JAMES ROBERTSON, Forester, Barnbill, Broughty Ferry.

Inverness, JAMES A. GOSSIP, Nurseryman, Inverness.

Kincardine, John Hart, Estates Office, Cowie, Stonehaven.

Kinross, . James Terris, Factor, Dullomuir, Blairadam.

Lanark, . . John Davidson, Forester, Dalzell, Motherwell.

JAMES WHITTON, Superintendent of Parks, City Chambers, Glasgow.

Moray, . John Brydon, Forester, Rothes, Elgin.

D. Scott, Forester, Darnaway Castle, Forres.

Perth, . W. HARROWER, Forester, Tomnacroich, Garth, Aberfeldy.

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, Strangaer.

H. H. WALKER, Monreith Estate Office, Whauphill.

### England.

Cor		

Beds, . Francis Mitchell, Forester, Woburn.
Berks, . W. Storie, Whitway House, Newbury.

Cheshire,
 WM. A. FORSTER, Belgrave Lodge, Pulford, Wrexham.
 Devon,
 JAMES BARRIE, Forester, Stevenstone Estate, Torrington.
 Durham,
 JOHN F. ANNAND, Lecturer on Forestry, Armstrong College,
 Newcastle upon-Tyne.

Hants, . W. R. Brown, Forester, Park Cottage, Heckfield, Winchfield.

Herts, . . James Barton, Forester, Hatfield.

THOMAS SMITH, Overseer, Tring Park, Wigginton, Tring.

Kent, . R. W. Cowper, Gortanore, Sittingbourne.

Lancashire, . D. C. Hamilton, Forester, Knowsley, Prescot.

Leicester, . James Martin, The Reservoir, Knipton, Grantham.

Lincoln, . W. B. Havelock, The Nurseries, Brocklesby Park.

Middlesex, . Professor Boulger, 11 Onslow Road, Richmond Hill, London, S.W.

Notts, . . . WM. ELDER, Thoresby, Allerton, Newark. W. Michie, Forester, Welbeck, Worksop.

WILSON TOMLINSON, Forester, Clumber Park, Worksop.

Salop, . FRANK HULL, Forester, Lillieshall, Newport.

Suffolk, . . George Hannah, The Folly, Ampton Park, Bury St Edmunds.

Surrey, . . . John Alexander, 24 Lawn Crescent, Kew Gardens.

Warwick, . A. D. Christie, 16 Oak Tree Lane, Selly Oak, Birmingham.

Wilts, . . Andrew Boa, Land Agent, Glenmore, The Avenue,

Trowbridge.

York, . D. TAIT, Estate Bailiff, Owston Park, Doncaster.

#### Ireland.

Dublin, . A. C. Forbes, Department of Forestry, Board of Agriculture. James Wilson, B.Sc., Royal College of Science, Dublin.

Galway, . . . Arch. E. Moeran, Palmerston House, Portumna.

THOMAS ROBERTSON, Forester and Bailiff, Woodlawn.

King's County, Wm. Henderson, Forester, Clonad Cottage, Tullamore.

King's County, WM. HENDERSON, Forester, Clonad Cottage, Tul Tipperary, . DAVID G. CROSS, Forester, Kylisk, Nenagh.

ALEX. M'RAE. Forester, Dundrum.

## Royal Scottish Arboricultural Society.

#### FORM OF PROPOSAL FOR MEMBERSHIP.

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

	Full Name,	
	(Full Name,	
Candidate's -	Address,	
	Life, or Ordinary Member,	
	Life, or Ordinary Member,  Signature,	
	(Signature	
Proposer's «	Signature  Address,	
Seconder's	Signature,	
	Address,	

#### 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:—
  - Proprietors the valuation of whose land exceeds £500 per annum, and others, subscribing annually . One Guinea.

  - Foresters, Gardeners, Land-Stewards, Tenant Farmers, and others, subscribing annually . . . . Six Shillings.
  - 4. Assistant-Foresters, Assistant-Gardeners, and others, subscribing annually . . . . . . . Four Shillings.
- IV. Subscriptions are due on the 1st of January in each year, and shall be payable in advance. A new Member's Subscription is due on the day of election unless otherwise provided, and he shall not be enrolled until he has paid his first Subscription.
- V. Members in arrear shall not receive the *Transactions*, and shall not be entitled to vote at any of the meetings of the Society. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.
- VI. Any eligible person may become a *Life* Member of the Society, on payment, according to class, of the following sums:—
  - Large Proprietors of land, and others,
     £10 10 0
     Small Proprietors, Factors, Nurserymen, Timber Mer-

3 3 0

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

others.

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

## CONTENTS.

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

		PAGE
17.	Forestry in Some of its Economic Aspects. By Professor William Somerville, M.A., D.Sc.,	121
18.	The State in Relation to Forestry. By Dr. W. Schlich, C.I.E., F.R.S.,	132
19	Afforestation and Timber-Planting in Great Britain and Ireland. By Dr. J. Nisbet,	139
20.	Afforestation. By Lord Lovat,	156
21.	Afforestation. By R. C. Munro Ferguson, M.P.,	169
22.	The Royal Commission on Afforestation: their German and English Critics and remarks thereon. By Bert. Ribbentrop, C.I.E.,	180
23.	Report of the Royal Commission on Afforestation. By Sir John Stirling-Maxwell, Bart.,	186
24.	The Erosion and Afforestation Royal Commission Report. By J. F. Annand,	188
25.	Deputation from the Society to the Chancellor of the Exchequer on National Afforestation,	200
26.	Afforestation of Waste Lands in Denmark. Holland, France, Belgium, and Germany,	207
27.	The Aberdeen Branch of the Royal Scottish Arboricultural Society—Excursion to Forglen and Hatton,	211
28.	The Trees of California. By F. R S. Balfour,	213
29.	$\label{eq:case-by-Marion-I-Newbigin} The \ Glencorse \ Smoke \ Case \qquad By \ Marion \ I  Newbigin, \ D. Sc \ ,$	221
30.	Continental Notes—Germany (with Two Plates). By Bert. Ribbentrop, C I E.,	227
No	tes and Queries: -Forestry Museum: Murthly Estate, .	237
Re	views and Notices of Books:—Illustrations of Conifers. By H. Clinton Baker. Vol. 1. 12+75 pp., with 66 beautifully executed full-page plates showing foliage and cones. Printed privately by Simson. Hertford, 1909,	239
	Schlich's Manual of Forestry. Vol. V. "Forest Utilisation." By W. R. Fisher, M.A. 2nd Edition	240
Pro	oceedings of the Royal Scottish Arboricultural Society, 1909, with Appendices.	



## TRANSACTIONS

OF THE

## ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

### 17. Forestry in Some of its Economic Aspects.1

By Professor William Somerville, M.A., D.Sc.

After summarising the recommendations made by the Select Committee of 1885, and the Departmental Committees of 1902 and 1907 (Ireland), with their results, Dr Somerville proceeds:—

"Lastly, there remains to be mentioned the inquiry that has recently been concluded by the Royal Commission on Coast Erosion and Afforestation in terms of the reference 'Whether in connection with reclaimed lands or otherwise, it is desirable to make an experiment in afforestation as a means of increasing employment during periods of depression in the labour market, and if so, by what authority and under what conditions such experiment should be conducted.' In their Report Commission recommend that Forest Commissioners appointed to determine the specific areas that may with advantage be afforested - amounting, it is estimated, to 9,000,000 acres—and that the work should proceed at the rate of 150,000 acres annually, at a cost for land, labour, and material, of £2,000,000 a year. Seeing that this is a reproductive work it is recommended that it should be financed by loan, the annual interest, together with administrative charges, amounting in the first year to £,90,000, and rising to over £,3,000,000 in the fortieth year, after which, till the eightieth

<sup>&</sup>lt;sup>1</sup> Condensed from a paper read by the author before the Royal Statistical Society, 16th February 1909.

year, the woods would be more than self-supporting. Thereafter there would be a clear revenue of over £21,000,000, which would represent about  $3\frac{3}{4}$  per cent. on the whole of the charges of creation and maintenance accumulated till the eightieth year at 3 per cent. compound interest, less the intermediate returns similarly accumulated. It is suggested that land be acquired by voluntary negotiation where possible, but that compulsory powers be obtained and exercised if necessary. Owners of land falling within a statutory definition of "suitability" would be exempted from the operations of the Act, provided they were prepared to afforest the area within a reasonable time, and in a manner satisfactory to the Forestry Commissioners. Afforestation on the scale contemplated would mean the employment during the winter months of some 18,000 men, who, it is suggested, should be selected on their merits, and not from eleemosynary considerations. Afforestation is thus no panacea for unemployment, though, to the extent indicated, it would react on the general situation.

"A subject that has received such a large amount of official attention during recent years, and which has been so favourably reported on by one Select and two Departmental Committees, and by a Royal Commission, must have merits that are intrinsically attractive; and I therefore propose to discuss very shortly some of the social and economic aspects in which forestry, in its widest sense, may be regarded."

After stating the extent and percentage of wooded area in certain European countries, the author shows that:—

"Should 9,000,000 acres be afforested, as recommended by the Royal Commission, the percentage of wooded area in the United Kingdom would be raised from 4 to 15.6, placing this country above Denmark, the Netherlands, and Italy, though still below all the other important countries of Europe. In Scotland, where, it is suggested, two-thirds of the total area would be situated, the percentage would be raised from 4.6 to 35.4, which would make that country one of the best-wooded in Europe."

He then discusses at some length the quantity and money value of our present timber production, comparing these with the returns derived from certain State forests in Germany. He estimates the net amount of our annual payments for imported timber at £26,000,000, exclusive of those made for certain

imported wood products which amount to nearly £17,000,000; and observes that, although we, of all nations, are the most dependent on foreign supplies to meet our timber requirements, several other countries are also large importers of this commodity, the largest being Germany, the United States, France, Belgium, and Italy, while the largest exporters are the United States, Russia, Austria-Hungary, and Canada. Dr Somerville disclaims any intention of showing, or even suggesting, by means of the figures given in his tables, that we, in this country, could ever hope to become self-supporting in the matter of timber and timber products. He continues:—

"A large proportion of our imports reach us from tropical and sub-tropical climates, but, on the other hand, the bulk of our supplies have been produced in temperate countries. If we exclude the United States, which sends to us, amongst other woods, pitch pine, a tree that demands for its growth a higher range of temperature than these Islands can show, and confine ourselves to countries which for the most part have a climate not unlike our own, we find that from such countries we draw about two-thirds (8,500,000 loads) of our timber imports, paying for them roughly about £,20,000,000 annually. On the assumption of an annual increment of about one load per acre, it would take some 9,000,000 acres of forest to give a sustained yield of this amount, and if the recommendations of the Royal Commission are given effect to I do not doubt that eighty years hence we should be producing this yield. Whether the area be 9,000,000 or whether the alternative scheme, involving 6,000,000 acres, be adopted, the land has got to be found, and it is evident that no such area of "waste" ground exists in this country. Clearly, extension of silviculture in this country must be associated with displacement of food and with disturbance of population. As regards the former, it may be said that even the most enthusiastic advocate of extended silviculture does not suggest that good arable land should be planted. Woods, as is well known, show good growth on land of low agricultural and pastoral value, provided the altitude be not too great. This is due to two reasons; the first, that wood removes from the soil relatively little plant food, and the second, that many trees thrive well, in fact some thrive best, where the rainfall is so heavy as to make tillage farming impossible, and even pastoral farming difficult.

- "Table V.—Amount of the more important constituents of plant food removed from an acre of land by the annual produce of certain crops and trees.
- "(From Warington's Chemistry of the Farm, 15th ed., pp. 72-74; except as to the nitrogen in Scots pine, which is taken from Ebermayer's Physiologische Pflanzenchemie, p. 67.)

Crop.			Weight per	Amount Removed in a Year's Growth.				
			Acre (dry).	Nitrogen.	Phosp. Acid.	Potash.		
Wheat, .			lbs 4183	lbs. 50	lbs. 2I'I	lbs 28.8		
Meadow hay,			2822	49	12.3	50.9		
Mangolds, .			7568	149	52.9	300.7		
Beech, .			2822	10	1.2	4°2		
Scots pine, .			2884	2.1	1.0	2.3		

"Not only do trees require but little plant food, but they have special powers of collecting even that little, inasmuch as their root range is immensely greater than that of grass or of farm crops. Thus it comes about that one may find a crop of timber of maximum quantity and quality on land of a rental value of a few pence per acre, and in support of this statement there is abundant evidence in the volumes of the proceedings of the various public inquiries which have been held.

"Speaking generally, and with very few exceptions, the land that it is suggested may with advantage be afforested is at present grazed by mountain sheep. Even below the upper limit of profitable tree-growth in this country—1500 feet—it is seldom that such land can support throughout the year more than one sheep to two acres. The tangible produce that finds its way to market is the four months' old lambs, minus such female lambs as are necessary to maintain the flock at its numerical strength, plus a proportion of the ewes—the "draft" or "cast" ewes. In addition to this meat there is the yield of wool, of which the annual supply for the class of sheep in question may be put at 4 lbs. per head, or 2 lbs. per acre.

"The Royal Commission that have recently reported went in considerable detail into the relationship of afforestation to meat

production, and they arrived at the conclusion that the weight of meat, calculated as mutton, that would be displaced by the extensive planting of the class of land indicated, would amount at most to 15 lbs. per acre per annum.¹ The weight of meat that would be displaced by the afforestation of 9,000,000 acres would therefore aggregate 60,000 tons per annum; and, utilising the figures of the Milk and Meat Committee of this Society,² the Commission pointed out that the meat displaced would amount to 4.81 per cent. of our total home-grown produce, or 2.67 per cent. of our annual consumption.

"While there would be some displacement of meat there would be no displacement, though there would be some disturbance, of population as a consequence of extended afforestation, so long as the work was confined to pastoral areas. In the absence of tillage a very small staff of shepherds suffices to work a grazing farm of the character of those which embrace the hill districts of Scotland, and the north and west of England. The number of sheep placed in the charge of a man varies to some extent with the breed and with the character of the ground, but chiefly with the character of the stock, that is to say, whether it is a ewe or wedder stock. A breeding stock requires most attention, and the usual number allocated to a shepherd—the "hirsel" as it is called all over Scotland-is 500. Wedder stockswhich, however, are hardly known outside the higher ground of Wales and the north of England and the Highlands of Scotland—are shepherded at the rate of as many as 2000, but as the grazing ground of such flocks, for the most part, lies above the planting limit, they may in this connection be disregarded. If two acres be allowed to each ewe, it means that one shepherd is employed on a thousand acres, and this figure has been accepted in both the recent English inquiries.

"The question then arises: How many men can find constant employment per unit of area—say, 1000 acres—in a forest worked upon a definite rotation? The answer will obviously depend upon various considerations: The species of tree, the length of the rotation, the character of the ground, the method of working—whether stocking is accomplished by natural or artificial means, and, if the latter, whether by sowing or planting—whether the trees are sold standing or are first felled, whether

<sup>&</sup>lt;sup>1</sup> Report, sect. 78-79.

<sup>&</sup>lt;sup>2</sup> Journal of the Royal Statistical Society, vol. lxvii., p. 380.

the timber is disposed of "in the rough" or is partially converted, and so on. The census reports for 1901 show that 16,395 persons in the United Kingdom were returned as woodmen, and if this figure be used as a divisor for the number of acres under wood, 3,075,773, we get 187 as the number of acres allotted to each man. But, interesting as this figure is, it is obvious that it cannot be applied to our present purpose. A very large proportion of our wooded area is held in such small portions say under 50 acres—that the owner does not keep a woodman, while in the under-wood districts of England-chiefly the southeast—the woods are often let to the agricultural tenants, who do the cutting with ordinary farm labour. One gets a better idea of the labour that land under wood can absorb, by ascertaining the number of the forest staff on estates with a large area of woodland. But in this country even this method of inquiry will yield a figure that is not quite satisfactory, inasmuch as the growing stock of timber in our woodlands is almost invariably lower than it would be under good management, and consequently the staff required is also somewhat below the normal.

"The most reliable data as regards labour are undoubtedly furnished by the great State forests of France and Germany, and there it is found that forest work, up to and including the felling of the timber, requires the services or provides the remuneration of one man to 75 to 100 acres. If these figures be adopted, as they have been adopted in recent inquiries, it means that pastoral land converted to silviculture can maintain a population ten to thirteen times as dense as that which formerly occupied the ground. And this, of course, takes no account of the further labour that is required for hauling the timber, and for manipulating it in the sawmill, pulp factory, or elsewhere.

"I have indicated what is, approximately, the density of the population that forest land can permanently maintain; but where the forests are first to create, a more immediate question is: What amount of labour will be required during the stage of sowing and planting? The answer to this question also depends on a variety of circumstances—the kind of ground, the species of tree, the size of plant, the method of planting, and others—

<sup>&</sup>lt;sup>1</sup> Report of Royal Commission, sect. 62-65. Report of Committee of 1902, sect. 9.

but, taking a broad average, it is probable that the afforestation of 100 acres will require the services of twelve men during six months. While the general operations of forestry extend throughout the year, the actual work of planting is confined to the period between the middle of October and the middle of March. This is the time of year when labour is most abundant, and it is also the time when work on farms is least pressing. Forestry, therefore, fits in well with our rural social conditions. While the Royal Commission fail to see in afforestation any solution for the problem of unemployment, they point out that it is better fitted than any rural industry to retain population on the land, while it also harmonises well with the development of small holdings. On the Continent most of the winter work in the forests is performed by men who, during summer, are engaged in agricultural operations, generally on their own holdings. It was given in evidence that in Scotland crofters found it an immense advantage to have woods in their neighbourhood, in which they could find remunerative employment at a time when they could be readily spared from their holdings.

"A subject that has long interested those who have given their attention to the world's trade in timber is the question of the maintenance of supplies. With few, if any, exceptions those who have examined the situation have come to the conclusion that exports cannot be maintained at their present level, and at no time has the probability of a timber famine been more insisted on than at present."

After discussing this question generally, Dr Somerville proceeds as follows:—

"The Royal Commission on Coast Erosion and Afforestation took much evidence on the subject of the trend of prices and quality of timber, and the Report¹ and volume of evidence prove conclusively that while prices have been steadily rising during the past twenty years, and markedly so during the past ten, the quality has been persistently falling. A rise therefore of 20 per cent. in the price, for instance, of first quality Baltic yellow deal is, in itself, sufficiently serious, but the aspect of the case becomes still more serious when it is found that timber classed as "Grade I." to-day, would some ten years ago, have been classed no higher than "Grade III."

<sup>1</sup> Section 25.

"Of the four countries on which we chiefly depend for our timber imports, it would appear that we cannot cherish the expectation that either the United States or Canada can long maintain their supplies. While there is uncertainty about Russia (including Siberia) the probability would seem to be favourable to that country maintaining her exports for a long period.1 As regards the fourth of these countries, Sweden, we have it on the authority of the Central Bureau of Statistics that, in 1900, 106,000,000 cubic feet were annually being withdrawn from her forests beyond what is annually produced.<sup>2</sup> If this be so it would appear that a curtailment of supplies from that country must soon be expected. Time does not permit of the subject being pursued further, though the fact is not overlooked that relief may, to some extent, be found in the direction of the displacement of wood by concrete, iron, and similar substitutes. Much may also be done to prevent and control forest fires, which in the past have perhaps consumed as much timber as has fallen to the woodman's axe. Then, again, nations that have hitherto recklessly exploited their forests are now taking some steps to secure regeneration, and, in the course of time, such action will have its effect on supplies.

"If material extension of afforestation is to take place in this, or, in fact, in any country, it can only be through the direct agency of the State. The planting of trees has appealed with great force to individuals, who have formed or extended woodlands to give shelter, afford sport, and improve the amenities of their estates. As often as not woods have been formed to gratify a taste of much the same character as that which induces a man of means to buy pictures, or establish a herd of pedigree shorthorns. The timber that private woodlands yield is of service in the upkeep of the estate, and the revenue resulting from the sale may be substantial as well as attractive. Few landowners care to see woodland reverting to rough pasture, so that one may say that it is seldom that the proportion of woodland on an estate is not maintained. But substantial extension of afforestation on an estate is comparatively rare. Of course there are exceptions, as in the case of the witness who came before the Committee of 1902, and testified that he

<sup>&</sup>lt;sup>1</sup> Schwappach, Forstliche Reisebilder aus Russland, Zeit. für Forst und Jagdwesen, 1902.

<sup>2</sup> Sweden, edited by G. Sundbärg, 1904, p. 620.

himself had extended his woodlands by 12,000 acres.1 afforestation can never appeal to the individual as a purely commercial undertaking. This, it seems to me, is inherent in the circumstances of the case, for when a scheme of planting is comtemplated the landowner has to face two considerations, either of which may make him pause, and both of which will almost certainly make him stop. In the first place, the necessary land has to be withdrawn from some other form of utilisation. and this means the loss of immediate income. In the second place, capital has to be found for the silvicultural operations, and this must be accompanied by suspension of interest, or it must entail the payment of interest on borrowed capital. individual may be quite convinced of the soundness of the investment, and of the ultimately remunerative character of the undertaking, but present necessities are much more potent than future advantages, and especially is this the case where the advantages are quite certain to be reaped by some other individual. In the case of the State, however, the matter appears in an entirely different light. An undertaking whose returns may be deferred for even a century need not deter her from taking action. A century, where an individual is concerned, is overwhelming; a century in the life of a nation is insignificant. To what depths of pessimism must a nation have descended if it dare not postulate an existence of a hundred years! In point of fact, a crop of certain kinds of timber may be reaped in half this time, but even this restricted period has no attraction for the individual. On account, therefore, of the necessarily deferred character of the returns of forestry, the State is preeminently qualified to undertake the work. But on other grounds also the State makes an excellent forester. Continuity of management, comprehensive working-plans, and maintenance of supplies at a steady level can only be satisfactorily secured in State forests. Whether large extension of afforestation in this country is desirable or not is open to argument, but if the desirability of such extension be admitted, the conclusion, it seems to me, cannot be avoided, that the State alone can accomplish the result."

### 18. The State in Relation to Forestry.1

By DR W. SCHLICH, C.I.E., F.R.S.

As forests occupy a part of the land, their position must, in the first instance, be considered from the point of view of political economy. We understand by the latter:—"That branch of philosophy which discusses the sources and methods of material wealth and prosperity in a nation."

Applied to forests, we arrive at Forest Policy, which inquires:—"Whether and in how far forests need be maintained in a country, whether the State as such should hold the forests, or whether the maintenance of them may be left to private enterprise."

It is evident that, to answer this question, the general utility of forests, in the economy of man and nature, must be ascertained. That utility is of a direct and indirect nature.

Taking the latter first, it must suffice to state that —

- (1) Forests reduce the temperature of soil and air to a moderate extent, and render the climate more equable.
- (2) They increase the relative humidity of the air and reduce evaporation.
- (3) They tend to increase the precipitation of moisture in the shape of rain, snow, and dew.
- (4) They help to regulate the water supply, produce a more sustained feeding of springs, tend to reduce violent floods, and render the flow of water in rivers more continuous.
- (5) They assist in preventing erosion, landslips, avalanches, the silting up of rivers and low lands, and arrest shifting sands.
- (6) They reduce the velocity of air currents, protect adjoining fields against cold or dry winds, and afford shelter to cattle, game, and useful birds.
- (7) They may improve the healthiness of a country.
- (8) They increase the artistic beauty of a country, and thus exercise a beneficial influence upon man.

The direct utility of forests is due to the produce which they yield, the capital which they represent, and the labour which

<sup>&</sup>lt;sup>1</sup> Paper read before the Scottish Society of Economists at Edinburgh, on 18th March 1909.

they provide if established on surplus lands. The last point is of special importance, if the industries of the country are not sufficient to give enough occupation for the population. It is only too well known that this is the case in the United Kingdom.

Whether, and in how far, these effects are produced in a particular country depends on its special conditions. In this respect should be mentioned:—

- (1) The position of the country, its communications with other countries, and the control it exercises over other countries, such as colonies.
- (2) The quantity and quality of substitutes for forest produce available in a country, such as iron, coal, and peat.
- (3) The value of land and labour, and the returns which land yields if used for other purposes, such as agriculture.
- (4) The density of population.
- (5) The presence or absence of waste land.
- (6) The amount of capital available for investment.
- (7) The climate and configuration of the country.

These considerations show that no general rule can be laid down showing whether forests are required in a country, or what percentage of the land should be so used. The question must be answered for each country separately. Thus, in European countries, we find that the percentage of land under forest, ranges from 48 to 4 per cent., these Islands and Portugal being last on the list.

As far as Great Britain and Ireland are concerned, their climate depends on other and more powerful agencies than that of forests. On the other hand, erosion has taken place and is now going on in various places, though not yet on a disastrous scale. When we come to the economic question, we find that these Islands import at least 75 per cent. of the timber which they require. Of the imported timber, 87 per cent. consists of coniferous wood. Much has been written and said as to the sustained supply of this timber (about 10,000,000 tons), and I consider that it is by no means secure. At any rate, I feel sure that prices will continue to rise, as they have done ever since 1894, owing to the gradual exhaustion of the more accessible forests in the exporting countries, and the increasing demand on all sides. Assuming this to be a correct view of the case, the question arises:—How can this prospective decrease in supplies and increase in prices be met?

I have on various occasions pointed out that sufficient waste and mountain land is available to produce, at any rate, all the coniferous timber which we now import. The difficulty is to decide who is to do it. And this brings me to the main question with which I have to deal

Every civilised State has various duties to perform. It must make laws which limit the action of the individual, with the object of securing their rights to all citizens, of protecting them against illegal interference of any kind, and it must maintain such laws. On this point we are, I think, all agreed. The State should, however, do more than this. Its action should also be directed to furthering the welfare of the people, in all cases where the power of the individual is not sufficient to attain objects which are essential for social and economic development; more particularly, when the advantages to be derived are not sufficient to induce private individuals to take up the task, or where free action on the part of the individual endangers the interests of the community as a whole, or when it is preferable that the State should guard the interests of the community. This occurs when permanent institutions must be made independent of momentary personal fancies or wishes; in such cases, the State alone affords sufficient guarantee for continuity of action in a given direction.

It will thus be seen that, while it is desirable in all civilised States to leave matters to the free activity of the individual, whenever this can safely be done, there are cases of special interest, which are better kept under the care and management of the State. The limits between the two classes are not easy to draw, nor can they be fixed once and for ever; they depend on the degree of civilisation of the people, as well as on the industrial condition of the country.

The question before us is, whether afforestation comes under that class of undertakings which should be taken up by the State. It is so considered in nearly all European states, in India, the United States of America, and in several of our Colonies. As to these Islands, I may offer the following remarks:—

- (1) We require large quantities of timber, the supply of which from outside sources in the future is more than doubtful.
- (2) A falling-off in the supply of timber would have the most serious effect on our national life.

- (3) Sufficient land is available for extended afforestation.
- (4) We have a surplus population, leading to an ever increasing army of unemployed, more particularly in times when trade is slack. Afforestation would lead to the retention of more people in the country, and would thus be an auxiliary in reducing the number of unemployed in the towns, apart from the fact that it would have a most beneficial effect upon the physique of the people.
- (5) The land which it is proposed to afforest gives now very low returns, whereas it can be made to yield a considerably higher income if placed under forest; hence, any comprehensive scheme of afforestation would certainly not lead to financial loss.

The following different methods for carrying out the work of afforestation present themselves:—

- (1) To let private owners afforest their surplus land. In the case of owners who are willing to do so but are in want of pecuniary assistance, advances could be given by Government at cost price, on proper security.
- (2) Joint action by the proprietor of the land and the State, the former contributing the land and the latter the funds for planting, administration, etc. In this case, it is essential that the State should keep the management entirely in its own hands, the net receipts being divided in the proportion of the capital contributed by each party.
- (3) The State may acquire the land and bring it under forest.

When I began, twenty-three years ago, to urge extended afforestation in these Islands, I proposed that all these methods should be put into operation, but the results are very small. A limited number of private proprietors have planted comparatively small areas, and the State, on behalf of the Crown, has bought an estate of some 12,000 acres in Scotland, and a few thousand acres in Wales, the sum total being disappointing. As a result, the idea has got abroad that the State must do the work alone. The Committee on Irish Afforestation, which reported last year, proposed that the State and County Councils should acquire 700,000 acres of unplanted land as well as a considerable portion of the 300,000 acres of existing woods; while

the Royal Commission on Coast Erosion and Afforestation proposes, practically, to buy, if necessary by compulsion, 9,000,000 acres of land, including 500,000 acres in Ireland, and to afforest them. It is added, in the latter Report, in a somewhat half-hearted way, that present proprietors may be allowed to do the planting themselves, provided it is done to the satisfaction of the State officials.

Before discussing the question whether these gigantic proposals are justified by facts, let us see what is the state of affairs in the principal European countries. The percentage of forests belonging to the State and the Crown is as follows:— In the United Kingdom 3 per cent., Italy 4 per cent., Belgium 5 per cent., Austria 7 per cent., France 12 per cent., Hungary 15 per cent., Denmark 24 per cent., Norway 29 per cent., Sweden 33 per cent., Germany 34 per cent, Finland 35 per cent., and European Russia 66 per cent. No doubt, in several of these countries the forests belonging to Communes and other Corporations are also under State control. For instance, in France such areas cover 23 per cent. of the forest area, bringing the total area under State control up to 35 per cent. of the whole forest area; while in Germany the communal forests amount to 19 per cent., making a total controlled area of 53 per cent. These two countries may be considered as those in which systematic forest management has been brought to the highest perfection. If they can produce highly satisfactory results, the one with a properly controlled area amounting to 35 per cent., and the other with 53 per cent., why can we not do the same in this country? The answer is perhaps not far to seek: We have never given a fair chance to private proprietors, and hence they have not participated to the desired degree in the scheme of Afforestation.

To begin with, until comparatively recent years, adequate instruction in the Science and Practice of Systematic Forest Management was not available. The former is now being rapidly supplied; but where are as yet the experimental areas so frequently asked for? In this case the State has delayed too long in taking the necessary action. I do not overlook the fact that the Commissioners of Woods have placed some of the Crown woods under the operation of systematic working-plans, but trees do not grow in a day, and much time has been lost. If steps had been taken when the subject was first

brought forward, we should now be well on the road to obtain useful information for future guidance.

The present system of levying rates and taxes is, to say the least of it, unreasonable, if not unjust. Taxes should be assessed according to the yield-capacity of the property, but what actually takes place? As soon as a piece of waste land has been planted, in many cases the assessment is raised, although no income can be expected for many years to come. On the contrary, additional expenses have to be incurred, until, some twenty or thirty years later, the thinnings commence. Surely, such a procedure is unreasonable!

Then, there are the unfair railway rates. Imported timber is carried to the places of consumption at lower rates than that from British forests, even if the length of haulage is less in the latter case. Cannot Parliament do something to remove such an anomaly?

We have only too often seen cases in the papers in which payment for damage to public roads was not only demanded but actually given by the Courts, although the forest land had paid rates and taxes for many years without using the public roads at all.

The last, but by no means the least, burden placed on forest property results from the death duties. Indeed, they form one of the chief reasons why afforestation has made such poor progress of late years. Cases are known in which these duties had to be paid twice within a few years. The duty has to be paid on the value of the standing crop, which should not be looked at as capital in the ordinary sense, but as an accumulated income which the proprietor draws in one lot instead of taking it out annually as in other concerns. Moreover, the woodlands have only too frequently to pay the death duties of the whole estate!

For all these reasons, I maintain that in the past woodlands have not been given a fair chance, and if the now existing heavy burdens were lightened, there seems to me every probability that private proprietors would participate on a liberal scale in the work of afforestation, rather than see their land expropriated; this would considerably reduce the enormous outlay proposed by the Royal Commission. Unquestionable evidence is available to show that there is no necessity for the State to hold *all* forest lands in a country. This is of the utmost importance, as it is clear that Parliament will think twice before it

sanctions an expenditure which will amount to more than  $\pounds_{400,000,000}$  by the end of eighty years, and that the forcible expropriation of some 9,000,000 acres of land would create a storm, which no Government in this country could weather, be it Liberal or Conservative!

Practical politics clearly indicate that the State, private proprietors, and Corporations must co-operate in this scheme, and the proposed law should be shaped accordingly. In the first instance, the proprietor should have the chance of doing the work himself; next he should have the opportunity of joint action with the State by contributing the land; and then the State should acquire the land necessary to make up the area which it is proposed to afforest annually. This should be done, whenever possible, by private treaty, but compulsory powers may be required, so as to secure the lands which are necessary for the benefit of the community as a whole.

As indicated above, the State must take certain matters under its own management, but it should never go beyond what is absolutely necessary. If, in our case, the State were ultimately to hold half the total forest-area, this would suffice to secure all the timber required by the country.

I now come to the question of areas. The Royal Commissioners give (apart from material which cannot be grown in this country) close on 9,000,000 tons as the quantity annually imported of late years, and they propose to provide all that timber at home, by the afforestation of an additional area of 9,000,000, acres. Nobody, however, ever suggested that the whole of the present imports would fall away; what has been predicted was that a serious reduction in the imports would come as time went on, and especially in the larger sizes and better qualities, owing to the gradual reduction of the amount of such timber available for export in foreign countries. Of the smaller sizes there will, in all probability, always be a considerable import; hence there is no necessity to afforest so large an area as 9,000,000 acres. The utmost area which I suggested in previous publications was 6,000,000 acres, and probably 5,000,000 would meet the case. If, nevertheless, the Commissioners proposed the larger area, they did so because they thought it would provide more labour. While they thus strengthened their case in one direction, they weakened it in another.

On reference to the details of the Report, it will be seen that the proposed area includes something like 2,000,000 acres of tillage land. To convert these into forest means a reduction of labour, as well as of the food supply of the country. Such a procedure I have never suggested, nor shall I support it now. All my proposals referred to surplus, and not to cultivated land.

The Commissioners propose to work so large an area as 3,000,000 acres under a rotation of forty years for the production of some 3,000,000 tons of pit and pulp wood. I fear that I, for one, cannot approve of this. The proposal enables the Commissioners to show that, probably, the Treasury will at the end of forty years be relieved of paying some £3,000,000 by way of interest on the borrowed capital; but, on the other hand, we should in all probability overstock the market with material of the class of timber produced under so short a rotation. The remaining 6,000,000 acres would produce at least another 2,000,000 tons of such timber, making 5,000,000 tons in all. We receive now, and are likely always to receive some 600,000 tons from the west coast of France, being the produce of the thinnings made in the extensive maritime-pine forests of the Landes, to which the imports from the Baltic must be In my opinion, the financial forecast should have been based on the assumption that the bulk of the area will be worked under a rotation long enough to produce large timber. and counting on the necessary pit and pulp wood being provided by the thinnings. Moreover, such a short rotation as forty years is possible only on land of some substance. the proportion of which is small in the case of the land here under consideration.

Although the Commissioners appreciated my evidence on the great importance of combining field with forest work, they overlooked the fact that for this very reason afforestation by private proprietors should as much as possible be encouraged. The ideal solution of the problem is, not the creation of large extents of forests in one place, which would lead to a separation of field from forest work, but the establishment of fair-sized blocks scattered over the country. As long as each block is large enough to justify the employment of a man in charge, economic management is possible just as well as, if not better than, on large continuous areas. The labourers who work

in the fields in summer can do the forest work in winter, without leaving their homes. In the other case, they have to emigrate to forest colonies or whatever they are called. Moreover, by a proper distribution of the forest-areas amongst cultivated lands, a local market for the smaller dimensions of timber and for firewood would be created, whereas much of such produce would be of little or no value in large concentrated blocks of forest, owing to the cost of haulage.

As to the financial aspect of the scheme, into the details of which I cannot enter on this occasion, I gave it as my opinion that 3 per cent. on the capital outlay might be expected, if the maximum price of the land did not exceed  $\pounds$ 10 an acre, and provided that the scheme were conducted on rational and economic lines. It will not suffice to have experts at London, Edinburgh, and Dublin; an essential point is that there shall be thoroughly competent managers on the spot in the field. Unless this is attended to, the estimated returns will not be realised.

There is a strong feeling in the country that something substantial in the way of afforestation should be done, and it is to be hoped that people will not be frightened by the gigantic scheme of the Royal Commission. After all, it is easy to cut it down to the proportions required by the wants of the country. Indeed, the Commissioners seem to have felt that themselves, as they append an alternative scheme for 6,000,000 acres; the more pity that they did not start with it. They were, apparently, led away by the desire to provide as much labour as possible for the unemployed. Although afforestation can be made a useful auxiliary in the solution of the question of the unemployed in the immediate future, its principal value in this respect lies in the fact that it will gradually reduce the stream of population towards the towns, by making it worth while to remain in the country. If afforestation achieves that, and I believe it will, then the State can well afford to devote a large sum of money to making it a reality, though we need not go so far as £,400,000,000. One-fourth of that sum, invested during the next sixty or eighty years, will suffice.

# 19. Afforestation and Timber-Planting in Great Britain and Ireland.<sup>1</sup>

By Dr J. NISBET.

During the last twenty-five years, four Committees and Commissions have been appointed by Government to deal with the question of Forestry in the United Kingdom, and with what is now, by rather a lax use of the term, spoken of as Afforestation, when timber-planting is really meant. In 1887, a Select Committee of the House of Commons recommended the establishment of a Forest Board and Forest Schools in England, Scotland, and Ireland, and pointed out 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. This subject is one of great importance, and well worthy of early consideration." No action was taken in the specific directions recommended by this Committee.

The second inquiry was made in 1902, when a Departmental Committee of the Board of Agriculture 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." Reporting in 1903, they urged "immediate and effective provision for bringing systematised instruction within the reach of owners, agents, foresters, and woodmen . . . as the first requisite in any project for the improvement of forestry," and recommended that "additional facilities for instruction be afforded," and also that "assistance should be looked for from local authorities, societies, and individuals interested in forestry and technical education." And they also made another very important recommendation, that Government "should take steps to compile a statement of areas presumably suitable for afforestation in Great Britain." But though they took note of "the great area of waste land in these islands which might be afforested," they expressly refrained from advocating "any general scheme of State forests under present circumstances," . . . and merely remarked that "Once adequate provision for training is made and the

<sup>&</sup>lt;sup>1</sup> Reproduced, by permission, from the *Journal* of the Society of Arts.

consequent improvement of our present woodlands becomes manifest, it will then be opportune to raise the subject either of loans or of State forests." The drawbacks to private planting were dealt with as "Minor Considerations"; and while the Committee were not prepared to make any recommendation regarding the incidence of local rates on plantations and the assessed valuation of woodlands, they thought that the claims for "extraordinary traffic" made by local authorities against timber merchants (and therefore ultimately paid by the timbergrower) were unjust and "unreasonable"; that the estate duties needed "immediate revision" as being "peculiarly unfair to the poorer districts," because "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"; that security was needed against fires from railway sparks (since very inadequately provided up to a maximum compensation of £100 under the Railway Fires Act, 1905); and 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," so ruinous are these to systematic forestry and natural regeneration.

Very little action was taken upon this Report. Many of the most important recommendations have been tacitly ignored, and especially that recommending the detailed inspection and scheduling of land suitable for profitable planting, which must of course be a step taken before any practical scheme of very extensive planting can be properly considered. By not carrying out the recommendations of the Committees of 1887 and 1902 much valuable time has been lost.

The third inquiry was that which took place when, in October 1907, a Committee was appointed by the Department of Agriculture in Ireland to advise regarding an extensive scheme of forestry operations. Previous to this, however, while the Land Purchase Act of 1904 was under consideration, certain preliminary inquiries had been made as to the extent of waste and poor land which might probably be plantable with a reasonable prospect of direct profit, and the late Mr Parnell's estate (Avondale, Co. Wicklow) had been acquired in 1903 and equipped as a school for the training of practical

foresters. In April 1908, this Committee's Report was issued. It is by far the most business-like and practical afforestation and timber-planting scheme that has as yet been suggested for any of the four countries forming the United Kingdom. It recommended the acquisition of sufficient land (including some of the existing 300,000 acres of woodland) to provide for the formation of about 700,000 acres of woods and plantations, of which about 200,000 acres or more should be State forests in large blocks, while about 500,000 acres of smaller areas should be under County Councils or in private ownership. The weakest point in this scheme is, it seems to me, that it is not intended to confine planting operations to waste land and really poor grazing tracts worth only about a shilling an acre, but it recommends the afforestation of grazing land worth about 3s. 6d. per acre on the average, and usually capable of improvement. Anyhow, what is of vast practical importance, it very plainly indicates how, in the Committee's opinion, the money for carrying out this Irish afforestation scheme should be obtained. These proposals are still under consideration, though over a year has now gone by without any pronouncement having as yet been made on the subject by Government.

The fourth and last inquiry was that instituted after the Association of Municipal Corporations had (in 1907) pressed upon the notice of Government "its opinion that the time has now arrived when the question of afforestation should be seriously considered," through the enlargement of the Royal Commission on Coast Erosion to report whether "it is desirable to make an experiment in afforestation as a means of increasing employment during periods of depression in the labour market, and, if so, by what authority, and under what conditions, such experiments should be conducted." Its Report, submitted on 4th January 1909, went far beyond the terms of reference as regards "an experiment in afforestation," and recommended the afforestation and planting of 9,000,000 acres, mostly grazing land at present, within the next sixty years, at a rate of 150,000 acres a year, and at a cost of £,13, 6s. 8d. per acre, £6, 13s. 4d. being for the freehold and £6, 13s. 4d. for the expenses of afforestation, or £,2,000,000 annually though it also outlined a smaller scheme for afforesting and planting 75,000 acres annually at a total cost of £1,000,000

a year. With regard to the question of afforestation as providing suitable work for the unemployed, the Commission has reported that "They have no hesitation in asserting that there are in the United Kingdom at any time, and especially in winter, thousands of men out of work for longer or shorter periods, who are quite ready and able to perform this or the higher class of labour." Here, however, their opinion is diametrically opposed to that of the Irish Forestry Committee, who were unanimous in stating that afforestation would not prove a direct remedy for the chronic state of unemployment from which Ireland has for years been suffering, though they pointed out that any extensive scheme of planting must indirectly help to ameliorate the condition of the working-classes. The exact terms in which this clear Irish statement was made are as follows:—

The question of promoting forestry as one of the means of dealing with what is called the problem of unemployment, having been brought to our notice, we think it right to state our opinion on this question. It is, emphatically, that forestry cannot be considered as a specific for curing the evil which is commonly understood when this problem is spoken of, that of the chronic disemployment, especially in large cities, of large numbers of people belonging to different trades or callings. That the promotion of forestry on an adequate scale will provide a great deal of employment is unquestionable, and that is one of its principal advantages to a country. But such employment would be employment naturally forthcoming from the plantations and woods for the agricultural population in their vicinity, and it would be employment for an industrial population, more or less rural, forthcoming from the industries and commerce which may be developed in connection with the conversion and handling of the forest produce. This sort of employment cannot be provided on a large scale at once. It must be developed with steadiness and system, and above all it must be on sound economic lines.

Our planting season is from autumn to spring; and while the formation, tending, and harvesting of timber-crops will increase the amount of employment given to the rural population, it seems hardly reasonable to expect that planting work on wind-swept waste lands in autumn and spring can be suitable for the elderly, the weakly, and the least skilful and energetic, who must always be the first to be thrown out of work, and the last to become re-employed in our large industrial centres. But as a practical commentary on what the second city in the British Isles thinks of this remedy for the unemployed it is noteworthy that on 23rd February 1909,

the Glasgow Distress Committee resolved that it should *not* be represented at any interview with the Secretary for Scotland regarding a national scheme of afforestation.

On the average a 60-year old wood should yield about 100 tons weight of timber per acre; and the felling, logging, transport, conversion, and distribution of woodland produce will, of course, add directly and largely to the total amount of wages that would then be payable to labourers and workmen in this country, in place of being sent to foreign countries, as is at present the case. Indeed, there is hardly any branch of industry which would not benefit largely by our having extensive woodlands, and this obvious advantage is surely great enough to commend rational proposals for timber-planting to our national business instincts.

The Royal Commission's vast scheme of afforestation is supported by financial calculations showing that timberplanting will prove a very profitable investment for the nation eighty years hence. These actuarial calculations have no practical value, for they deal with conditions and timber-crops which do not exist. They are little better than the usual prospectuses issued by vendors of concessions when floating speculative companies. If such calculations based upon vague data always came true there would never be insolvent joint-stock companies or bankrupt tradesmen, for reasonable business men only embark on ventures that give fair promise of being profitable; and the nation will be unwise to risk an investment of either one or two millions every year for the next sixty years merely upon the hope of having very profitable money returns from eighty years hence onwards. It is indisputable that timber-planting is desirable to the utmost extent possible; but a great national scheme of afforestation should rest upon a broader and surer economic basis than subtle calculations (based mainly upon German data as to yield) that may easily be partially upset by heavy gales like those which wrecked the Tay Bridge, at Christmas 1879, blew down millions of trees in Perthshire in November 1893, and did a vast amount of damage to woodlands in Ireland, in February 1903—to say nothing of epidemic fungous diseases, such as the larch canker, to the development and spread of which our comparatively mild, humid, and equable climate is even more favourable than it undoubtedly is also to the growth

of timber-trees. Unquestionably, extensive plantations would give work to the rural population, and would bring great and almost immediate advantage to agriculture, especially to stock-raising, on wind-swept moors and hillsides; and ultimately the handling of the timber-crops and the timber itself, as a raw material for many industries, would circulate a very large total amount of money throughout the British Isles. It is on these firmer economic realities, rather than on unreliable forecasts and calculations, that any national scheme of afforestation must be based; and there can be little doubt that with the world's constantly increasing demand for wood, and constantly decreasing supply, well-formed plantations ought to prove a sound and remunerative investment if made prudently, and on a large scale.

The Commission has quoted many examples of profitable forestry in Britain; but mention of dead failures seems to have been deliberately suppressed. What of the Knockboy plantations in Connemara, where £10,000 was lost utterly on a site upon which the planting experiment was foredoomed to failure?

It may be urged that these calculations as to profit eighty years hence are based upon German data; but this presumes that German physical and economic conditions are analogous to our own, which is not the case.¹ In Germany most of the vast woodland tracts have been under forest from time immemorial, have been under prudent management for generations, and have for at least during the last sixty or seventy years been worked with a scientific skill that we cannot hope to attain at once. Moreover to plant bare, denuded

¹ About one-third of all the wood grown in Germany is required as fuel; and on all wood imported into any part of the empire there is an impost duty varying from about ½d. a cubic foot (true contents) on wood of any kind in the rough, up to ½d. a cubic foot, or 10s. per dozen pieces, for wrought and manufactured wood. Now, even a ½d. a cubic foot for rough poles and logs means about £10, 8s. 4d. an acre for an average 60-year old conifer crop, besides also enabling thinnings to become profitable at an earlier age than can possibly be the case in Britain. And ½d. a cubic foot, or 10s. per dozen pieces, for wrought and manufactured wood, encourages all timber working, transporting, and distributing industries in a way that is impossible in Britain. And a saving of £4, 5s. 4d. an acre on the average cost of planting waste land in Prussia, capitalised to 60 years, also gives an enormous further advantage to the German results.

waste lands with timber is quite a different matter from merely improving the management of great natural forests. To create new woodlands on bare, impoverished, and often water-logged land involves a great capital outlay, with all the risks and disappointments attendant on a vast scheme of creating supplies of raw material for the establishment of new industries in the British Isles. And if German results be appealed to for guidance in this particular business, then it is not to Saxony that one should look, but to Prussia, which has much greater resemblance to Britain so far as regards its northern climate, its partial sea-board, and its great stretches of poor moor and heatherland, with a scanty population—although Prussia, too, has large areas of splendid spruce forests (Harz) and rich oak and beech (Solling, Ems, Weser, etc.). During the four quinquennial periods from 1877 to 1896 the average net income per acre per annum for the Prussian State forests was 3.7, 4.1, 4.9, and 5.1 shillings; and though it is larger now than then, it does not necessarily follow that British plantations on waste lands and poor grazing tracts will either equal or surpass in net income the profit earned in Prussia from twelve to seventeen years ago. But as the reclamation and planting of waste land has been going on in Prussia continuously for over fifty-five years, it would have been of special value to have had definite and unprejudiced evidence as to the actual material and monetary results now accruing from these plantations.

So far as their Report shows, the Royal Commission does not appear to have attempted to obtain any information on this most important point. Certain data referring to afforestation and planting, I can give you now, however, which will of themselves prove most emphatically that the physical and economic conditions throughout the waste-land tracts of Prussia are entirely different from those obtaining in our waste-land areas and poor pastures. Between 1st October 1904 and 30th September 1907, the Prussian State Forest Department acquired by purchase 46,346 acres of waste land, and planted 33,998 acres with timber-trees of various kinds, mostly conifers, at an average cost of 48s. per acre. But, besides that, village communes and corporations, and other bodies have likewise been carrying out planting operations, towards the expenditure on which the State also makes a partial contribution. The Prussian Forest Department, to

whose courtesy I owe these details, unfortunately did not state the cost of the land acquired; but the planting at  $\pounds 2$ , 8s. per acre is very different from the average of  $\pounds 6$ , 13s. 4d. an acre, which the Royal Commission considers necessary (see footnote on page 144).

The serious position of Britain with regard to timber is perhaps hardly as yet realised generally. Apart from all other timber, in 1907 our imports of rough-hewn pitwood came to 2,627,209 loads, valued at  $\pm$ 3,049,484, while those of woodpulp came to 672,499 tons, valued at £3,312,347. These two items alone amounted to £6,361,831, and exceeded in value the similar imports of any previous year. To supply these demands alone, without making any provision for future increase with increasing population, would need the annual fall from about 3,000,000 acres of conifer and other woodlands—that is to say, an annual cut of about 60,000 acres of woods worked with a 50-years' rotation, or of 50,000 acres of woods worked on a 60-years' rotation. The satisfaction of the future demands for pitwood is surely one of the most important matters connected with afforestation in the United Kingdom. It is probably only a question of time before the large pitwood imports from the French State forests near Bordeaux to Britain must fall off, owing to the increasing demand for and the decreasing supplies of suitable wood for the collieries in the interior of France. In coming years the supply of pitwood to British coal mines is likely to cost more; and whatever tends thus to raise the price of working coal must at the same time influence all our industries dependent on coal as part of their raw material for producing commercial articles. The wood-pulp industry (hardly existing in Britain, and only on foreign wood) is capable of enormous expansion, given sufficient supplies of softwood; and it is an industry that would spring up in rural districts wherever such raw material could be supplied in large enough quantities. In 1904 mechanical wood-pulp cost in Britain 85s. a ton, in 1908 it rose to 120s. In America its price has been trebled in the last ten years, and everywhere its value is bound to increase greatly in the near future. Pulpwood thus differs from pitwood, for even now fairly large supplies of wood that might well be used in coal mines have little or no value in situ owing to the cost of transport to the mining districts.

And last year, a year of great commercial depression, our imports of pitwood and wood-pulp were far larger than ever before, increasing respectively by £530,000 and £313,000, or £843,000 in all, over the previous highest record in 1907.

					Year.	Loads.	Value.
Hewn Pitpr	ops or	Pitwo	ood,		1906	2,451,665	£2,713,005
,,	,,	,,		•	1907	2,627,209	3,049,484
"	"	,,			1908	3,041,440	3,579,355
					Year.	Tons.	Value.
Wood-pulp,	•				1906	606,811	£2,915,209
,,	•				1907	672,499	3,312,347
,,	•				1988	748,419	3,625,803
Combined Wood-pul	value p alon	of	Pitw		and	Year	Value. £5,628,214
,,		,,			,,	1907	6,361,831
"		,,			,,	1908	7,205,158

The total value of our wood and timber imports was £27,507,410 in 1906, £27,093,054 in 1907, and £24,306,059 in the depressed year of 1908. Of this total £18,534,958 in 1906, £17,146,823 in 1907, and £14,515,433 in 1908, were for wood "sawn or split, planed or dressed," and at least one-third of this amount represents wages paid to foreign workmen (in addition to the ordinary cost of extraction from the forests), a great part of which might be retained for our own industrial classes if we had the necessary raw material to operate upon.

If our waste lands and poor pastures are at all plantable with profit, it will be in coniferous and softwood crops for pitwood and pulp that the best returns must be sought. Such crops are the most likely to thrive on poor land, cost least to establish, and give the quickest returns. It may be safely taken that 3,000,000 acres of woodlands (chiefly conifer) are the minimum that should be provided either by the State on its own responsibility or in co-operation with County Councils and private landowners.

To carry out a vast scheme of afforestation, such as the 9,000,000 acres of planting which the Royal Commission

recommends, three main points have to be taken into consideration:—

- r. Money.
- 2. Land.
- 3. Labour and Supervision.
- I. Money.—With regard to providing funds no suggestion whatever has been made. With an enormous deficit to face. the Treasury cannot possibly grant funds for such a vast and not immediately profitable investment. Probably the only way in which money can be raised as required will be to form a "National Afforestation Fund" by issuing guaranteed 23 per cent. stock for the amount needed during each of the next sixty years while planting continues. But why not here look towards Prussia for light and guidance? Parts of the Grunewald Forest, near Berlin, have risen greatly in value, and portions of this are being sold, in order to buy big stretches of waste land for afforesting and planting. Now, the £,561,000 a year at present being raked into the coffers of the Commissioners of Woods, Forests, and Land Revenues of the Crown are mainly obtained from London house and office property; and as the hundredyear leases are now falling in, these most valuable properties can easily be sold to provide many millions of pounds sterling for the afforestation and planting of waste lands and poor pastures, if the Treasury approve and authorise such a course being taken.
- 2. Land.—The Commission estimated that 6,000,000 acres of suitable land are obtainable in Scotland, 2,500,000 acres in England and Wales, and at least 500,000 acres in Ireland, making 9,000,000 acres in all. But the land area of Scotland is only 19,069,770 acres, while that of Ireland is 20,327,947 acres; and to suppose that there is about twelve times as much plantable land in Scotland as in Ireland is incorrect, while it is equally wrong to imagine that nearly one-third of the total area of Scotland is plantable with profit. Over 31 million acres are above the 1500 feet contour; and to assert that nearly two-fifths of all the rest is waste land or poor pasture plantable with profit must seem strange to those well acquainted with the Scottish hills and moors. Even in the most favoured localities timber-growing can seldom prove profitable as high as 1000 feet; and if all the land above that elevation be subtracted, then it will probably be found that

6,000,000 acres represent quite an irrational proportion of the remaining land less suitable for agricultural occupation than for forestry. And as most of the hill land below 1000 to 1200 feet forms winter pasture for sheep stocks, if that be taken for afforestation the whole grazing industry will become dislocated, and the whole of the Highland sheep-farmers will be in a state of political revolt.

But even more amazing than the extent of land considered suitable for profitable planting is the manner in which it is proposed to be acquired. No attempt is to be made to assist and encourage landowners willing to plant, and this is a very weak point in the scheme; because, although under existing conditions and laws the State is the only landowner that can afford to create large compact blocks of woodland without desiring quick returns, yet a vast State monopoly of timber-growing can only be justified after the failure of fair attempts at assisting and encouraging private landowners by means of money loans and legislative amendments (e.g., as to settled estates, law of entail, rating and valuation, succession and estate duty, lands improvement, railway fires, damage by ground game, railway and road charges, and various other matters affecting land, crops and finance). Under the existing conditions, my own personal opinion (stated on page 93 of vol. i. of The Forester, in 1905) coincides with that expressed by the Commission, and is as follows :-

The necessity for State assistance is 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, vol. x. p. 9.)

This is precisely what the recent Committee on Forestry, 1902, 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.

But even if substantial inducements could be offered by Government to private landowners, it would not necessarily follow that the plantations thereafter formed would be managed upon more business-like principles than are the existing woods and plantations. The State is the only possible landowner that can be expected to create large compact blocks of woodlands in the United Kingdom, to be managed on silvicultural principles, with the

twofold object of providing supplies of timber in the future, and of fostering and encouraging rural and wood-consuming industries. If this be a duty at all, it is the duty of the State, and not of the private landowner. The State is the only landowner that never dies nor is called upon to pay estate and succession duty, and it is the only landowner that can make large investments without being compelled to desire quick returns in the shape of income; hence the State is the only landowner that can be sure of remaining free from the temptation to thin timber-crops at an early age, and to a great extent—or, in short, that can afford to grow the best classes of timber upon rational principles.

Private timber-planting has hitherto failed from want of funds, oppressive legislation and financial burdens, want of systematic management, and overpreservation of game (especially ground game). But these drawbacks can be remedied; and till private landowners have been found unwilling to agree to reasonable proposals when made by Government there seems no justification for the compulsory expropriation of nearly one-third of the whole of Scotland, as thus recommended by the Commission:—

It will be necessary at an early stage, for the State to acquire suitable land, and at once the alternatives arise of acquisition by negotiation or by compulsion . . . we, therefore, recommend that compulsory powers be obtained by legislative enactment, and that a general survey should be made with a view to ascertaining what lands are available for the purposes of State afforestation. These lands should be purchased from time to time as required, the owner receiving in compensation their full value in all the circumstances of each particular case, following the precedent of the Small Holdings Act, 1907, so far as it is applicable. Compensation should be paid also to sitting tenants.

During the last five months my professional advice has been asked regarding timber-planting on several Argyllshire estates, and in each case I have advised the landowner, before committing himself to any such investment, to ascertain from Government what financial and other assistance and encouragement they are prepared to give in this direction. But the recommendation of the Commission is dead against any such assistance:—
"In no circumstances do your Commissioners suggest that the State should be expected to finance schemes of private afforestation, by way of loan or otherwise. The security would not, in their opinion, in such cases, be of a sufficiently substantial kind to warrant such action."

Here again, however, on this most important point, the Irish

Forestry Committee gave a different, and a far more commonsense recommendation in the following words:—

For the . . . larger landed proprietor, the inducement must be of a nature that would relieve him to some extent from the immediate lock-up of capital incurred in planting operations, and at the same time provide a guarantee that the outlay would prove, so far as the holding is concerned, a sound investment. Easy loans, with deferred interest, absolute security of tenure in respect of the lands coming under the scheme, and free advice in all branches of forestry, are the chief means which seem to us best calculated to meet this case.

When it seems to suit their purposes, the Commission quote German and French forestry statistics, though they ignore other very relevant data. In both France and Germany the great bulk of the woodlands is in private or corporate ownership:—

				ance.	Germany. Acres.	
Woodland area, .			23,400,000		34,730,000	
Percentage of woodlands	owne	d by	:			
-				Per cent.	Per cent.	
State and Crown, .				11	33	
Private landowners,				$66\frac{1}{2}$	$47\frac{1}{2}$	
Church lands and other	er end	owm	ents,			
municipalities, villa	ge con	mmu:	nals,			
and corporations,				$22\frac{1}{2}$	$19\frac{1}{2}$	

Although both of these countries are devoting large sums annually to the acquisition and planting of waste lands, yet private planting is encouraged, and compulsory acquisition is only resorted to in extreme cases (e.g., mountain-planting in the Pyrenees); and even then the planted land can be subsequently reacquired by the original owner at its actual cost after the reboisement has been carried out. Why should not reasonable endeavours be made in this direction in Great Britain? The Irish Forestry Committee's Report of April 1908, is much more common sense in this respect when it advocates the planting of 200,000 acres of State forests in large blocks, and of 500,000 acres by County Councils and private landowners in smaller blocks. And, further, the class of land acquired for planting should certainly not be that having a freehold value anything like so high as £6, 13s. 4d. an acre, for many hundred thousands of acres can easily be acquired at about £,2 an

acre, plus sheep acclimatisation value of about other 5s. per acre, or  $\pounds_{2}$ , 5s. in all.

3. Labour and Supervision.—Even supposing that the £,2,000,000 a year recommended by the Commission to be spent on acquiring and planting land could be provided, it could not be economically spent at present owing to the Committees' recommendations in 1887 and 1902 not having been acted on. Within the last five years small schools for practical foresters have been formed at the Forest of Dean for England and Wales, and at Avondale (Co. Wicklow), for Ireland; but as yet no such school has been established in Scotland, and the only places where more or less systematic outdoor instruction in woodland work is there given are private estates such as Scone and Murthly, in Perthshire. In this respect Scotland is deeply indebted to landowners like the Earl of Mansfield, Mr Steuart Fothringham, Mr Munro Ferguson, and some others, who have done much to advance the education of forest apprentices. But for a great national scheme of planting a large number of well-trained practical foresters will be required, . and such training has not yet been organised to meet the demand that would then be made for men of this class. And the labour difficulty will be enormous. Already, in Argyllshire, planters and nursery hands receive 3s. 4d. a day, and suitable men are exceedingly scarce. Special arrangements would have to be made for planting colonies, while the men engaged would need extra close supervision. No class of work can more readily lend itself to scamping than planting; and if the planting be badly done, then the Commission's sanguine financial forecast becomes utterly impossible of realisation.

Nothing is yet known as to the intentions of Government with regard to either the Irish scheme, or that recommended for Great Britain. In the House of Commons, on 17th February 1909, Mr Burns, President of the Local Government Board, said concerning the latter that—

One of the reasons why the Government did not include afforestation in the King's Speech was, that the Report was only just submitted to them, and was to be read in connection with the Report of the Poor Law. It was a subject that did not require legislation of an elaborate sort, but it did require a great deal of money, and the Government were not justified in including any proposals in the King's Speech in regard to it until they knew what money the Chancellor of the Exchequer would be able to place at their dis-

posal. The thing, however, had passed from an experimental stage, and the Government were seriously considering it with a view to action.

This last official statement was immediately contradicted by Mr Munro Ferguson, who maintained that—

The right hon, gentleman was entirely wrong in telling the House that afforestation had passed beyond the experimental stage. There had been a few experiments by a few scattered landowners, but the State itself had done absolutely nothing. The State had not only kept its own forests in a most disgraceful state, but it had failed, in spite of every kind of pressure, to provide any training whatever either for its own servants or those of the private adventurer. We must at least have two Schools of Forestry, and the Government would want about £100,000 to start with.

Now, all that has been done experimentally by Government was thus summed up by Mr Pease, Junior Lord of the Treasury, on 11th February 1908:—

The amount spent by the Commissioners on Woods and Forests during the last ten years, in England and Wales, on afforestation, by which term is meant planting new areas, not previously under timber, as distinguished from re-planting old woods, is about £5000. The cost of land, in England and Wales, bought during the same period for afforestation, is about £1200. There has been no expenditure on planting new areas in Scotland or Ireland, but £25,000 has recently been spent in buying land in Scotland for afforestation.

Since then no planting has yet been done on this Crown estate of Inverliever Argyllshire (bought for £25,000); but planting is to begin this autumn, and only 150 acres a year are to be planted for the next twelve years.

And Mr Burns's statement, that anything like a great national scheme of afforestation is "a subject that did not require legislation of an elaborate sort," is quite wrong, and simply shows that apparently Government have as yet no proper idea of this subject at all. Very numerous legislative amendments will have to be made in existing Acts (e.g., rights of owner in possession under law of entail in Scotland, and various other Acts previously referred to), which are bound to have farreaching consequences. And the proposal to expropriate for afforestation about one-third of the land of Scotland, must either result in the fall of any Government that is foolish enough to propose it, or, if carried, will mark the first and the greatest step towards an era of Socialism in Britain. And if land is to be forcibly nationalised for forestry, then, the ancient royal

forests must be the first areas dealt with by the State and expropriated from the Crown.

With both the Irish Forestry Committee's and the Royal Commission's contradictory reports before them, it may probably be expected that the Government will desire more detailed information regarding separate schemes for England, Scotland, and Wales. The best way of formulating really sound and practicable schemes is, perhaps, first of all to determine to what Department of Government afforestation work in each country shall be entrusted; and then in each of these three countries to appoint a National Forestry Board or Afforestation Committee, consisting of representatives of (1) Government; (2) County Councils; and (3) Landowners, Land Agents and Sheep Farmers, to consider and report, whilst simultaneously collecting reliable local data, county by county, regarding the amount of plantable land probably obtainable on reasonable terms, and the existing conditions with regard to the supply of labour suitable for planting-work. And if, as should certainly be the case, it be desired to assist and encourage landowners to plant (e.g., by granting loans at 3 per cent, under proper conditions as to security and systematic planting and management, and by lightening the burdens on land put under timber), then such Boards or Committees will have many knotty points to consider. Thus, with regard to rating, it will not be sufficient merely to exempt the land from rates till the timber-crops give good returns, for that would mean throwing an additional burden on the whole of the rest of the rateable land in the county; and the only way of removing a difficulty of this sort will be for Government to give an annual bonus equal to the amount of the rate paid until returns are obtainable from the timber-crop.

The Royal Commission has not given sufficient consideration to the great practical difficulties connected with hill planting on a large scale. Probably they had no evidence before them as to the immense jungle of long grasses and weeds that springs up when the sheep are taken off and the area is fenced and planted; and late frosts in spring have done much damage in many recent plantations.

Confining my remarks merely to Argyllshire, which contains much suitable land, an enormous amount of drainage will be needed, for in many parts the average rainfall is near or over 100 inches. And throughout the greater part of Scotland land-

owners, factors, foresters, and labourers will all have to be educated up to the point of seeing how pernicious on stiff or peaty soil is the now long-practised, irrational system of notch-planting, unsuitable for any except a very light soil, though it is certainly the cheapest method of planting. "Profitable crops have been raised thus in the past, and why not now?" they ask; or else unfavourable criticism of this method is met with a cold and rather contemptuous silence. It will take years to educate the local labour up to this point, and it is hardly conceivable that casual labour will meanwhile be obtainable either in sufficient quantity or with the necessary skill for this particular kind of out-door work.

Sometimes, also, the objection has been raised that extensive planting would increase the rainfall, impair the climate, and affect the national character. Such fears are unfounded. It is not on local and interior conditions that our damp insular climate is mainly dependent, and by which it is regulated, because the chief factors are the Great Atlantic Gulf Stream to which our mild, equable climate is due, and the moist Atlantic winds coming from the south-west, which prevail throughout the greater part of the year. Large woodland tracts would hardly, if at all, increase the rainfall perceptibly, though their influence would certainly tend to increase the relative humidity of the atmosphere in the vicinity of the forests; but any drawback which might possibly thus arise (and this it would be difficult to estimate beforehand) would certainly be far outweighed by the additional shelter they would provide for grazing stock, and by the water-storing capacity of the woodlands and the immunity against inundations that this tends to provide. The heaviest annual rainfall in the British Isles is in Cumberland (Styhead Pass), but is the character of Cumberland men therefore impaired on that account? Or has that in the slightest degree dulled their natural shrewdness or their business instincts and capacity?

In conclusion, it has often been asserted that extensive planting would interfere greatly with sport. If the bare Scottish deer forests were covered with woods the character of the sport would certainly be changed; but it is far more likely that the sport would be improved than deteriorated thereby. Any closer consideration of this particular point, however, would only unnecessarily extend this already long paper.

### 20. Afforestation.

By LORD LOVAT.

During the course of the 1908 Session, in one of the Houses of Parliament, that ever-green topic, the horse supply of the United Kingdom in its relation to war mobilisation, was debated at some length. As is usual on such occasions, the front benches, the Board of Agriculture authority, numerous under-secretaries, and others, who-by their own account at all events-had given the subject their special attention, poured forth a medley of knowledge of a highly technical and sufficiently convincing order. The possibilities of limestone soil and of line breeding, the theories of Mendel and Weismann, Telegony-the connection between Garage and "Harras"—and other arguments less or more to the point were put forward, some with adroitness, all at considerable length-The debate had reached its height and both sides had proved their point to their own, if not to their opponents' satisfaction, when a douche of cold water was poured from the back benches and it became evident even to the more heated of the disputants that, through the incorrect reading of a Nota bene in a Board of Agriculture return, the main statement on which the whole argument turned was founded on an initial error roughly estimated at two million horses!

The would-be student of State afforestation starts his inquiry from a not less uneasy base.

The same welter of semi-digested information, the same eagerness in the presentation of theory, the same light-heartedness in the production of schemes, the same absence of "home-grown" statistics and bed rock facts, make confusion worse confounded in either case.

There is, however, one important difference in the two inquiries, viz., that while the investigator of the horse supply problem finds the Board of Agriculture with its correspondents in the country and its machinery at a central office, capable of providing the necessary data, were it so minded, the arboriculturist in search of information has no such organised body to which to turn.

It would seem a suggestion too self-evident to be seriously put forward—if the successive findings of Forestry Commissions

and the indifference of succeeding Ministries did not teach otherwise—that, if only as a preliminary measure to decide whether or not State afforestation were within the bounds of practical politics, a Forestry Board should be appointed to prepare properly tabulated and ordered information on British silviculture, and above all to settle finally (1) what is the total acreage of poor "mountain and heath land" in Great Britain that will grow trees, and (2) what portion of that area it is advisable in the interests of the general community shall be afforested by the State.

It is necessary to emphasise the importance of this double line of inquiry, involving considerations from two separate standpoints which in previous inquiries have not been clearly defined.

Of the land on which trees can be grown to a marketable size, the practical forester is obviously the best judge. The extent of that area that it is advisable to afforest lies equally surely in the province of the economist. In the former case suitability of soil, exposure, climatic conditions, aspect, drainage, etc., are the governing factors. In the latter the test or standard must be (1) whether the economic subject, of which the land to be planted forms part, can by afforestation permanently maintain a larger and more prosperous population on the soil, and (2) whether the subject so taken can be worked at a profit, or at all events without great loss, to the State.

Of the extent of ground in Great Britain which will produce sizeable trees, we have had some interesting opinions which may, but equally well may not, be correct.

To ask a business nation to believe, however, that the pious opinions of individuals who have experimented with a few ten thousands of trees in a single county can be accepted as affording material certainty as to whether 150,000 acres, that is to say 600 million trees a year, can be planted in the whole of Great Britain and Ireland and that for an 80-year period, is to imagine that a contractor, asked to put in a tender for the removal of the sand from the Sahara, could base his calculations on the observations of the first statistically-minded of Cook's Egyptian tourists. It may be argued that the total acreage that will produce trees is a question of minor importance, it being only a question of degree involving a

larger or smaller scheme. From the purely silvicultural standpoint this is no doubt true, but unfortunately in dealing with particular areas there are other factors which require consideration.

It is probably a reasonable statement to make that a large proportion of "the subjects" available for afforestation (deer forests, sheep runs, grouse grounds, common grazing, and crofter "summing") are composed partly of low ground which can be planted, and partly of high, wet, or unsuitable land, on which experience has shown silviculture on a commercial basis to be impossible. It will also be allowed that the planting of any subject will interfere not only with the exact area which is taken for tree growing, but also with the residue of the unsuitable land thrown out of gear by the reduction of what is technically known as "wintering."

It is therefore a fair deduction to make—except where the land severed can otherwise be profitably employed—that in any area the proportion of plantable low land to unplantable "hinterland" will be the determining factor whether that area can be planted with economic success or with economic loss.

Let me put this in a concrete form. A sheep farm of 5000 acres with 500 acres of plantable valley ground might maintain some 2000 sheep including 800 breeding ewes. If the 500 acres of wintering were curtailed by a planting scheme involving the acquisition of say 100 acres of low-lying land per annum, the reduction would be one-fifth, not one-fiftieth, of the value of the farm. It might therefore be argued that, by the end of the second year of planting, when the ground capable of wintering the ewe stock had been very considerably reduced, the farmer would ask for and would receive compensation based on the valuation of the whole of the sheep stock and not on the two-fiftieths of the same, as the Erosion Report would lead one to suppose.

It does not require a profound knowledge of sheep valuations to realise that in a case of this sort the sum allowed (6s. per acre) would represent a very small fraction of the compensation that might have to be paid for every acre of land planted.

Take again the case of the typical deer forest of 10,000 acres with 2000 acres of wintering. It is conceivable, by careful management and by planting over an extended period

with due regard both to the sporting and silvicultural interests, that a portion of the low ground might in time be planted without materially damaging the forest as a whole, and that in consequence compensation might be kept within reasonable bounds. On the other hand, on a sporting estate with a small area of wintering, five successive years' planting without knowledge of local conditions or care of existing values, might conceivably reduce the monetary yield by 50 per cent., and the initial expenditure in compensation might make the afforestation of the area economically impossible.

But it is not to the economic side only that we must look in examining the case for afforestation. It is necessary to show the prospect of permanent employment, if not for more, at all events for the existing number of the rural population in any locality. In considering, therefore, whether the million acres of "poor tillage land"—suggested by Colonel Dudgeon and accepted by the Erosion Commission—are suitable for afforestation, it must be proved not only that these acres will grow trees and, after all claims for severance and valuations have been settled, grow them to a profit, but also that the small farmers, farm labourers, cottars, etc., dispossessed by the destruction of the old industry, can be replaced by a not less large population permanently employed in the new one.

The same principle holds good in the case of common grazing or "summing." Here the arable areas are usually small, and the individual interests depend absolutely on the hill ground for the maintenance of their live stock. Before taking such lands away from small holders, it would have to be shown not only that the scheme was economically sound, but also that in the altered conditions at least as large and well-doing a population could be maintained there.

There is a further economic question upon which the Erosion Commission appear to have hardly touched, and which affects not only tenant and landlord, but also each and every dweller in the country-side. I mean the question of rates. In Scotland, where nine-tenths of the afforestation area is situated, the rates in the poorer districts where "rough mountain and heath land" predominate, run from 4s. to 14s. in the pound. In many parishes, and notably in the Highlands, the sporting subjects are responsible for 45 per cent., and the sheep-farms for a further 20 per cent., of the local rates.

Now on the Commission's own showing, it is clearly set out that in the first forty years of afforestation there can be little or no annual return from the woods on which rates can be levied, and furthermore, that during these forty years the rateable value of a very large number of sheep farms and sporting properties will be adversely affected. With the present incidence of local taxation, is it an exaggerated estimate to make that in certain "favoured" parishes the public burdens for owner and occupier might reach 15s. to 20s. in the pound? The bald statement made in the Erosion Commission's Report that rates had not been gone into, as it was expected they would be more than met by sporting rents, may satisfy the paper enthusiast; but it can hardly be regarded with equal complacency by the average ratepayer. The feeling of anxiety will not be diminished when the following naïve confession is considered: -- "But their (the Commissioners) chief concern is not with the permanent employment offered by long-established forests, but with the temporary occupation that is associated with the establishment of forests" (Erosion Commission Report, Paragraph 68).

I bring these facts forward in their nakedness not simply for destructive criticism—I yield to no man in my belief in a well-thought-out scheme of afforestation as a check to rural depopulation—but rather to demonstrate that difficulties do exist, and that they are not got over by merely avoiding them. Enthusiasts in their optimism have wrecked many an admirable scheme by looking only at the attractive side of the picture, and timely criticism may sometimes obviate subsequent opposition.

If the facts I have put forward are correct, two general principles directly follow: (1) That the plantable area of poor "mountain and heath land" under 1000 or 1500 feet is not necessarily co-terminous with the area that it is advisable, in the interests of the body politic, to afforest; (2) That even of that area of poor "mountain and heath land" that will "stand" planting, a considerable portion, probably the greater, lies on the border line between possible success and prospective economic failure, and that it is only by the best management, by the closest study of local conditions, and by a reduction of the initial expenditure to a minimum, that satisfactory results can be obtained. It is with these inherent difficulties in view

that I would urge the examination of the schemes set out by the Erosion Commission Report, and the letter of Mr Munro Ferguson and your anonymous correspondent (R.S.A.S. *Transactions*, Vols. XXI., p. 135, and XXII., p. 8), in order to consider not only the merits of each and how far they are mutually supplementary, but also more particularly—for therein lies the solution—to which class of land each is best applied.

#### AFFORESTATION BY THE STATE.

It is a curious fact that all discoverers of the new republic start their Utopia from tabula rasa either by blindness, more or less assumed, to existing facts, or by an imaginary transfer to the islands of the blest. The modern silviculturist collectivist, as represented by the Erosion Commission, and in a limited sense by Mr Munro Ferguson, is not less callous, or shall we say optimistic? The interests of the evicted farmers are dismissed with the curt phrase: "The tenants will probably find holdings elsewhere" (Erosion Report). The rural population is given the scant comfort that it is not with permanent employment for the countryman, but rather with the wastrels of the towns that the Erosion Commission is mainly concerned. Mansion-houses, according to Mr Munro Ferguson, are to be bought and sold, apparently without reference to the feelings of owners or occupiers, provided only that no loss will accrue to the State. Farms and villages according to the same authority are to change hands, and if there is any signification in the phrase, "Where also the State and local authorities could well conduct to the best advantage popular (sic) experiments in small holdings," the era of the State nationalisation of land is to commence.

As far as can be gathered from the Erosion Commission's Report—though here, Mr Munro Ferguson, with his knowledge of silviculture and great practical experience, holds very different views—the pathway of progress to 9,000,000 acres afforested is to be simple and straightforward.

In the "Golden Age" time is not of moment; Boards will grow like mushrooms, and trained "Forstmeisters" blossom forth before the foundation of training colleges are laid. Vast areas will be controlled before experience, built up on hard years of administrative work, is acquired. No rabbit so bold as to eat his way through a paper regulation; no squirrel so

abandoned as to reduce the value of a 70-years' rotation to less than £195 odd per acre.

Now this is charming, but is it practical? Can we reasonably expect that a scheme, equalling in magnitude the operations of the centuries-old German forest department, can be started ab ovo without Board, experience, or foresters, and avoid failures on an equally comprehensive scale? Can it be argued from what we know of municipal trading that this, the most difficult of all communal undertakings, can be carried on without certain waste, even if the cruder forms of leakage are prevented? Again, before Parliamentary powers are obtained, before plans and surveys have been made, before the training colleges have not only been built but also begun to produce foresters, how many years must elapse? Our one afforestation experience is no happy augury. It has taken ten years' agitation to purchase the Government's ewe lamb—Inverliever. It is a significant fact that after two years' occupation not a tree has been planted, and the only overt departmental act has been the removal of the one crofter inhabitant, and the giving of notice to sheep farmers that their leases are to be terminated. To build up an industry requires brain, application, thought; to destroy one, a little wind in Parliament and the stroke of the permanent official pen suffice

While the difficulties in the way of a State Afforestation scheme are enormous, let it at once be admitted, that there is much the State can do, and do better than the individual entrepreneur. As a broad generalisation, all that appertains to pure forestry—if I may use the term—readily falls into the province of a State department; and equally certainly all that may be classed as local forestry (estates, surplus land, etc.) is better left to the enterprise of the individual—aided by the State if occasion demands. In order to obtain the all-important advantages of continuity of management over woodland areas, and so far as possible benefit the State, probably all practical men would agree that the procedure must be on the following lines, viz.:—

- (1) The formation of a Central Forestry Board, without which no forest scheme, or even a plan for the making of a forest scheme, is possible.
- (2) The acquisition of experimental and demonstration areas—not like the poverty-stricken Inverliever, where

the trees have yet to grow before demonstration can begin—but centrally situated, well-wooded estates with plantations of various ages (not over-thinned) containing suitable land for planting and timber limits due for felling, sufficient in size to give experience and education in administrative work, and with large enough woodlands to combine practical demonstration of approved methods with experiments in new ones.

- (3) The establishment of a school, or schools, for foresters at, or in, the vicinity of the demonstration areas, capable of turning out a supply of uniformly trained foresters in sufficient numbers to control the State forests' areas as they are planted.
- (4) The survey of mountain and heath lands of Great Britain and Ireland, the formation of schemes, division into districts, and the appointment of inspectors.
- (5) And finally, the scheduling and gradual afforestation of such blocks of poor "mountain and heath lands" as can be planted to profit by the State, and in which the unplantable area left on the hands of the Commissioners does not represent an important proportion of the whole subject taken.

It cannot be too strongly urged that until an Administrative Department, necessarily selected for silvicultural knowledge, has had experience in dealing with estate work and the many and varied interests connected with land, the simpler the proposition undertaken, and the less "moiling" with the affairs of tenants, improvements, shootings, way-goings, etc., the greater the probability of success. There is no royal road to successful forestry, and only individual attention and unremitting care can give the return the Erosion Commissioners so confidently anticipate.

#### CO-OPERATION OF STATE AND LANDOWNER.

While in general agreement with the scheme of your anonymous correspondent (R.S.A.S. *Transactions*, Vol. XXI., p. 135) as a necessary supplement to any plan of State afforestation, I consider that there are certain relations in the work of co-operation between State and landowner which require further definition,

and for the sake of clearness I beg to put forward the following suggestions:—

- (1) That the State should provide the money necessary for the establishment of forests at a low rate of interest.
- (2) That the landlord should provide the land, and should be credited in the joint account with its unimproved capitalised value, at the same rate of interest.
- (3) That the work of afforestation should be done by the local expert (the landlord or his forester) supervised by the Departmental expert—the Government Forest Inspector.
- (4) That the landlord should retain the "solum" and sporting rights, but should he exercise the latter to the detriment of the woods, the Government would have the power (a) to interfere and effectually control the game, (b) to charge wanton damage against the landlord's account and share of eventual profits.
- (5) That parallel columns, profit and loss account, should be keptforthe expenditure by State and landlord; that credit should be given for any money spent by either party and for the interest due thereon. That at the first felling a balance should be struck and profits divided pro rata, according to the aggregate disbursements made.
- (6) That at any period the landlord should have the power to buy out the State—(a) By repayment of the capital sum expended and interest due; (b) By repayment of an additional bonus at the time of final felling, this bonus to be a percentage on the "present value" of the State's prospective profit, calculated at the time the sale was concluded.<sup>1</sup>
- (7) Should the landlord exercise his option of purchase he should be bound under a penalty (subject to certain reservations) to replant and maintain as woodlands, under proper silvicultural conditions, all land on which public money had been expended.

The modus operandi would be as follows:—A scheme for State-aided Forestry would be laid before the Central Board,

<sup>&</sup>lt;sup>1</sup> As the option of buying out the State lies with the landowner, it is necessary to exact a bonus in cases of repurchase, in order to cover any losses to the State which might occur in plantation failures, when the optional powers would obviously not be exercised.

who would consider the price of land, the compensations due to tenants for severance, sheep valuations and disturbance, the suitability of the soil, the prospective yield, the probable number of men to be permanently employed, and the injury done to existing industries. If the scheme were considered practicable the Board would proceed to call for tenders for planting, specifying the age, the species of plants, the method of planting, and the number required per acre. Provisional contracts would also be made for fencing, draining, killing beetles, switching bracken, removal of timber, etc. Arrangements for "bushing up," rabbit killing, vermin destruction, fire breaks, etc., would be made and penalties agreed upon.

After the Board had satisfied itself not only that compensation claims and initial outlay generally would leave a fair margin of profit, but also that the forest work could be carried on at a reasonable cost, it would sanction the scheme, and the work would be begun.

The principal argument raised against State aid to the private owner is that it implies a certain measure of dual ownership and control. This alone in the eyes of the more "phraseridden" is enough to condemn it as something necessarily vicious, vaguely—but by some subconscious mental process difficult to arrive at—inseparably connected with agrarian crime and misrule in Ireland.

It is worth while inquiring if this is a very enlightened view.

Dual control may be, and often is, a hard necessity, nevertheless it is a permanent factor in our everyday life, and to ignore it is not to face facts as they are. Every business, every farm, every estate that is run on borrowed money, every contract, every delegation of command by a central authority, implies a measure of dual control, and in some cases of dual ownership also. Yet it must be allowed that the path of progress is towards decentralisation and extension of local responsibility, and that in finance the tendency is towards the increase of turnover by expansion built up to the limit of borrowing powers. Is this consistent with the inherent evil suggested?

A little straight thinking will show that the evil of dual control is not "of itself" but in its application. Dual control with dual ownership is possible where there is unity of purpose, it is smoothly successful where there is in addition, similarity of method, but it is unworkable where there is a divergency of

objective between the principals concerned. It is this similarity of objective which has made the Crofter Act workable in the Highlands, and the Irish Land Billimpossible in Ireland; which in Army affairs, in spite of prophets of evil, made the Company system, as opposed to the Adjutant or Regimental system, the high road to military efficiency. It is community of purpose, taken in conjunction with similarity, or divergence of method, which is responsible on the one hand for the smoothness of working between the "sound company" and the bank financing it; or on the other, for the friendly but standing feud between the "go ahead branch," and the central office, or the little rubs between the Railway Directors and the Board of Trade.

The question therefore of importance in any State-aided scheme is not the measure of dual control, but whether the purposes and methods of the two contracting parties are identical. Is this likely to be the case? The answer is surely yes! The objective is the same—well-grown woods under the best silvicultural conditions, and at the least possible cost. As to method, there may at first be differences, but even these will tend to disappear as silvicultural education becomes standardised and experience of the administration of wide areas is acquired.

As has been pointed out afforestation work will be mainly conducted by contract, with specifications clearly laid down before hand, and it is difficult to see why trees should not be dibbled in 4000 to the acre with the same accuracy and satisfaction to both parties, as when a crofter contracts to build a dry dyke or Lucas and Aird erect a Barrage on the Nile.

Another argument that is used against State-aided Afforestation is that the landlord might get too high a return for his land. There is no reason this should be the case. Should the landlord wish to buy out the State, it is proposed that, apart from the return of the whole money advanced by the State, a further bonus should be paid, the exact amount of this bonus depending on the ultimate prospective profit, and the increment of wood added during the State's period of investment. While there is no reason why this bonus should be fixed so low that the landlord would make too large a profit, it is advisable in the general interest that the purchase clause should be made sufficiently inviting to make sales the rule not the exception.

It must never be forgotten that funds for afforestation will be always hardly won from a reluctant Treasury; also that there

are fixed limits beyond which it is dangerous for even a Government department to expand. If afforestation is to be really effectual as a check to rural depopulation, it must be on a scale so extensive that any factor tending to reduce expenditure, or broaden responsibility, must be viewed with favour.

Under the purchase clause every sale by the Government sets free money for new forestry schemes, and the risk to the State is *pro tanto* diminished, while at the same time the central idea "more woods at less cost" is kept in view by the servitude binding the landlord to keep under forest all lands on which public money has been expended.

If the objections to State-aided forestry are considerable the advantages gained are not small.

In the first place, by co-operation much land will be afforested which could not be planted with economic success if the State were acting alone. In the interference with the two great values—agricultural and sporting—and the substitution of a new enterprise, forestry, there must of necessity arise a gradual but far-reaching rearrangement of landholders, boundaries, interests, and a re-adjustment of equipment (farm buildings, lodges, etc.), and a temporary dislocation of trade requirements. It is very obvious that such a work of re-organisation can be best done by those who are conversant with estate management, rather than by a central body primarily selected for quite other work. Compensation in kind for land taken, re-grouping of farms, and of lands perhaps outside the scheduled area, temporary grazing rights, can all be arranged with less friction and at less cost by private individuals than by the State.

Again the "surplus land" question can be more easily tackled by the landowner. It seems hardly realised that if the State alone secured three million plantable acres in the Highlands, the lairds of the North would be administering a few thousand acres of arable land on the Coast, while the Forestry Board would be saddled with a total area to be reckoned in millions of acres, including the unletable blocks of hinterland of most if not all the deer forests in Scotland.

But there are other arguments equally weighty. Under the co-operative scheme no purchase money would be paid out for land. Taking the Erosion Commission's figures as correct, this would at once double the area that any given sum supplied by Treasury would afforest. Again, there would be a great saving

of time if full use were made of existing organisations. There would be no necessity to wait for the army of State foresters, administrators, surveyors, etc. Once a Central Board had been appointed each scheme proposed could be considered on its own merits, and contracts made and work proceeded with under the local forester.

Apart from the reduction of the initial cost there would be a considerable saving of expenditure in actually carrying out the executive work. Local control would ensure efficient labour, while past experience would secure cheap rates of planting and suitable plants.

Finally there is the question of game in its double capacity of "revenue producer" and "tree destroyer." From both standpoints the game question is more easily handled by the landlord acting with the State, than by the State alone. The keeper in the permanent pay of the landlord will do better work at less cost than the hired trapper, whose main object is but too often to leave "stock" sufficient to ensure his services being required another year.

In maintaining the rents for game and thereby limiting compensation claims, the advice of those who have made the matter a life study cannot be altogether devoid of value.

There is nothing the forester is more apt to forget than that  $\mathcal{L}_{\text{I}}$  per acre sacrificed in initial expenditure (compensation for loss of rent, etc.) represents  $\mathcal{L}_{\text{IO}}$ , 12s. at the final felling, while the sacrifice of a few trees by opening woods to deer say at twelve instead of twenty years, or the partial injury to a few half acres for pheasants' rises, represents no such great loss.

#### Conclusion.

State Afforestation has been for many years before the public. It has its regular cycle of interest, enthusiasm, and apathy. It has its recognised opponents who doggedly resist its every move, and it has its votaries who are enthusiastic, often it must be confessed by their very narrowness, only to destroy.

There is reason to suppose that the present moment is one in which the public might be persuaded to act—over-crowding in the towns, unemployment, and the report of the Erosion Commission have all tended to focus public opinion—the opportunity if lost may not occur again.

Though there may be difference of opinion as to method, the general line of action is clear:—(1) The Forestry Board and an official survey. (2) Experimental areas. (3) Afforestation, whether State-aided or not, set about tentatively and in carefully selected areas. So may success silence the critics, and experience, gradually but systematically gained, pave the way for enterprise on a larger and ever-increasing scale.

## 21. Afforestation.1

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

It will become me, and suit my audience also, perhaps, if we discuss British Silviculture in its practical aspects. We succeed best in this country by grappling with actual facts, rather than by foreshadowing ideal possibilities, or constructing highly detailed technical schemes. It is perhaps the very defect of this quality which has blighted British silviculture, for a crop which takes 80 to 200 years to mature, necessitates a long look into the future, and a good deal more planning than a field of wurzel. I am, unhappily, no trained expert, but having associated with experts and foresters through that part of my life which I have been able to give to forestry, my private conviction is that to secure success the expert and the practical forester must work together. Progress is slow whilst they revolve in different spheres, and a certain aloofness between the man with the pen and the man with the tool is the origin of weakness in more than one industrial sphere, for when skilled pen or tongue fancies itself superior to skilled hand and eye, the feeling is cordially reciprocated, and progress is nil. Everything is so easy on paper,—Trees grow; the unemployed plant; towns are depleted of surplus population; profits pour in; the rural population increases in numbers and accumulates wealth. A couple of hours steady writing does the thing. But the practical man scoffs and recalls the last drawing of that great wit. artist, and thinker, Caran d'Ache, in which a "French Volunteer" in a wonderful get-up informs a Pomeranian Grenadier "Que

<sup>&</sup>lt;sup>1</sup> An address delivered at the National Liberal Club, in London, on 22nd April 1909.

nous sommes déjà au fusil à pensée," and the Pomeranian replies, "Ach! pour nous, nous sommes encore au fusil à balle."

It is comparatively recently that the politician and the writer have taken up forestry, and meanwhile something has been actually done to bring theoretical and practical silviculture into closer combination. And it was time, because public attention is at length drawn to afforestation, and there is a danger of its future being compromised by its transformation from a highly skilled economic industry to a form of relief for the unemployed. With a few scattered exceptions, it cannot be said that we have as yet any organised silviculture-meaning systematic growth of the largest possible quantity of the best and most profitable timber upon any given area. Our present position is that we have 4.000.000 acres or so of woodland worked over all at a dead loss. A few landowners and their foresters have shown what our soil and climate can do when properly utilised. The State has remained inactive. Crown woods are still for the most part models of what they should not be. The State has provided, sometimes lavishly, for almost every kind of training: it has done next to nothing for silviculture, in spite of the fact that this industry makes the greatest demands on training.

The Government of India trains its forest officers at Oxford, but sends them abroad for their practical course. We cannot supply that training, nor are we in fit condition to emulate forthwith our European neighbours and adopt a large plan of national afforestation. We have not reached the stage of training, or attained the standard, in silviculture, that we have in agriculture. A farmer who left his roots unthinned, or allowed his corn to stand until shaken out, would excite notice, unfavourable comment, and possibly active restraint, but the forest owner committing equivalent absurdities escapes detection. One disadvantage from which private ownership suffers is that it cannot secure continuous good management throughout the growth of the crop, partly for want of trained foresters, and partly because the legislature has so far removed the control of the dead hand that no forest plan can be made permanent; and without continuous good management and a settled policy there can be no silviculture. There is no track laid by usage and tradition which the average unenlightened owner and forester may follow mechanically. Until quite recently they have not had any facilities for acquiring knowledge, while

even now facilities for theoretical training are few and superficial, and there are no object-lessons in silviculture, save those due to individual experiments. We have to set up a true standard of excellence in silviculture before we can either improve existing woodlands by State or private enterprise, or rightly afforest the waste partially-utilised land suited to timber. Until we have such a standard we need not expect to have any successful silviculture carried on by owner, corporation, or State.

In my country there ought probably to be the same area under silviculture as under agriculture, or about 41 million acres, but without a survey the areas available in that or any other part of the United Kingdom are mere guess work. All that is certain is, that several million acres in the United Kingdom now under heather or rough pasture are eminently suited to afforestation, and that there is no reason why our silviculture should not, like our agriculture, be the finest in Europe instead of the worst. Actual facts suggest action on a large scale by the State. It is to be noted, however, that eminent authorities maintain either that afforestation, like any other business, is best left entirely to private enterprise, or else that it could best be developed by State loan, applied under State supervision and control, the owner pooling his land, and the State the costs of stocking, the profits being allocated so as to remunerate both parties. Purely State Afforestation is objected to on the grounds that the Nation is embarking on an immense speculation, with which it is traditionally and otherwise unfitted to cope; that State employees would be immensely increased, and that they have given rise to enough trouble and corruption already in many constituencies; that the position in France to-day, in this respect, is not one to emulate. To the nationalisation of many undertakings these objections would apply, but the advantages the State has in dealing with silviculture are wholly exceptional, and sufficient to outweigh the disadvantages. The State can provide a management that never dies over operations covering a century or even two. It can afford to have its capital locked up for this lengthy period; while on the other hand, the area to be dealt with is so large that it must be developed on right lines, and under one general scheme, so as ultimately to secure a definite and certain supply of timber in view of a probable shortage in the world's output. From the commercial point of view, a patch of one kind of timber here and another there, a large supply at one moment and practically none at another, is useless. To secure a market the product must be of equal quality and quantity continuously supplied. In forestry finance the State (or the Corporation) has advantages over the individual, in addition to the considerable one of being able to borrow money at a low rate. It pays no death duties, which by their inequality operate injuriously on private forests. Timber on a rich estate will pay no death duty, whilst on a poor one the full duty exigible may fall with crushing effect upon the timber, and this tends to bring forests prematurely to the axe.

This at least is certain:—either the State must itself extend the timber area, or else it must advance the costs of stocking, to responsible individuals or corporations, and provide the management to safeguard its investment. The latter course involves divided responsibility, always a doubtful expedientespecially in forestry, where ground game and squirrels, wind and fire, disease and neglect, may ruin any plantation in a few hours, weeks, or years. If I hazard a suggestion at the present stage it would be that the State should take the main part of the work in hand; that the initiative of the private owners should be encouraged; while it may even be found expedient to indulge in a certain measure of combination between the State and the individual,—once, that is, we have an established Board of Forestry with its recognised standards of good practice,—for the problem of severance and the liability for claims becomes so serious in dealing with small areas that this special difficulty alone may require circumvention. Co-partnery proposals present great difficulties, whether to the State or the individual, but should not be absolutely ruled out as an accessory to the main effort. As a matter of fact we need not tie ourselves down to any particular dogma, if only because there is plenty of time to think over these three lines of action.

The immediate requirements are:—adequate provision for thorough training; a survey of available land; a general scheme based upon ascertained facts, the whole interests of forestry being centred in a responsible Department.

In Germany, whose woods are, along with those of Switzerland, perhaps the best managed over all, the ownership is divided amongst landowners, corporations, and States. The

governments make provision of every kind to stimulate and protect silviculture, the result being that some 4 millions of the population exist by it and its attendant industries, and land worth 3s. an acre per annum in the Sachsenwald becomes worth 50s. an acre in producing spruce for wood pulp, an industry so perfected that a tree growing at 5 A.M. has been sold in the street in the form of newspapers by 10 o'clock, 5 hours later. In Germany there is no hard and fast system of tenure or procedure. Some private forests are under the control of State Forest Officers, others are not; in certain cases owners are under the obligation to restock felled areas. The advice of State officials is often given free, plants may be provided gratis, or taxation remitted. No aspiring forester lacks facility for training in school and college, forest school, or university. Twenty years ago there were 7 Chairs of Forestry in the one University of Munich. As a result, we find everywhere the most rigid teutonic habits of continuous good management, regular clean fellings, and uniform annual income, so beneficial alike to producer and consumer. German timber is largely of the coniferous varieties, which constitute 87 per cent. of our own imports, and in which the world's shortage is most imminent.

In France there is a more centralised organisation, with its magnificent School at Nancy. A larger proportion of her forests are hardwood, often managed on the selection system, so well suited to English proclivities and to Indian necessities. There may be greater inequalities in French administration, but here, as in most other European countries, there are admirable results. Natural woods are fast disappearing. In Scandinavia the saw-mills are rather too good for the silviculture.

Russia, with the chief reserve of European coniferous timber, has so prodigious a domestic consumption, that the balance exported from the Baltic must diminish.

Meanwhile the wastage in the U. S. A. and Canada, and in Australia, was and is incalculable. Mr Roosevelt inaugurated a serious conservation policy, much of it necessarily of a superficial character; and in the far and lively West a forest officer's main recommendation sometimes consists in being a dead shot.

Our own supplies are drawn almost entirely from abroad, our home grown timber being limited in quantity, and through

neglect and ignorance inferior in quality. We import about f, 30,000,000 worth, and evidence is practically conclusive that we could well produce the bulk of it at home—an objective worth pursuit. Timber is a permanent need. It is true that some substitute continually supplants it for certain purposes, but some new demand arises even more frequently. We could produce all our own wood pulp, but we produce none. Whole populations amongst the western nations of the new and old worlds live in wooden houses-which are not only suited to small holdings-for which the cost of an English model cottage is too great a burden—but also afford the best accommodation at lowest cost, even in severe climates. It is significant that Dr Schlich has reviewed somewhat pessimistically the question of the world's supply and demand, and in that connection we ask ourselves what is the home area, and what crop can it raise? Protection we may once more set aside, for timber duties were about the last to go, and did nothing to stimulate the infant industry. We have had three official Forestry reports in less than 25 years, besides one or two for India, and many unofficial views have been expressed—reports and opinions of various values, but received until to-day with obvious indifference by the public and its rulers. The report of the Commission on Coast Erosion deviated somehow into Afforestation, and created an artificial connection between it and urban unemployment. recommendations are calculated to erect an elaborate superstructure on inadequate foundations,—and though that has not rendered it the less effective in bringing afforestation into favour, it makes it all the more necessary to take the immediate steps, long since officially recommended, to provide for organisation, survey, training, planning, co-ordination, and negotiation for purchase. We must create a working machine which will provide scientific economic control for the main operation. Even to organise a large landed estate on sound lines is not a matter to trifle with, and national afforestation is not only a tremendous undertaking, but one for which straw has vet to be gathered to make the bricks. To attempt to afforest without staff, organisation, training, experiment, and survey would be sheer folly. Even our experts cannot be trusted, for their sphere of practical experience in this country has been so limited as to render their guidance of only partial reliability. To avoid disaster and the disappointments we practical planters

have experienced, there must be a properly constituted State authority. This should be either a branch of the Board of Agriculture, or better still, a separate Department under the Treasury. It should take over such provision for training as now exists under the Board of Agriculture, the Woods and Forests Department, or the Education Departments, and develop it into a complete system. The Board or Department should set up two, or perhaps three, Forest Schools. It should acquire several large well-timbered areas to serve as Demonstration Forests, where, as well as in Forest Gardens and in combination with private scientifically-conducted woods, experiments of all kinds would be carried on. These would embrace nursery work, methods of planting, mixing varieties, thinning, under-planting, transport, and marketing. In these schools and forests, foresters of all grades would get technical training. There also working-plans would be drafted and some of them applied. Staffs would be selected and organised, as experience was gained, for the larger operations to follow. The expert and the working forester would rub shoulders together, as they set about bringing 100,000 acres or more of Demonstration Forest into full bearing and proper rotation. Eight or ten years must elapse before this side of the Board's work is sufficiently advanced to enable it to advise Parliament as to a general scheme, or to carry out a scheme without loss or failure. Parliament can then take its final decision in comparative confidence, and leave the enlightened Forest Board to lay down and carry out the work of National Afforestation. Meanwhile the Board of Forestry will have trained skilled wood managers for woods privately owned and worked. It will have set up a standard of silviculture to which all will endeavour to conform, and which would render co-operation between the State and the individual less hazardous than it would be to-day. Broadly stated, it should be able to rely on private enterprise to cope with the improvement of the 4 million acres of existing woodland, and even a larger area, with State co-operation. There might be in Scotland, perhaps, 11/3 million acres under private or communal ownership (municipal catchment areas should be afforested), leaving possibly three millions to be nationalised at probably much the same cost as Inverliever, say £2 an acre. £5 an acre should cover purchase and stocking. This expenditure of  $f_{15}$  should make a return eventually of at least £50. Indeed, under Larch, land worth 30s.

may, with the underplanting, yield a crop worth £, 150 an acre. A forester is required for every 100 acres (instead of a shepherd or gamekeeper for every 1,000 or 2,000), not to speak of the eventual attendant industries under private management which should employ two or three times as many skilled hands. No British accounts can be produced to prove this, because until recently no books have been kept-and such accounts as we have mostly show a loss; but this at any rate is quite a fair anticipation, from home and foreign data, to justify the action proposed. Hardwood plantations are more costly to stock, and all parts of a forest are not equally remunerative; we should begin with the cheaper, more easily stocked soils over large acreages, which afford the surest prospect of financial and social success. The Survey would estimate the area best suited to private initiative, and experience would show how far the State and the individual could actively co-operate, what area the State itself must deal with, and what are its probable liabilities and prospects in so doing; how far common rights in England and Wales should yield to afforestation, and how far out-runs to farms can be curtailed without disaster to agriculture, and without unduly rousing agricultural opposition. In Ireland public opinion cannot be counted on to favour afforestation, even when under the popular auspices of County Councils, whose plants, I understand, have been removed by an unsympathetic public. Elsewhere grave obstacles must be met and dealt with.

Forest plans will be prepared to lay out the lands and arrange for an annual average yield, so as to insure steady income and employment either on a clean-cutting compartment system, or on the selection system, i.e., felling ripe trees in forests stocked with those of all ages. These plans would show the order in which land should be acquired, the areas to be stocked annually, and how. The work of survey and preparation of plans must take years. In the Highlands, where great areas can be most easily acquired with fewest complications in transfer, there will be two main difficulties—the effect of afforesting winter grazings (plus the future utilisation of what remains); and the bearing of these operations on the incidence of local taxation. Admit that—great as is the revenue derived from sport, and beneficial as is usually its expenditure-society would be on a sounder footing had the Highlands never drawn a shooting rent, since reliance on sporting values has discouraged solid industrial enterprise, yet the hard

fact remains that many Highland parishes, and some counties to a large extent, are dependent in the main on sporting assessments for local revenue, especially where there are many crofts which under the Crofters' Act are rated, where crofters have made their own improvements, on the low scale of their land alone. Highland rates being already sometimes well over 10s. in the pound, the financial consequences of general afforestation of those winter grazings, which contain the most profitable silvicultural area, might conceivably render a 20s. rate inadequate for local government requirements. This is quite a possible contingency, unless the Chancellor of the Exchequer redistributes grants in aid according to the recommendations of the Minority Reports on the incidence of local taxation; for rates on plantations, as on crofters, rule low, and a disappearance of the sporting and sheep farm rents from some assessment rolls (these being the values on which the normal rates are mainly levied) would in many instances at once provoke a financial crisis. It will be a delicate matter to withdraw from existing holdings the land really required for afforestation, and to re-allocate the portions unsuited to silviculture; for the great economic problem of the Highlands is winter keep, and this is found below the 1000 ft. level, which is as a rule the upper limit for profitable silviculture. Above that line most of the area would be most profitably allocated to sport. Where the Crofter Acts operate, little can be done for silviculture, and elsewhere the problem of re-allocation being serious, the afforestation of small areas is better left to the individual. The best sphere for the State lies in the purchase by agreement and compulsion of large grazings or whole estates, thereby minimising claims for severance damages. What is not wanted for afforestation can then be re-allocated for sport, or in the case of arable land for small holdings, which fit in well with silviculture. What is certain is that any hap-hazard scheme, arbitrarily applied, would meet with united opposition in the Highlands or anywhere else. What is, and what is not, practicable will be made apparent by the survey. This once settled, we can concentrate on the respective capabilities of scheduled lands, and get reliable figures as to the cost of stocking respective areas. This varies from 40s. an acre on the heathery slope to £10 an acre for ordinary English hardwood plantations. The supply of local labour and its quality will be ascertained, and the cost-in the absence of

local or efficient workmen-of settling Forest Colonies. We shall learn also what, if any, openings can be found for temporary or casual employment, as to which no forester is sanguine. The fact is that as silviculture extends it creates a sphere for local skilled employment, which remains practically closed to the urban unemployed. Silviculture will keep people on the land it will not provide for surplus urban unskilled casual labour in times of emergency. It is one of the most highly skilled amongst rural industries. Every detail from the nursery to the saw bench requires skill, while the actual planting should only be undertaken by experienced hands. Any of these operations if bungled may mean all the difference between profit or loss on the crop, and, indeed, the want of skill in our professional foresters accounts in some measure for the economic failure of their industry. Ignorance and game are the ruin of British woodlands. Abroad the damage done by deer in Germany and by hares in France is often serious, but is mitigated by professional capacity. Surely if the ignorance of the best of us is a stumbling-block, the inevitable consequence of letting loose upon the State Forests the temporary clients of Urban Distress Committees would be to add enormously to the disadvantages under which Forestry has hitherto laboured. is a proposal which no forester can understand; for to combine silviculture with relief works spells certain failure, unless indeed such labour is restricted to piece work on roads in summer, and that is obviously the last operation to be taken in hand.

The divorce between our urban population and the soil is a national calamity. The cure seems to me to lie in the extension of intensive cultivation round populous centres, adjacent to the urban home, and in surroundings to which people are accustomed. If you rarely attract the townsman to the land, you will as rarely fail to keep the countryman upon it if you give him openings for self and family, and the Nursery work provides splendid training and employment for many boys. One of my gardeners came to Novar entirely because he had a large family of sons, and knew that they would all find employment leading on to skilled occupations. This is just the type of family that usually drifts into the towns. Silviculture gives an even more steady employment than does agriculture, and it is these regular employments which our present day social system lacks. The necessity for fostering them

is the great truth that lies behind the cry of back to the land. It may be that legislation following upon the Poor Law Inquiry will, either through labour colonies or classification of the unemployed, alter present conditions. Meanwhile we have to proceed on ordinary commercial lines, getting the best men available to do the work.

We have to treat afforestation, in short, as the development of a neglected branch of our social economy, as a matter of ordinary business, and to follow the lines of least resistance, so far as they are effective. Any question as between land nationalisation and private ownership will solve itself in the light of experience. There is general concurrence that large areas should be nationalised for silviculture, and that is sufficient for believers in State forestry.

All depends on the preparatory work done in the next decade, and this cannot be too soon begun. We start, fortunately, at a time when those blessed, if wearisome, words "co-ordination" and "organisation" begin to influence our methods, and assuredly these are the watchwords for Silviculture.

My aim is to invite suggestion, not to lay down the law; I know enough to avoid that. If in so doing I have given elasticity to some of my previous contentions when urging some one line of action as against another, it is to ensure that no contribution of any value shall be kept out of the pool,—for nothing should be lost or neglected which can help us to realise our great end, viz., the full utilisation of the poorer soils adapted to silviculture, and the ample development of all natural resources, with a view to providing full employment for our people.

# 22. The Royal Commission on Afforestation: their German and English Critics and remarks thereon.

By BERT. RIBBENTROP, C.I.E.

The Royal Commissioners held fifty sittings, examined eighty witnesses, and have recommended a truly gigantic plan. By it they have once more convincingly brought before the public the vital importance of large and conservatively managed forests, and their beneficial effect on the economic development of any country, and have proved that the creation of such forests in these Islands must be made a national undertaking. In Germany this result is fully recognised and highly praised.

The form of the Report (evidently both of the two parts are referred to) is somewhat severely handled by the German critic Dr Moeller, who condemns it as vague, badly arranged, fatiguing on account of its numerous repetitions, and generally purposeless. He evidently does not appreciate the drift of the Commissioners, and excuses the unnecessary elaboration of the Report by the supposition that it was meant for an assembly more or less ignorant of forestry, as understood in Germany, and in which an interest in real silviculture had still to be awakened; for, he continues, "with as yet few but increasing exceptions, the Briton though an excellent arboriculturist is not a forester." Dr Moeller, in comparing the existing state of forest conditions in Germany and England, writes: "In Germany a large proportion of the original natural forests was, owing to the political and economic development of the country, saved from destruction, and was in most instances brought under conservative management before the forest soil had deteriorated. On considerable, though comparatively small areas, the forests were destroyed and the character of the forest soil was lost, leaving no option but reafforestation, for though a considerable percentage of the country is forest-clad, a further large increase in the forest area is recognised to be a matter of national importance. England has lost its compact forest areas and the Commissioners Report conclusively shows that, under existing circumstances, an amelioration on a sufficiently large scale cannot be expected, unless the State intervenes." "They now," the critic continues, "desire to create in that country, under the political, social, legal, and economic conditions of the twentieth century, in the course of sixty years, results similar to those which Germany owes to many centuries of historical development—a veritable labour of Hercules!"

The Commissioners' estimates for afforestation are considered excessively high, amounting to double the actual cost in Germany of similar operations with hole planting, under the most difficult and expensive conditions, and including the cost of planting material. The costliness of the work is ascribed to the proposal to utilise the labour of the unemployed, which, for all cultural operations is condemned as unsuitable and unnecessarily expensive in Germany, where women and boys are employed on the actual planting, and where one foreman is employed to twenty or thirty labourers.

It is noted that the Commissioners' scheme extends only to such areas as have been actually acquired by the State, and that it contains no final proposals for encouraging private parties to participate in the national undertaking. This is unfavourably compared with the action of the Prussian Government, who undertake the supervision of all village, communal, corporation, and institution forests gratis, and grant considerable sums to poor communities for the afforestation of their waste lands in hilly regions. The success of the scheme, both from a silvicultural and financial point of view (land and money being forthcoming) is fully accepted, but it is considered problematical whether, even under such circumstances, the arguments of the Royal Commission, collected with great industry, will be sufficient to move the English Parliament.

All the British daily papers have commented on the afforestation scheme evolved by the Royal Commission, but the most valuable and only real criticism I have read is contained in a paper read by Dr Nisbet at the fifteenth ordinary meeting of the Royal Society of Arts. It is a well considered and practical article; still I fail to see why, with reasonable deductions for unexpected disasters, estimates should not be framed as regards future silvicultural and financial possibilities for periods sixty or eighty years ahead. As a matter of fact, Dr Nisbet does this himself in the paragraph preceding that in which he criticises the actuarial calculations, as he calls them, by saying that on an average a 60-year-old

wood should yield about 100 tons (5000 c. ft.) of timber per acre. Personally, I see no reason for questioning Dr Schlich's estimates, though I prefer to make, at the outset, some deduction for possible disasters. Dr Nisbet accuses the Commissioners of, whilst quoting many examples of profitable forestry in Britain, deliberately suppressing all mention of dead failures, a charge which, however, is hardly substantiated by facts, for, in paragraph 21 of the Report, failures in abundance are acknowledged; and a study of the evidence which the Commissioners had before them shows that such failures were in many instances due to avoidable causes, such as attempting to cultivate trees in lands unfit for any forestry work, the faulty selection of species or wrong methods of cultivation, and I consider that they were right in basing their calculations of future possibilities on successes only.

The (doubtlessly reliable) data, regarding the financial success of forest management in various German states, which the Commissioners quote as an additional base of their forecasts, are, as Dr Nisbet points out, not applicable in this respect, not because social, climatic, or geological conditions would render such comparisons unjustifiable, but because they refer to large forest areas of which afforested waste lands form but a small part. Dr Nisbet suggests that a comparison with the results of the extensive afforestation schemes carried out in Prussia since the middle of last century would be more to the point. I do not agree with this, for these figures would embrace the numerous and heavy losses incurred during the prolonged period of successive failures, and thereby give the impression that the afforestation of waste lands is under all circumstances an unprofitable undertaking. That this, however, is by no means the opinion in Prussia, is evidenced by the fact that the Government bought 213,710 acres of waste land in the twenty years 1883-1903, and 59,058 acres in the following five years, and cultivated 237,574 acres during these twenty-five years. They still own some 64,000 acres of waste land fit for afforestation, and their working-scheme provides for an annual afforestation of from 10,000 to 12,000 acres, with the purchase of similar areas for an indefinite period Afforestation of waste lands by private owners and village communities is, at the same time, actively encouraged. Associations with this end in view are formed under the patronage of Government, and

the members (on subscribing to the conditions of not exploiting without permission the areas entered by them in the records of the association, for pastures, leaf-manure or wood) receive free advice, free supervision, free seed, free plants, cultural instruments and technical instruction, and, in the case of poor communities, financial help.

In Prussia the afforestation with conifers of heaths, abandoned fields, and other waste lands, was started on a large scale without the necessary experience, for the few records which existed of similar works carried out after the thirty-years'-war were brought to light only after the mischief had been done. No German forester dreamt of the dangers which thereafter threatened their cultures, and afforestation works were started all over the country with a light heart and in full expectation of the best results,—expectations, which in most instances, however, were not realised.

We in these Islands are in a much more favourable position than they were in Prussia sixty years ago, for, in the first instance, we can profit by the experience gained abroad at great cost during more than half a century, without paying for it, beyond the expense of studying reasons and results on the spot. We now know from experience, gathered both here and on the Continent, that (1) the method of cultivation adopted exercises a lasting influence on the growth and future of the forest; that (2) coniferous forests owing their origin to any description of notch planting, exist always at a considerable disadvantage; and that (3) even where, under specially favourable conditions, they may have produced profitable crops, they have but a fraction of the power of resisting storms possessed by more rationally grown ones. We have much less to fear from drought in our afforestation of waste lands than on the Continent, and the initial failures in cultural operations should be much less. Altogether the conditions for arborivegetation are, generally speaking, superior in the British Islands to those of Germany, and if we, nevertheless, produce inferior coniferous or other timber, this is not due to the action of nature but solely to the acts of man.

All the same, the Royal Commissioners made, as Dr Nisbet points out, a great mistake in not ascertaining the silvicultural and financial facts and data regarding the extensive afforestation of waste lands in Prussia, and especially the position that

Government takes up in the face of the numerous original failures. Many other practical questions of vital importance were pressed into the background by the desire to produce a scheme that would greatly help to solve the problem of unemployment. The witnesses were examined, cross-examined, and re-examined on this point to a tedious extent, evidently in the hope of gathering sufficient support for the preconceived purpose. The Commissioners have, at a cost of much valuable time and labour, succeeded to a certain extent, and by the very magnitude of their proposals, in throwing sand into the eyes of even such a paper as the *Times*, which hails the scheme as providing employment for many of the men who are at present without work in the towns, and says that even the more feeble and unskilled workers could be remuneratively employed in planting.

Dr Nisbet makes a very telling remark on this subject, and I may mention that, in order to secure an experienced staff of labourers for cultural operations, a scheme has been introduced in Germany under which work-people, both men and women, who have been employed for three years, obtain an increase in their daily wages of nearly 10 per cent. and a further similar advance after the sixth year. This scheme gains more support daily, and has, in the hope that it will tend to check immigration towards the towns, been extended to all other forest work, even when done under contract. Even during the period of afforestation, however, a considerable number of country people, men, women and youths, living in the vicinity of such cultural work, will find employment, year after year, during periods when other work is scarce.

Now though it may be unhesitatingly accepted that afforestation of properly selected land, costing even up to £10 an acre, would be a safe, and under some conditions even a very profitable investment, I feel inclined to believe that some more rational way of effecting this could be found than by the wholesale expropriation proposed by the Royal Commission, a step which would only be defensible after all other means had been tried and failed. Paragraph 93 of the Report sketches out a plan on the lines of which a feasible scheme might be built up with reasonable hopes of success. Prima facie it seems unobjectionable that the proprietors should give the land, the State providing the cost of afforestation, management, and

exploitation, and that the profits should be divided pro rata; but there are many other points to be considered before a practical working-scheme can be formed. It is essential that the Government should have full power of control over the management of such property through such agency as they may appoint, but as a co-proprietor the State should naturally become pro rata responsible for rates, taxes, and death duties. A most reasonable concession, and one which should go a long way to solving the problem, would be that no assessment should be levied until the property begins to yield, and that no death duties should be payable on immature crops; also that when either payment becomes due, the proprietor and the State should pay it pro rata. In cases where the proprietor desires to pay the cost of afforestation and management himself, similar concessions might reasonably be made, should he elect to work his property in accordance with a plan laid down by the forest authorities appointed for this purpose, and under their control. The difficulty as regards shooting in both classes of forests exists, but might be overcome.

The almost entire absence from the list of witnesses before the Royal Commission of the class of men most vitally interested in the land, shows that, from the outset, it was never intended to consider the question from their point of view, and that the suggestions made in paragraph 93 of the Report were nothing but a sop offered to them. The neglect of the landowner was the most fatal mistake the Commissioners could have made, for the country would never stand such wholesale interference with private rights unless the necessity for doing so were proved up to the hilt. It is not at all necessary that the State should, as the Royal Commissioners propose, hold the whole or even the greater part of the forest area of the country; but it is essential that it should show the way in practical work on a large scale, and I can see no reason why suitable land should not at once be acquired by private treaty, and why practical afforestation should not be begun forthwith, for the Commission have made out a good case showing that this would be a safe investment to which no Treasury need object.

It is not necessary that such areas should be in large compact blocks, so long as the aggregate in one locality is sufficiently extensive to give prospects of profitable local conversion of the timber produced, as the railways carry all scantling at the same rate, independently of its origin. I consider that the plan of afforesting 9,000,000 acres in sixty years is unnecessarily ambitious, and that the afforestation of 6,000,000 acres with conifers, by the combined efforts of the State and others, should meet every reasonable demand. As yet the landowners, large and small, have not had a fair chance, and until such a chance has been given and refused, it is too early to talk of expropriation on a large scale.

I cannot agree to the proposal to work a third of the area to be afforested on a short rotation, for this is an inadvisable makeshift and far too speculative as regards the probabilities of market for small timber.

# 23. Report of the Royal Commission on Afforestation.

BY SIR JOHN STIRLING-MAXWELL, BART.

The editor has asked me to contribute a note on the Report of the Erosion Commission from the point of view of a landowner. A document which has directed so much attention to silviculture must from that point of view be heartily welcomed, in spite of some inaccuracies and some rather wild proposals. Treasury quails (as well it may) before the part assigned to it by the Commissioners, it will be relieved to learn that the area suitable for forest is probably much less than the nine million acres of the Report, and that there is no reason why the State should bear the whole expense and risk of planting it. levels above 1000 feet trees will not thrive (as I know to my cost) except in good soils and sheltered aspects, and it is doubtful whether even in choice places they can be made to pay. Even from the moorlands below 1000 feet large deductions must be made for:-(1) areas of peat moss, etc., which are not worth planting; (2) land that is more profitably employed as pasture or grouse ground; and (3) sheltered places now devoted to wintering sheep or deer, which cannot be planted without rendering large tracts of adjacent high ground perfectly useless. Dr Schlich's six million acres is undoubtedly much nearer the mark than the nine million of the Report.

. The scheme proposed by Mr Grant and his colleagues is heroic, but heroic methods scarcely suit a difficult and risky

enterprise, especially one for which no machinery exists at present. Even if the State has to do all the work, it ought to begin cautiously. But with reasonable encouragement I believe that landowners would undertake a great deal of the work at their own risk. By reasonable encouragement I mean-

- (1) A survey of the areas really suitable for silviculture;
- (2) The creation of State forests (at least six for each of the three kingdoms), each forest to be a complete "economic unit" where scientific silviculture and its dependent industries could be studied, and where foresters could be trained;
- (3) The appointment of forest experts (one perhaps attached to each forest) whose duty it would be to advise landowners on their plantations, and provide workingplans at a reasonable fee;
- (4) Relief of plantations from rates and taxes during the periods when they yield no income.

I believe that these inducements (slight though they may seem) would lead many landowners to plant on a large scale. They would greatly reduce the risk of failure, which is at present nearly always due to ignorance. Taken in conjunction with the growing interest in forestry, and the extraordinary hold this pursuit keeps on those who once take it up, they would in my opinion work a great change. That change would of course be hastened by the rise in the price of timber which the Report prophesies with so much confidence.

Much of the money now spent on elaborate and often uninteresting gardens, unsuccessful home-farms, pheasant-rearing, and other overdone accessories of a country place, would be diverted by intelligent landowners into this more useful and profitable industry. Their friends on Sunday afternoons would find the nurseries and plantations less tedious than the greenhouse and ribbon-border, and a welcome change from the pheasant coops and shorthorns.

I have said nothing about loans from the State to intending planters. They do not seem practicable unless the State makes itself responsible for the management of the forest. To meet this difficulty Lord Lovat devised the scheme of partnership, or dual ownership, between the landowner and the State, which he laid before the Commission, but the proposal does not seem tempting from the point of view of either partner.

# 24. The Erosion and Afforestation Royal Commission Report.

By J. F. Annand.

The whole question of forestry has been brought before the public in a very forcible manner by the Royal Commission on Coast Erosion and Afforestation, in their recently issued Report dealing with the possible development of forestry as an industry, with a view to mitigating the evils of unemployment and keeping people permanently on the land; probably nothing has previously done so much to arouse a general interest in the subject.

Perhaps what strikes one most about the forestry proposals of the Commission is their magnitude. To put 9,000,000 acres of bare land under forest—land presumably comprising a variety of geological formations, of climates, and of local peculiarities, exceeding anything to be found anywhere within a similar area on the Continent of Europe—is certainly no light task. It is indeed greater than anything yet attempted by any of the European States with the best forestry traditions of a century and a half behind them. For the Continental forester has had to deal mostly with the improvement of existing forests, and has had comparatively little to do with the formation of new ones.

If this great scheme is to be brought to a successful issue—even if the smaller scheme of afforesting 6,000,000 acres (which by the way would seem to be ample) is to be carried out, it will, in my opinion, most certainly require the united efforts of the State, the landowners, and every one else connected with the management of land.

The Commissioners say that it is a task for the State, and no doubt this is to a great extent true. The want of continuity of management has been a serious drawback to the success of all forestry operations hitherto undertaken in this country by private owners, and there has been too much haphazard work at all times. But has the State done any better? The small extent of our Crown lands under forest, managed as they have been under various Acts of Parliament for a variety of purposes and according to traditions of a sort, have not always proved an unqualified success from the timber-grower's point of view; and some still maintain that the State is likely to do no better, if entrusted with the management of millions of acres, than it has done in the past in the management of thousands.

With a changed national sentiment, however, with proper professional training, and a better and fuller conception of the true aims and objects of forestry, it is not likely that the mistakes and errors of the past century will be repeated in the future. Still it is well to remember, when summing up what has been done for forestry by the State and by the private owner respectively, that the really good and successful work must be placed almost entirely to the credit of the latter.

# THE SUGGESTED TIMBER FAMINE.

As far back as 1830, we find writers on forestry matters deploring the reckless methods of exploitation employed in America and Northern Europe, and prophesying an almost immediate timber famine. One Cruickshank, who was forester to the then Earl of Fife, and who published, about the year 1828, a useful book on planting, wrote in this strain. He pointed out that we were then importing timber to the value of about one and a half million pounds sterling. The natural forests were being destroyed, and he considered that we were then nearing a shortage, if not a famine, in timber. Many things have happened since then, and one can only smile when one realises how far this man's views have been falsified. Nevertheless, if planting on an extensive scale had been carried out eighty years ago, as he suggested, though we might not now have had extensive forests of first - class timber, we certainly might have had a foundation to work from, which would have much simplified the present-day task of afforestation. At fairly regular intervals throughout the whole of last century, various writers (some interested, some disinterested) wrote in a similar strain about a timber famine, but people get callous when they hear the same story repeated again and again, without anything very dreadful happening; and until quite recently, very little attention has been paid to what many considered to be a question of merely academic interest. The value of our annual imports of timber, etc., now considerably exceeds £, 30,000,000 sterling. We certainly have not yet reached the famine stage, but prices are steadily rising, while the quality is as steadily going down.

All the best natural stands of coniferous timber in accessible parts, both in Northern Europe and America, are being swept away; and we have now reached the stage when timber everywhere will cost something to produce. A certain rise in values must, as a consequence, result, with much better chances of paying crops of timber being produced at home.

WHAT CLASSES OF TIMBER WILL BE SCARCE IN THE FUTURE, AND TO WHAT EXTENT MAY WE SAFELY AFFOREST?

Assuming that 9,000,000 acres of plantable land are available for planting, is it necessary to make this enormous addition to the present forest area of the country? Our chief imports are of coniferous timber, or the product (wood-pulp, etc.) of coniferous timber. It is quite true that timber merchants have now to pay from 30 to 35 per cent. more for, say, Scandinavian red or white deal (Scots pine or spruce) than they paid twenty years ago, and that they receive timber younger and of poorer quality than formerly; but, so far, they have experienced no difficulty whatever in getting their supplies. How long these conditions may be continued it is difficult to ascertain with accuracy, but it seems quite certain that transport expenses are getting heavier, that younger timber is being cut, and that the tendency generally is for the best qualities to rise in price.

"Memel," the finest brand of red deal, which formerly used to be quite plentiful, is gone for ever. The same remark will apply very soon to many other of the finer brands of pine timber, which have taken a century and a half or more to grow All the best qualities and sizes are getting scarcer and dearer, as the market for them extends more and more.

But it is not at all likely that the export of timber from Northern Europe will entirely cease. The foresting of so large an area as 9,000,000 acres is evidently intended to cover the total extinction of imports, unless it is anticipated that new industries will arise, and that new uses for timber will be found; and this latter eventuality is not improbable. But in both Norway and Sweden energetic measures are being taken to conserve the forests and to regulate the output of timber. Owing to their geographical position, and the climatological peculiarities resulting therefrom, neither of these countries is capable of industrial development to the same extent as those situated further south. For this reason the production of coniferous timber will probably always constitute one of their

chief industries, and we may safely reckon on always getting a certain amount of timber from them, although we may have to compete for it in the market with other Continental countries advancing industrially at quite as rapid a rate as ourselves. The matter is very different however in the case of America and The best sources of supply both in the States and in Canada have already been tapped. There are no new sources of supply of the finest brands of timber, and with rapid industrial development in both countries, it seems quite certain that the exports of timber from both will very soon entirely cease.

On the other hand, our present forest area will no doubt become more and more productive as State-example and improved methods of forestry begin to have effect, and when a great deal of the land at present only nominally covered with timber becomes fully stocked. When everything is taken into account, therefore, it would seem that, unless greatly extended markets for timber and many new industries are developed, the smaller scheme embracing an ultimate extension of 6,000,000 acres of forest should be sufficient; but at all events there is no question whatever but that some considerable extension of our present forest area is highly desirable as a matter of national policy.

Of timber almost certain to command a ready market in large quantities in the future, if it is produced in a regular and steady manner, tall, straight, well-hearted Scots pine, grown in dense stands, will probably head the list. In certain localities of limited extent, species like Douglas fir or Corsican pine will probably produce a larger bulk of timber of a similar quality, although not quite equal to Scots pine. These should also command a ready sale, and in these exceptional localities will probably yield more remunerative crops than the Scots pine. When the present high value of larch timber and the correspondingly low value of Scots pine are alone taken into account, the soundness of this view may well be questioned. It is quite true that at the present moment the larch, per unit of bulk, is the most valuable of all our coniferous timbers. is stronger and more durable than any other, but its tendency to warp and twist makes it less suitable than pine for a great variety of purposes, e.g., for building construction. market for larch is therefore comparatively limited, and if the area of the larch crops were very much increased there would no doubt be a corresponding depreciation in price. It has, however, one great advantage over all other sorts, namely, the entire absence of competition from abroad. The Siberian larch timber, which has lately been shipped to our ports in considerable quantities, is very poor material indeed when compared with the well-grown home product, and, so far as quality of timber is concerned, the two species (Larix europæa and L. siberica) differ widely. Our own larch will no doubt, therefore, continue to command a fair price at all times if the market is not glutted by over-production; but in any great national scheme there should be less striving after the growing of larch crops in (often) unsuitable lands than has been the custom in the past. The great temptation to grow larch lies in the fact that early returns are obtained, but the reasons which prompt the private owner to grow it wherever he can should apply with less force where the State is the owner.

On the other hand, it is quite true that in the past Scots pine timber has been as difficult, as larch has been easy, to sell. But the reasons for this are not far to seek. Firstly, our Scots pine timber (and the same applies to spruce) is not properly grown. It is often immature, openly grown, and generally of very poor quality. Secondly, it is not produced in sufficient quantity, nor with sufficient regularity, to create or to keep a market. If the timber merchant cannot obtain a regular supply, he cannot of course satisfy his customers, and the result is that both the merchant and the ultimate purchaser probably go elsewhere.

The supply of larch has been steadier and it has always been sufficient. With a regular supply of well-grown mature first-class pine timber the case would be different, and the prices of well-grown pine timber and larch would no doubt approach each other much more closely than at present. A rotation much under ninety years would probably not be suitable for Scots pine, as quality increment as well as quantity increment would have to be taken into account in fixing a rotation for the production of timber of this description, and probably a sufficient development of heart-wood could not be obtained much sooner.

Spruce does not produce timber so freely with us as on the Continent, but in certain moist localities both the common and the Sitka spruce, if grown in sufficiently dense masses, will produce a good useful quality of timber, and a great deal more of it than could be obtained from either larch or Scots pine. Several other species are on trial, and a few may prove useful, but more experiments must be made before they can be brought into general use.

Amongst broad-leaved species, oak and ash are the two most important timbers. Ash timber is already getting scarce, and when the hickory and ash supplies from America fail, as they are likely to do soon, home-grown ash timber will again be more in demand. There will always be a market for good oak timber. Beech must always be grown to a certain extent where oak and ash are produced, and a better quality of beech than is usually grown at present could no doubt be sold at a profit.

The present woodland areas, however, if fully stocked, would no doubt supply the greater part of the hardwood timber needed, and there is probably less need and certainly less room for extending the area of hardwoods than that of first-class coniferous timber trees,

The growing of crops of pit timber on short rotations does not present an attractive field, with railway rates at their present figure. The imports of small mining timber, supplied and used in the round, do not show any signs of falling off in quantity. The only observable variation is that prices, still low, are rather stiffer than formerly. Small pit timber is a class of material which can always be readily put on the market by the Scandinavian peasant-owner, and there is far more likelihood that future markets will become over-stocked with it than with well-grown matured timber. Except in the immediate neighbour-hood of mines it does not seem desirable, therefore, to specially devote land to the growth of crops of pit timber, and with rather denser stocking at the outset, sufficient supplies of pit timber could probably be had from thinnings in the high-forest to be grown to the age of 80 or 90 years.

The case would be different with timber for pulp, because wherever the material could be grown in sufficient quantity, pulp mills could be set up; but here again thinnings, and the lighter material from the final cuttings of the mature crops, would supply large quantities of pulp-wood, just as is the case at present in forest districts on the Continent of Europe and in America.

If the production of high-class timber, which will probably be scarcest in the future, is made the ultimate goal, supplies of wood-pulp material and mining timber, from thinnings, etc., will fall in as a natural consequence.

# PLANTING WORK AND UNEMPLOYMENT.

The question how far afforestation would provide a remedy for unemployment has been much discussed. Once forests are established, there can be no two opinions about their providing winter employment for a large number of people, and the figure has been put as high as one man for every roo acres of fully-stocked forest. In addition, there is the work of hauling, sawmilling, etc., which would provide for as many more. Be this as it may, forestry combined with small farms or holdings such as one finds, for example, in the Black Forest, does certainly provide for the maintenance of a larger rural population than would be possible where large tracts of poor land are found associated with comparatively small areas of land suitable for the cultivation of field crops. By this combination, rural depopulation and the overcrowding of the cities with men in search of a livelihood might to some extent be diminished.

The combination of forest and small farm provides permanently a preventive measure against unemployment, and one which is certainly much easier of application than any other which might be attempted. But the formation of forests takes time, and the pressing and more immediate question is whether the unemployed in the cities can to any extent be relieved by being put to work in planting operations.

One great drawback to the employment of city men out of work is that planting has usually to be done at far too great a distance from the homes of the people who need work. And then, planting, if it is to be successful, has to be done by men who are skilled in the work.

During the planting season also the weather is very uncertain, and it is not unusual in some parts of Scotland to have snowstorms, and to find the ground covered with snow for weeks at a time, during which out-door work on the bare hills and moors would be completely at a standstill. "Broken" time would often be excessive, and in such a contingency the problem of providing for large numbers of men far away from home would be a serious one. The question of housing would also, in many cases, present difficulties if the planting ground were far away from any villages or centres of population. It is quite true that portable wooden houses could be provided, but this would add to the cost of planting, and a more important drawback is that

the city-bred man would be little able to "rough-it" under such conditions.

It is the present custom on many wooded estates, where extensive planting is done year after year, to employ extra hands during the planting season. These extra hands are drawn of necessity from the temporarily unemployed. The writer of this note has employed casual labour of this sort for several successive seasons in two widely different parts of Scotland, and the results in both cases were quite satisfactory. In one case the men were drawn from a small manufacturing town, but in both cases they had had a rural training. They had never used the actual tools required for planting, but they had used similar ones, and with a week's training and a little extra supervision, they did quite good work when stiffened, as it were, by the regular estate hands. The extra men went back to their ordinary occupations again at the end of the planting season. There were no housing difficulties in these cases, for the men could walk to their own homes, or find quarters in the houses of the permanent estate men.

The case would be rather different with city-bred men, and only from the best types of the city unemployed could one hope to draw a suitable class of workers; but even the best of them would need far more training and supervision than country-bred men. If due allowance were made, however, for the extra cost which would be incurred by the employment of such men, there seems no reason why they might not be tried in certain localities at any rate. And in any case, if work were thus given during the winter months to men in rural districts who otherwise could find no employment, the present tendency for such men to flock to the towns would be very much checked, and in the long run the effect must be to improve the congested condition of the labour market in the large cities.

### FINANCE.

The financial proposals of the Royal Commission have been subjected to a great deal of adverse criticism; but probably this is because they have been, to a certain extent, misunderstood. The figures of the Commissioners' Report have obviously been intended to give a general indication of what the financial outcome might reasonably be expected to be, and must not be regarded as absolutely correct in every detail and

under all local conditions. Practically all the data on which reliable calculations of this sort could be based are awanting with us. There is not a single completed record of the financial outcome of any tract of forest land in the country. And besides, the results must vary greatly, no matter how good or how uniform themanagement may, be over so vast a tract as nine millions, or even six millions, of acres in a country like our own.

Accidents such as gales, snow-break, fires, insect attacks, and fungous diseases, have all to be reckoned with; but with a rising and extending market there seems no reason to doubt that paying crops of timber can now be grown in the country, and as a general indication of the final outcome the Commissioners' figures are no doubt quite sufficient. What must have the greatest influence on the final financial result will be the selection of the correct species for each locality, and the adoption of the most economical method of efficiently stocking the ground. In any case, as a question of national policy, the promotion of afforestation would seem to be desirable, even though the financial outcome should prove to be much less favourable than that anticipated.

When railways are made through new parts of the country, or through new territories, the promoters and chief shareholders of such concerns seldom look for, and as seldom get, any large dividends on the money they invest in the undertaking. But very often the shareholders have an indirect interest in the success of the railways; they often hold, or have an interest in, the surrounding lands. If new industries are created and fostered by means of better transport facilities, and if the land becomes more valuable in consequence, they reap considerable indirect benefit. In the same way, if the State, by promoting and fostering afforestation, assists to start new industries, and thus to increase and ameliorate the condition of the rural population, then the benefit both to the State and to the community generally is at least equal in importance to any direct pecuniary gain which may accrue from the working of the forests.

What the State might Do, and what might be Done by the Private Owner.

We may assume that a Forestry Board, or some suitably constituted and responsible authority, will be created to supervise.

whatever new schemes of afforestation may ultimately be decided upon, to extend and improve facilities for instruction, and generally to foster and encourage afforestation throughout the country. The first steps necessary would no doubt be:-

- (a) To make an inspection and survey, by fully qualified men, of the plantable land throughout the country; and
- (b) To ascertain what proportion of this land would be reasonably available in the near future without unduly interfering with existing interests. This would enable the land to be duly classified.

For example, existing leases of pasture lands, and the rights of tenants to which they are subject, would have to be reckoned with; and many similar local matters would have to be adjusted, whether the State or the private individual were the owner. Then the next important and really urgent matter would be the provision of Example or Demonstration forests. This is clearly a matter for the State. The Demonstration forests ought to serve as examples of good management for all time to come, and experimental work should also be undertaken in them. They should be situated in as many different parts of the country as possible, and should also constitute a nucleus round which the woodlands might extend. Such extensions might ultimately have to be made partly by the State, but there is every likelihood that extensive afforestation by private owners would result from the State example.

It is improbable that whole estates suitable for afforestation could be obtained by purchase in suitable localities, but this would be no drawback so long as the estates bought were worth the money paid for them. In fact, it would be an advantage. because the better land could be put to more profitable use for tillage, either as small or comparatively large holdings according to circumstances, and the necessary forest labour could be drawn from such holdings. Many of the Crown woods in England have now been put under systematic management by H.M. Commissioners of Woods, and by and by these will constitute valuable Example forests in the districts where they lie, but they are few in number. The estate of Inverliever will also ultimately provide an example of forest management under continuous treatment, but it will only serve for the western part of the country where it is situated, and where the climatic conditions are quite exceptional.

Strong objections have been raised to the afforestation of land by the State, on the ground that the State would compete with, and would probably injure, the markets of the private owner. No doubt there would be solid grounds for this fear if the large scheme proposed were carried out in its entirety, and by the State alone; but a moderate extension in the form of Example forests, spread over as many districts as possible, would have just the opposite effect. One great disadvantage in the home-timber market at present is that there is no continuous supply. A continuous output of timber such as would eventually result from having a large extent of woodland under systematic management in various districts would have a steadying effect, and would make it worth while for timber merchants to establish businesses in such localities. This would improve the local timber markets, because rough timber cannot be carried long distances economically. It must be partly worked up on the spot. If a steady and moderate policy were pursued of purchasing land, from time to time, in the open market (as in the case of Inverliever), for Example forests, substantial progress would no doubt soon be made without entailing hardship on any one. The estates purchased should be sufficiently large to admit of being managed economically.

Then, as regards the part which might be taken by private owners in the extension of the present forest area, it is well to bear in mind that they hold practically all the plantable land in the country. It is quite true that they have not done very much in the past in the way of extending their woodlands, but they have had little encouragement to do so, and until recently, instruction in scientific forestry and advice as to systematic management were not available.

Rates and taxes have often to be paid for a long period of years on woodlands which are yielding nothing at all. As regards parish rates, a certain amount of money must be found, and if woodlands are not rated, then a larger rate will have to be put on other adjoining lands probably belonging to the same owner. County and Imperial taxes are somewhat different, and it does seem unfair that, as regards commercial woods, Income tax should have to be paid on anything but on the net profits derived from the working of them. Then death

duties are a serious burden on forest land. It has been put forward as a reason why the State should undertake afforestation, that the State never dies, and that consequently no death duties have to be met. This would seem a very good reason why the private owner should receive some equivalent for this serious handicap. The system of levying rates and taxes on woodlands surely needs revision. On many estates the "machinery" available for carrying out forestry operations is already in existence and only needs strengthening and extending. There are people in want of work during the winter months in most districts, and it should not be impossible to devise some scheme whereby the private proprietor could undertake a good deal of the afforestation necessary, or could co-operate with the State in doing so. Opinion on forestry matters has entirely changed during the past twenty years, and a great many proprietors are now anxious to set about the systematic management and extension of their woods. surely could be no great objection to the State advancing money where necessary, at a low rate of interest, to private owners, to be expended on planting operations, if proper security were obtained. But to be of any practical value a much cheaper method of carrying through negotiations for loans would have to be devised than at present obtains for agricultural and other estate improvements.

Properly drawn up schemes would have to be made if money were advanced by the State, and there could also be State advice and supervision or periodical inspection. The difficulties and drawbacks connected with the compulsory acquisition by the State of land on a colossal scale, such as has been suggested, would in this way be avoided. In most European countries a great deal is being done by the State to assist private afforestation. This policy seems at least equally necessary with us where practically the whole of the forest land is privately owned.

In this work of worthily developing British forestry there appears to be ample room for the energies both of the State and of private individuals; and the foregoing suggestions indicate in a general way the writer's views of what part might reasonably be undertaken by each in the immediate future.

As has been already noted, the striking recommendations of the Royal Commission, in their Report, have had the effect of creating an enormous amount of interest in the general question of afforestation; and although every one may not agree with all their views, nor be prepared to go quite so far as they go, none will deny that operations on a substantial scale are imperatively needed; and it is to be hoped that with this quickened interest a steady, persistent, if cautious, policy may be adopted by the State for the furtherance of some practical schemes for the speedy advancement of forestry in our country.

# 25. Deputation from the Society to the Chancellor of the Exchequer on National Afforestation.<sup>1</sup>

The Chancellor of the Exchequer received, on 22nd March 1909, a deputation from the Royal Scottish Arboricultural Society, on national afforestation, in his room in the House of Commons. There were present with the Chancellor—Lord Carrington, Mr Alexander Ure, K.C., Lord Advocate, the Master of Elibank, and Sir Edward Strachey. The deputation consisted of—Mr R. C. Munro Ferguson, M.P., Hon. Secretary of the Society, Mr W. Steuart Fothringham of Murthly, Vice-President, Lochiel, Sir Herbert Maxwell, Sir Edward Tennant, Sir Hugh Shaw Stewart, Mr Galloway Weir, M.P., Mr A. T Gillanders, Mr John Crozier, Mr Adam Spiers, Mr G. A. Macdonald, Dr Borthwick, Mr Sydney J. Gammell of Drumtochty, Mr Norman Lamont, M.P., Mr McLaren, M.P., the Hon. E. S. Montagu, M.P., and Mr Robert Galloway, S.S.C., Secretary and Treasurer of the Society.

Mr Munro Ferguson, in introducing the deputation, referred to the constant efforts of the Royal Scottish Arboricultural Society to secure Demonstration Forests as training and experimental areas. He pointed out that the first step to be taken must be the creation of a responsible Department of Forestry, which would schedule areas suited to silviculture, and develop large Demonstration Forests, with at least two forest schools. The Royal Scottish Arboricultural Society was convinced that the Treasury would be involved in risks, and the future of silviculture would be compromised, were the Government to begin operations without the initial steps indicated, or were they

<sup>&</sup>lt;sup>1</sup> From the Scotsman report.

to act upon the false assumption that economic afforestation could be successfully carried on by unskilled and untrained casual labour.

Mr Steuart Fothringham, in the absence of Sir Kenneth Mackenzie, President of the Society, described the constitution and work of the Society. He pointed out that the need for industry was shown by the huge percentage of crofters who had been found entitled to, and had claimed, old age pensions. He was confident that nothing would conduce so much to the success of the small-holders as to have extra labour at their door, especially in the winter time; but he deprecated the initiation of a great scheme of national afforestation without careful preliminary inquiry and preparation.

Sir Herbert Maxwell said that he was aware that it required a strong case to justify any appeal for the interference of the State in an industrial matter such as forestry, but he was pleased to have been able to draw up the grounds upon which such a case was based. These were-firstly, the extent to which all our principal industries depended upon an abundant supply of timber at reasonable prices; secondly, the rapidly increasing consumption of timber not only in this country but in other countries, especially the German Empire and the United States, causing the disappearance of accessible forests in all parts of the world, and the consequent serious rise in prices, which had been equal to as much as 22 per cent.; thirdly, the inadequacy of existing British woodland to supply anything but an incalculable proportion of the foreign shortage; fourthly, the impossibility of expecting private landowners to meet the emergency by embarking on economic forestry, for three reasons—(1) that few landowners could lock up the necessary capital during the non-productive period, (2) that no private owner could ensure continuity of system on behalf of his successors, and (3) the rating of immature woodland and incidence of death duties, which might consume most, if not all, the profits; and their fifth reason was the extent of good forestable land, which could be procured for as low a price as £2 an acre. He estimated that the return on capital would show an amount of 3 per cent. in perpetuity, allowing for an unproductive period of from thirty to forty years. There was lastly the value of afforestation as a source of employment, and as a check to rural depopulation especially in connection with

small holdings. He would remind the Chancellor that four reports of Royal Commissions within the last twenty-five years had each expressed complete confidence in the belief that timber of the first quality could be produced in the United Kingdom.

Mr Gillanders, forester to the Duke of Northumberland, pointed out that without Demonstration Forests and facilities for training, it was impossible to educate foresters able to cope with the various conditions under which silviculture had to be carried on in this country, owing to the varying geological formations and the difference of soils.

Mr Sydney J. Gammell emphasised the need for training and the absence of properly qualified men.

Mr Spiers, of Edinburgh, Mr Macdonald, of Peeblesshire, Mr Crozier, of Kincardineshire, and Dr Borthwick also spoke.

Considerable conversation took place between the Chancellor of the Exchequer and members of the deputation on various points raised in the course of their speeches. The Chancellor's questions were particularly directed towards ascertaining the need for delaying any afforestation scheme until what the deputation suggested are the essential preliminaries had been adjusted.

The Chancellor of the Exchequer said that he supposed the whole experiment depended largely upon their being able to secure land at a reasonable price, because if they paid twice as much as the land was worth, it could not possibly be a commercial success, and he understood that Sir Herbert Maxwell was consequently in favour of compulsory acquisition of any scheduled lands.

Sir Herbert Maxwell agreed, provided a difficulty was found in acquiring land by voluntary means, but he did not anticipate any such difficulty in the present state of the land market. Of course, if the price went up the moment land was scheduled, then compulsion would need to be applied.

The Chancellor of the Exchequer, in reply, said:—"Mr Ferguson and gentlemen, I am exceedingly obliged to you for your kindness in coming here, because I really wanted to be informed upon these subjects, and when Mr Ferguson and the Master of Elibank suggested to me that I should receive a deputation, I felt quite grateful to them for the suggestion. I knew that the gentlemen they mentioned would be able to inform me from very special knowledge of their own and from

their experience upon the very subject which I was considering. I was rather alarmed at the recommendation of the Coast Erosion Committee with regard to the  $f_{,2,000,000}$  a year. It is rather dangerous to embark upon an experiment of this kind straight away without a period of probation. It is important that you should set up forestry schools here, and that you should have demonstrations in different parts of the country which will enable an Afforestation Commission—if a Commission or Committee is appointed—to judge as to the best method of proceeding in different parts of the country. I will consider this carefully with my colleagues. The part that concerns me is the finding of the money, but my other colleague, Lord Carrington, representing the Board of Agriculture, will be very practically concerned in the best method of expending that money, or, at least, in nominating somebody who will undertake the charge of that particular branch of the business. We are considering the matter, but we have not arrived at any decision, and that is why it was important that I should receive this deputation before the Government have given final shape to their proposals on the subject, and the suggestions which have been made to me will be valuable."

Mr Fothringham thanked the Chancellor for the kind way in which he had received the deputation.

# THE CHANCELLOR'S BUDGET SPEECH.

In connection with the foregoing it will be of interest to record that portion of the Chancellor of the Exchequer's Budget speech which states the intentions of the Government in regard to the promotion of afforestation. This is reported as follows in the *Times*:—

### Afforestation.

"This brings me straight to the question of afforestation. There is a very general agreement that some steps should be taken in the direction, I will not say of afforestation, but of reafforesting the waste lands of this country. Here, again, we are far behind every other civilised country in the world. I have figures which are very interesting on this point. In Germany, for instance, out of a total area of 133 million acres, 34 millions, or nearly 26 per cent., are wooded; in France, out of 130 million acres, 17 per cent.; even in a small and densely-populated country such as Belgium 1,260,000 acres are wooded, or 17 per

cent. In the United Kingdom, on the other hand, out of 77 million acres, only 3 millions, or 4 per cent. are under wood. Sir Herbert Maxwell, who has made a study of this question for a good many years, and whose moderation of statement is beyond challenge, estimates that in 1906 'eight millions were paid annually in salaries for the administration, formation, and preservation of German forests, representing the maintenance of about 200,000 families, or about 1,000,000 souls; and that in working up the raw material yielded by the forests wages were earned annually to the amount of 30 millions sterling, maintaining about 600,000 families, or 3,000,000 souls.' The Committee will therefore perceive what an important element this is in the labour and employment of a country. Any one who will take the trouble to search out the census returns will find that the number of people directly employed in forest work in this country is only 16,000. And yet the soil and the climate of this country are just as well adapted for the growth of marketable trees as that of the States of Germany. Recently we have been favoured with a striking Report of a Royal Commission, very ably presided over by my hon, friend the member for Cardiff. A perusal of the names attached to that Report will secure for it respectful and favourable consideration. It outlines a very comprehensive and far-reaching scheme for planting the wastes of this country. The systematic operation which the Commission recommend is a gigantic one, and, before the Government can commit themselves to it in all its details, it will require very careful consideration by a body of experts skilled in forestry. I am informed by men whom I have consulted, and whose opinion on this subject I highly value, that there is a good deal of preliminary work which ought to be undertaken in this country before the Government could safely begin planting on the large scale indicated in that Report. I am told that experiments ought to be made, so as to test thoroughly the varying conditions of climate and soil and the best kind of trees and methods of planting to meet those variations. I am also told that we cannot command the services in this country of a sufficient number of skilled foresters to direct planting. I am advised—and personally I am disposed to accept that counsel as the advice of prudence—that the greater haste in this matter will mean the less speed, and that to rush into planting on a huge scale without first of all making the necessary experiments,

organising a trained body of foresters, and taking all other essential steps to secure success when you advance, would be to court disaster, which might discourage all future attempts.

# DEVELOPMENT OF RESOURCES.

"I will tell the Committee how I propose that this subject should be dealt with; but, before I do so, I have something more to say about proposals for aiding in the development of the resources of our own country. The State can help by instruction, by experiment, by organisation, by direction, and even in certain cases which are outside the legitimate sphere of individual enterprise, by incurring direct responsibility. I doubt whether there is a great industrial country in the world which spends less money directly on work connected with the development of its resources than we do. Take the case of agriculture alone. Examine the Budgets of foreign countries—I have done it with great advantage in other directions—examine them from this particular point of view, and hon, members, I think, will be rather ashamed at the contrast between the wise and lavish generosity of countries much poorer than ours, and the shortsighted and niggardly parsimony with which we dole out small sums of money for the encouragement of agriculture in our country. We are not getting out of the land anything like what it is capable of endowing us with. Of the enormous quantity of agricultural and dairy produce and fruit, and of the timber which is imported into this country, a considerable portion could be raised, and ought to be raised, on our own lands. There hon, members opposite and ourselves are in complete accord. The only difference is as to the remedy. In our opinion the remedy they would suggest would make food costlier and more inaccessible for the people; the remedies we propose, on the other hand, would make food more abundant, better, and cheaper. I will tell the House what we propose. There is a certain amount of money, not very much, spent in this country in a spasmodic kind of way on what I will call the work of national development - in light railways, in harbours, in indirect but very meagre assistance to agriculture.

# A NATIONAL DEVELOPMENT GRANT.

"I propose to gather all these grants together into one grant that I propose to call a Development Grant, and this year to add

a sum of £200,000 to that grant for these purposes. Legislation will have to be introduced, and I will then explain the method of administration and the objects in greater detail, but the grant will be utilised in the promotion of schemes which have for their purpose the development of the resources of the country, and will include such objects as the institution of schools of forestry, the purchase and preparation of land for afforestation, the setting up of a number of experimental forests on a large scale, expenditure upon scientific research in the interests of agriculture, experimental farms, the improvement of stock-in respect of which I have had a good many representations from the agricultural community—the equipment of agencies for disseminating agricultural instruction, the encouragement and promotion of co-operation, the improvement of rural transport so as to make markets more accessible, the facilitation of all wellconsidered schemes and measures for attracting labour back to the land by small holdings or reclamation of wastes. Every acre of land brought into cultivation, every acre of cultivated land brought into a higher state of cultivation, means more labour of a healthy and productive character. It means more abundant food -cheaper and better food for the people. The sum which the Government propose to set aside for these purposes may seem disproportionate, especially as a good deal of capital expenditure will necessarily be invested in the carrying out more especially of the experiments. For the purpose of afforestation schemes, at any rate at the earlier stages when the expenditure will be particularly heavy, I propose that borrowing powers should be conferred upon the Commission directing the distribution of the grant, though I intend to avoid the necessity of resort to loans in connection with the capital expenditure required for other parts of the scheme. I shall hope to attain this end by what may perhaps at first sight appear a proposal of a more sweeping character. Hitherto all surpluses due either to unexpected accretions to the revenue or savings upon the estimates have passed automatically into the old Sinking Fund for the liquidation of debt. I propose that all these unanticipated accretions and economies shall in future pass into the Development Fund, so as to constitute a reserve of money to be spent on the recommendations of the Commissioners, but under the direction of Parliament, on such objects as I have too compendiously sketched."

# 26. Afforestation of Waste Lands in Denmark, Holland, France, Belgium, and Germany.<sup>1</sup>

The Board of Agriculture and Fisheries have been supplied through the Foreign Office with some information, of which a summary is given below, respecting the afforestation of waste lands in Denmark, Holland, France, Belgium, and Germany. This information was originally obtained at the request of the Irish Department of Agriculture on behalf of the Irish Forestry Committee.

### DENMARK.

Mr Vice-Consul Funch states that no fixed grant is made by the State in Denmark for the acquisition of waste lands, but between 1867 and 1892 about 42,000 acres on the Jutland moors and 1450 acres in Seeland were purchased at a cost of £42,780. The expenses incurred in planting the abovementioned areas in Jutland, and those which in previous years had been acquired in the same province, have in recent years amounted to £3300 annually, in addition to about £600 per annum for fencing, roads, etc. Tree planting on the dunes along the coast of Jutland, for the purpose of protection from drifting sand, is, however, continually going on, and the expenses during the last twenty years have averaged about £3300 for purchase, and £11,100 for planting.

Grants are made annually to the Danish Heath Society, the special object of which is to encourage tree-planting in Jutland. The amount allowed, as a rule, for each separate plantation is one-third of the outlay for cultivation, fences, roads, etc. The revenue of the State Forest Department in 1906-7 was £82,900, and the expenditure £60,280, leaving a profit of £22,620. During the last ten years the average profit has been £19,000.

# HOLLAND.

Sir Henry Howard, H.M. Minister at The Hague, has forwarded a memorandum drawn up by the Netherland Ministry of Agriculture, from which it appears that varying amounts of from £1000 to £2000 have been annually included

<sup>&</sup>lt;sup>1</sup> From the *Journal of the Board of Agriculture*, Feb. and March 1909. Summarised by the permission of the Controller of H.M. Stationery Office.

of late years in the State Budget to provide for the purchase of waste lands, while the expenditure on cultivation in 1907 was about £6700.

The State grants an annual subsidy to a private Association, the Netherland Heath Company, which has for its object the promotion of the cultivation of heaths, dunes, and other waste lands. This subsidy was formerly £440, but now amounts to £750 per annum. This Association gives advice, draws up plans, and carries out the work if desired, but it does not aim at making a profit.

For the promotion of the afforestation of waste lands belonging to communes, the Government have since 1907 granted loans free of interest, and have also provided technical assistance. Any commune which owns a sufficient extent of land suitable for afforestation may apply to the Minister of Agriculture for such a loan, or several communes may combine their lands in one application. If the application is approved, a plan of cultivation is drawn up by the State Forest Administration in consultation with the municipality, and the loan is fixed so as not to exceed  $\pounds_4$  per acre, or 80 per cent. of the cost of cultivation. The commune then binds itself to carry out the work under State supervision, and in accordance with the plans of cultivation approved by the Forest Administration.

### FRANCE.

As regards France, the Ministry of Agriculture state that in virtue of a law of 4th April 1882, dealing with mountainous lands, the State buys each year uncultivated lands in the Alps, Pyrenees, Cevennes, and the Central Plateau, for the purpose of re-afforestation. The extent of land thus acquired up to January 1907, was 503,000 acres. Grants of money are made, and plants and seeds are supplied to communes, associations, and private individuals to assist them in the work of reafforestation. The land planted through this public assistance is 249,000 acres.

Exemption from the land tax is granted to owners who afforest their lands, viz.:—Complete exemption during thirty years for sowings and plantings made on the tops and slopes of mountains; and a reduction of three-fourths for all land planted or sown, whatever its situation, during the first thirty years.

## BELGIUM.

H.M. Minister at Brussels states that the sum of  $\mathcal{L}_{12,000}$  is annually voted for the purpose of enabling the State to acquire wooded lands or lands fit for planting. When there is an opportunity of purchasing such land, the proposal is laid before the Chambers, who decide if the purchase should be made, and vote an additional grant if required. A sum of  $\mathcal{L}_{19,500}$  is also provided for works in connection with the State forests.

The State does not give financial assistance to private persons with a view to encouraging the planting of trees, except in certain particular cases, such as planting over abandoned mines or quarries, or with a view to screening a blemish on the landscape. In such cases, the expense may be partially or entirely borne by the State. The Government foresters are, however, always willing to give any information to private persons regarding forestry. Forests belonging to the communes are managed and inspected by the Forestry Department of the Ministry of Agriculture, and a part only of the expenses incurred is refunded by the communes. The Government, and in some cases the provinces, pay a portion of the expenses incurred in planting communal waste lands, or in re-afforesting districts where the communal woods have been destroyed. An exemption from taxes during ten years is granted to communes, in respect to waste lands which have been planted with trees. Public lectures on forestry are given free every year in various districts.

### GERMANY.

Prussia.—During the six years 1901–1906 about 300,000 acres of land suitable for forestry were acquired by purchase or exchange, of which a part was already wooded. The cost of purchase, including about 57,000 acres of agricultural land, as well as a number of dwelling houses and farm buildings which were taken over at the same time, amounted altogether to  $\mathcal{L}_{1,934,000}$ . The cost of afforestation amounts on the average to about 48s. per acre.

As regards measures for encouraging afforestation among rural communes and private landowners, it is stated that expert instruction and advice are given to landowners, the efforts of societies for silviculture are stimulated, seedlings and plants are provided cheaply or free of charge, and grants and prizes for afforestation are made. In 1908, an outlay of  $\pounds$ 22,500 was provided for in the Budget for the purpose of encouraging communal and private action, and the formation of forestry sections in the Chambers of Agriculture has done much towards the promotion of private enterprise.

Bavaria. - No provision is made for the acquisition or planting of waste and poor heath land, as such land is usually in the possession of communal or private owners. Should an exceptional case arise, however, ample funds are available for the purpose. There are no legal regulations by which private proprietors or communities can be constrained to plant waste lands, which have not hitherto been within the forest area, but the management of this latter area is defined by law and by regulations made thereunder. The Royal Forest Authorities must support by their advice and help efforts towards the afforestation of waste grounds; assistance and encouragement are given towards the afforestation of such land, as well as towards the planting of fruit trees, and the carrying out of such undertakings is rendered easy by means of loans at a low rate of interest. In addition, nonrefundable subsidies are granted to communes for the laying out of new plantations, from the State fund provided for agricultural purposes in general.

Saxony.—No waste lands of any extent exist in the kingdom, but a fund, formed by the sale of State property, is devoted to the acquisition of unproductive land in the neighbourhood of the State forests, in order that such land may be reclaimed by methodical planting.

The State, however, actively supports efforts on the part of communes and private persons who possess wooded areas, both by giving advice and by providing plants at cost price. Working-plans are also drawn up for such owners by the Forsteinrichtungsanstalt. Instruction is also given at the Tharandt School of Forestry.

The District Agricultural Societies also encourage private enterprise by lectures, and by the grant of subsidies to owners for the planting of deforested areas and the planting of bare pieces of land unsuitable for agriculture.

Würtemberg. — No special steps are taken by the State towards the planting of waste lands. In accordance with the

law, an area which in the opinion of the Forest Authorities is suited to timber-growing, but which becomes deforested, must be replanted within a certain time. In each forest district private forest land is inspected every five years in order to secure the carrying out of these and other regulations. The head forester, therefore, in each district has ample opportunities to stimulate the afforestation of land suitable for planting, and to give owners the benefit of his advice on all forestry matters. Saplings from the State nurseries are supplied at a small cost, instruction is given at the Agricultural Institute at Hohenheim, and in exceptional instances, such as the planting of rocky slopes, subsidies are granted towards the preliminary expenses.

It may be mentioned that in accordance with the property tax law in Baden, all private waste lands, pastures, fields, and uplands planted with timber remain free from taxation for a period of twenty years, counting from the beginning of the first year of planting.

# 27. The Aberdeen Branch of the Royal Scottish Arboricultural Society.

EXCURSION TO FORGLEN AND HATTON.

From Notes by C. S. FRANCE.

On Saturday, 12th September 1908, on the invitation of Sir George Abercromby, Bart., of Birkenbog and Forglen, and of Mr Garden Duff of Hatton, the members of the Aberdeen Branch enjoyed a highly instructive excursion to the woods of Forglen and Hatton.

### FORGLEN.

Mr Sydney J. Gammell of Drumtochty acted as leader of the party. At Forglen, Mr Bell, the forester, conducted them to the Meadowland plantation, about 80 acres in extent. He explained that the present crop of spruce was about 50 years old, and had been planted in succession to a former crop of Scots pine, a considerable number of which had been left standing, the result being, to a large extent, a two-storied crop. The volume of the existing crop was estimated to be about 4000 cub. feet per acre. A discussion here arose as to the merits

of clear cutting, as compared with the raising of a two-storied crop by underplanting, and other matters.

The plantation next visited was the Todlawhill Wood, which is about 200 acres in extent. It consists of a thriving young crop of Scots]pine planted in succession to a former crop of the same species, which had been removed between the years 1886 and 1897, and yielded timber of high quality. The present crop bids fair to equal its predecessor in that respect.

The party next examined the creosoting plant, the sawmills, nurseries, and gardens. A fine specimen of the narrow-leaved ash (Fraxinus excelsior var. angustifolia variegata) attracted considerable attention. It was 38 feet high and was evidently a graft on the common ash. It was noticed that certain branches of the graft produced leaves and buds like those of the common form. The pinetum was found to be very interesting, and several of the finer trees were measured. The most free growing among them were the Western American conifers. Attention was directed to an old larch tree, which had been planted in the year 1750, just twelve years after the planting of the first larch trees at Dunkeld by the Duke of Atholl. It was 70 feet high, 12 feet in girth at breast-height, and was computed by Mr Bell to contain 264 cubic feet (quarter girth) of timber. Another very notable tree was a Spanish chestnut, which was a particularly fine specimen of the species as grown so far north; it was 80 feet in height, and girthed 14 ft. 8 ins. at breast-height.

The party were entertained to lunch by Sir George Abercromby on the lawn at Forglen House. Mr Sydney Gammell, in proposing Sir George's health, took occasion to express the thanks of those present for the privilege they had enjoyed in visiting so well-wooded and beautiful an estate as Forglen.

## HATTON.

The party next visited the extensively wooded policies of Hatton Castle, where they at once proceeded to carry out the inspection programme which had been prepared for them by Mr Barron, the venerable forester of the estate, who is the second, if not the third, of his family in lineal descent to fill the important office of head forester at Hatton. He and his father or grandfather had planted nearly all the trees now growing there.

The first wood visited was Upper Greystone. The stock consisted wholly of spruce, about 25 to 30 years old, and was very

dense. The instructive value of the excursion was greatly enhanced by a discussion which here took place on the comparative merits and demerits of a high density of stock. Mr Duff kindly accompanied the party, and gave them much valuable information regarding individual trees and the plantations as a whole. An older plantation, which had been underplanted with Douglas fir, was then visited. The Douglas firs presented a very healthy appearance, and well illustrated their suitability as an under-crop. Several other very interesting woods were visited, including a young mixed crop of Scots pine and larch, where it was remarked with satisfaction that the larches were likely to outgrow the disease which had attacked them.

The excursion was brought to a close at Hatton Castle, where Mr and Mrs Garden Duff very kindly entertained their visitors to tea. The arrangements for what proved to be a highly enjoyable and instructive excursion were admirably carried out by Mr R. Scott, the Hon. Secretary of the Aberdeen Branch.

# 28. The Trees of California.1

By F. R. S. BALFOUR.

Before beginning to tell you what I know of the trees of California, I would like to explain briefly the geographical characteristics of the country. It is, as you know, a State about a thousand miles long, and nowhere over two hundred miles broad. The range of the Sierra Nevada Mountains divides it on its eastern frontier from the rest of the continent, and parallel with them is the Coast Range extending from north to south, and merging, with the Sierra Nevada in the north, into the Cascade Range of Oregon and Washington; the great Mount Shasta-14,400 feet, an extinct volcano-is the landmark on the northern boundary. The only important break in the Coast Range is the Bay of San Francisco. Between these two ranges lies the great central fertile belt, drained by the Sacramento and San Joaquin Rivers, which, flowing the one from the north and the other from the south, join and debouch into the Bay of San Francisco.

<sup>&</sup>lt;sup>1</sup> Lecture delivered, with lantern slides, to the Royal Scottish Arboricultural Society, at their Annual Meeting, 5th February 1908.

Owing to the many degrees of latitude covered by the State, and the great differences of altitude, the flora is more varied than that of any other; I suppose that no country in the world of its size is so especially rich in species of conifers. The two great valleys were originally a wilderness of wild oats and flowers, but are now almost entirely under cultivation. Of trees in the plains there are none except *Quercus lobata*, the great Californian white oak, standing solitary, and now surrounded by wheatfields and vineyards.

Along the banks of the rivers grow poplars of two or three kinds, the commonest being *Populus Fremontii*, several alders, such as *Alnus Sitchensis* and *A. rhomboides*. There are many willows, too, of which *Salix lasiandra* and *Salix Nuttallii* are perhaps the commonest. There, too, one finds the western plane tree—*Platanus racemosa*—a large tree not yet introduced into Great Britain.

The photographs I have to show were for the most part those taken on a trip eighteen months ago into the King's River Cañon, one of the great valleys which run up from the San Joaquin River into the heart of the Sierra Nevada Range.

Our starting-point was a fruit ranch in Southern California. For two days we drove through the brown and dried-up foot-hills, and on up the valley of the Kaweah River, to what is known as "Camp Sierra"—86 miles and a 6000-feet rise from the ranch. As we climbed we soon left the dried-up herbage and irrigated orange groves, and our road led upwards through a jungle of shrubs of many kinds. Conspicuous were the "Spanish Dagger"— Yucca Mohavensis—and the white-barked California buck-eye trees, the only Æsculus of California, with the leaves already sear and brown.

The great bulk of the brush, which covers countless square miles of the hills of South California, consists of Adenostoma fasciculatum—a large heath-like shrub belonging to the rose family, and flourishing on dry ground below the conifer belt. From a distance it looks like heather, but its average height is over 6 feet. Then there is the Ceanothus—represented by several species—a mist of blue earlier in the year; the Californian bay—a poor tree here compared to what it is further north in the Siskiyou Mountains; the Manzanita (Arctostaphylos)—with its grey round leaves, red

<sup>&</sup>lt;sup>1</sup> Erica arborea attains in the South of France a height of 12 to 14 feet.— Hon. En.

bone-like branches, and small waxy bell-shaped flowers. The only representative we have in Scotland of that family is the bear-berry, most of the others are to be found in California, and this one we saw 10 feet high. In a bend of the road I saw a few trees of the curious yew-like Tumion Californicum. I had seen it often before in the valleys of the Coast Mountains growing to 80 feet in height, and bearing profusely its plum-like fruit. Another strange tree or large shrub was the Fremontodendron Californicum. I have before seen it earlier in the year, covered with its yellow star-like blossoms, but now these had turned to seed-vessels. It is the only species of its genus in the world. There are many shrubby evergreen oaks, too, which do not raise their heads above the rest of the "chapparal"—the generic name in California for all brushwood. In the moister spots, however, there is Quercus Californica, the most beautiful of the black oaks, growing to a good-sized tree—with its shining leaves and dark trunk.

At last we reached the conifer belt, the first trees seen being Libocedrus decurrens and Pinus ponderosa; and on crossing a ridge of the mountain our road plunged at once into thick and splendid timber of Abies concolor and Pinus Lambertiana. No one who has ever seen that splendid pine in its native land can forget the majesty of the great outward sweep of its branches, leaving the smooth bole a hundred or more feet from the ground, with the huge cones hanging from the ends like tassels. It is the greatest pine in the world, living or extinct. It is not widely distributed, like Pinus ponderosa and Pinus monticola, and does not extend north of the Columbia River. The specimens to be seen in Europe give little conception of the great size and beauty which distinguish it in its native place.

It was ten o'clock and pitch dark before we reached the Camp Sierra, a summer encampment in the heart of the Sequoia National Park, the largest of the Californian forest parks, and embracing about 250 square miles. The park forms part of a forest reserve of 4,000,000 acres of territory—all more or less clothed with splendid timber. Although it was almost dark, we could see the outlines of the monster Sequoias, which dwarfed the other great trees. We spent a day in riding among the Sequoias, and seeing the gorgeous views of the high Sierra Peaks. There would be too much to tell of such an occasion as this, if I were to fairly describe these wonderful Sequoias. Perhaps my photo-

graphs will prove more eloquent than my words. Suffice it to say that there are many thousands of these trees in this park, of all ages, from the seedlings, such as you see here in England, to the veterans, many of whom exceed 4000 years in age, 110 feet in girth, 320 feet in height, and have bark 2 feet thick. Dr Muir, the botanist and explorer, describes one whose rings he counted, and found that at the beginning of the Christian era it was no less than 27 feet in diameter. It would appear that were it not for lightning or corrosion by the water of the ground at the base, these trees would live for all time. A dead standing Sequoia is a thing unknown; and, indeed, when the tree has fallen, its wood seems to be quite imperishable. Its sap is poisonous to all forms of insect and fungus life.

I brought some boards away with me, split from the surface immediately below the bark of a tree which fell 1000 years ago; this had been ascertained by felling and counting the rings of a younger Sequoia which grew astride of the fallen trunk. It is an impressive thing to see these giants, with their feathery green tops, and realise that they are the oldest living things in the world. Seguoia Wellingtonia covers a much smaller area than its only surviving kinsman Sequoia sempervirens. It only grows in scattered groves on the western flanks of the Sierra Nevadas at elevations of 5000 to 8500 feet, and its northern and southern limits cannot be more than 150 miles apart. Sequoia sempervirens, restricted to the Coast ranges, extends north just across the Oregon Boundary and south to Monterey County, California, a distance of 450 miles. The finest Wellingtonia we saw was named the "General Sherman," and I photographed it fairly successfully. There are said to be 25,000 of them in the park. Douglas fir is conspicuously absent from this district. In the more open country round Moro Rock, we saw very beautiful Pinus monticola mingling with the sugar and vellow pines.

The prevailing brush in the forest is Quercus chrysolepis, the "Gold-cup Evergreen Oak," in stunted form; also a charming little brown-barked shrub with blossoms like a raspberry's and fern-like leaves—Chamæbatia foliolosa—not more than 2 feet high. I must mention, too, the most curious of all flowers of that country—the snow plant—Sarcodes sanguinea—a crimson succulent thing which forces its head of bell-shaped flowers through the pine needles soon after the snow melts. The

immense number of bear tracks everywhere in the dust of the trails would go to show that these animals have profited by the protection the National Park gives them. We were kept awake one night by the barking of the dogs that had driven a large one into a tree 50 yards from our tent.

We "out-fitted" with horses at Camp Sierra, and set forth with my cousin and two guides northwards, to spend a few days in the King's River Canon. Shortly after leaving the Sequoias, we found ourselves in pure forests of Abies magnifica, tall and short-branched, with bark of a rich red and much furrowed—a most picturesque tree, far surpassing Abies concolor in interest, and never mixing with it. These Californian Abies, like the Grandis, Nobilis, Amabilis, and Lasiocarpa of the north, are almost worthless for timber, and are neglected by the lumbermen. Our trail led past Alta Peaks and Twin Lakes-where Pinus Balfouriana and its almost exact counterpart Pinus aristata grow, "foxtail pine" as they are both called by the mountaineers of the country-through many Alpine meadows, where the lupines, geraniums, columbines, Minulus, Erythroniums, and lilies were, some of them still blooming, the seed-vessels of others showing how gay August had been in these high places. Our highest point was a pass 9500 feet, after which we rapidly dropped down to our camping-place in a grove of pines. They were Pinus contorta var. Murrayana, and are, I believe, the largest in existence. I saw several 100 feet high, with trunks 5 feet in diameter. They are slow-growing smooth-barked trees, with spiral trunks, the wood extremely hard, but no good to the lumbermen because of the twisted grain. We had no tents with us, and found seven or eight degrees of frost rather trying after the great heat of the low ground we had left three days earlier.

Next evening, after a long trail, we unsaddled our horses on the flat floor of the King's River Cañon, at a point where the opposite walls of the valley had narrowed to a mile apart. These walls were absolutely sheer and 4000 feet high. These deep cañons, which are the most distinctive feature of the Sierra Nevada Range, run up from the main valley of California for 50 to 70 miles through the foothills almost to the main ridge of the chain, and rivers run through each, the waters of which form the Great San Joaquin. The greatest of these cañons is the Yosemite, 50 miles to the north. Others are the

present one, King's River Cañon, the Kaweah, by which we had reached the *Sequoia* forest, and further to the south the Kern Cañon, which is famous as being the only home of the Golden Rainbow Trout.

The peaks of the range are all about 14,000 feet in heightthe highest, Mount Whitney, being 14,500 feet. eastern side, the drop of 8000 feet into Nevada is very sudden, but it is not so to the western side, whither the rivers all drain. We saw a great many yellow pines—Jeffreyi variety—said to be distinguishable from the common ponderosa by its larger cones, smoother bark, and longer needles; however, I found these peculiarities existing indiscriminately, and am inclined to think there is no real variety at all. In the floor of the canon were beautiful black oaks-Quercus Californica-the largest I ever saw, and sugar pines and Libocedrus, the ground being carpeted with evening primroses in full bloom. We camped two miles from the head of the cañon, and fished and explored for a few days. I found Pinus monophylla growing on the precipitous sides of the main river, where it ran or rather fell into the head of the cañon. It is a small sturdy tree 15 to 20 feet high, rather like a well-shaped apple tree. I believe this is the only place where it crosses the ridge of the Sierras, its home being on the eastern side. Pinus flexilis is also said to grow in the cañon, although I did not find it. It is a smaller edition of P. monticola and P. Lambertiana, and, like them, a five-needled white pine. High above all the other trees on the main ridge of the mountains, sometimes at 10,000 feet, Juniperus occidentalis stands solitary on the bare glacier-worn granite "pavements." No tree has such a hold on life as this one. It seems to prefer the bleakest and most wind-swept situations, and lives to an immense age. Dr Muir speaks of finding this tree 2000 years old: and even when a veteran has succumbed to the blasts of winter and is lying over, as it were, on its elbows, there are still tufts of grey scale-like foliage if any root has got foot-hold. The wood seems to be almost imperishable, and when a tree is down it wastes out of existence about as slowly as the surrounding granite boulders. Dr Muir tells how he found one only 2 ft. 11 ins. in diameter, which was 1140 years old, and another, on the same ridge, 1 ft. 7 ins. in diameter, was 834 years old. The first 15 inches from the bark of a medium-size tree, 6 feet in diameter, had 859 layers of wood, or 57 years to the inch.

Our expedition lasted under a fortnight, and the return to the valley was by the same road as we had taken in coming. I must tell you, however, that while gathering the seed of *Fremonto-dendron Californicum*, after having left the *Sequoia* belt behind, I found the large seed-vessels of a climbing plant, which our guides called "Wild Cucumber." On my return home I sent these to Kew, and it proves to be a species of *Echinocystis*, which is new to science, the seeds germinating in a strange fashion. There are one or two other members of the family in California.

I must mention the "Digger Pine" or P. Sabiniana, which grows at the base of the foot-hills of the Sierra Nevada and Coast Ranges. Its nuts provide a tribe of Indians with their chief diet; and it is a curious tree, growing solitary or in groups—with striking, grey spare foliage and a large round cone—at far lower altitudes than any other Western conifer. It is preeminently the tree of the hot, sun-baked foot-hills.

We spent some time in the Coast country, and visited friends near Mount Diablo, which is the northernmost limit of *Pinus Coulteri*. It only grows in the Coast Range east and south of the Bay of San Francisco, and is interesting from the great size of its cones. It is a striking tree, 60 or 70 feet high, with open head and long needles, but the timber is worthless.

In the Coast valleys Quercus agrifolia, or "California live oak" as it is locally called, is the most important hardwood, and there you find Acer negundo—the only tree, so far as I know, common to Eastern and Western America alike. Cerasus ilicifolia is a handsome evergreen cherry, with silver trunk almost like a birch. Some years ago I grew several plants from seed at Dawyck, but it will not stand our late spring frosts. Heteromeles arbutifolia is a shrub which ought to do well in the south of England. Its bunches of berries are just like those of the rowan, and its leaves are evergreen. It is much sought after at Christmas time in California, where it takes the place of our holly.

In the valleys of the Coast Range, to the north of the Bay of San Francisco, one finds *Cupressus Macnabiana* here and there, but it is nowhere common: to the south of San Francisco, in similar situations, we found *Cupressus Goveniana*, both well known now-a-days in most British pinetums.

We went to Monterey to see Cupressus macrocarpa and Pinus insignis in their original home. Both have been pretty widely

planted throughout California near the towns, but their native haunt is restricted to a few square miles just south of Monterey, and, in the case of the pine, to some of the islands off the coast. The gnarled and wind-swept cypresses must be of tremendous age, and you will notice how entirely different their habit is to those one sees in Europe, or indeed in California, away from their natural habitat. I may say that I have seen these two trees growing in Devonshire and Portugal finer than anywhere in California. These are the only conifers I know which seem to thrive better in the land of their introduction than in their own home. (However, I saw some Norway spruce planted seven years ago, in the public park at Tacoma, Washington, which are over 25 feet high, and give promise some day of rivalling the native Douglas fir.)

I should have liked to have gone into the Coast Mountains, immediately behind Monterey, to see Abies brachyphylla or Venusta, but had no time to do so. It is by far the rarest of American silver firs. Further south along the Coast grows Pinus Torreyana, and to the north in Marin County—Pinus muricata, the "Bishop pine."

The only other conifers I need mention are the small nut pines—Pinus quadrifolia and P. cembroides, which grow over the tops of the mountains of Southern and Lower California. The Douglas fir is common throughout the Sierra Nevada and Coast Range, though strangely absent from the King's River district. On the Coast Mountains of Southern California another form of the tree is found, called by Professor Sargent Pseudotsuga macrocarpa, never such an imposing tree as its kinsman the common Douglas, but with bluish-grey foliage and much larger cones.

Of all the trees of the State there is none which provides such magnificent timber as the Lawson cypress, which grows on the Coast on both sides of the California and Oregon boundary, over a comparatively small area. The wood of this tree would be well worth importing by our English timber merchants, did they realise its merits and its comparative cheapness. It is known to the lumbermen as "Port Orford Cedar."

Of all the nine Californian oaks, there is not one whose timber is of any use except for fuel.

# 29. The Glencorse Smoke Case.

By Marion I. Newbigin, D.Sc.

On page 15 of the present volume of these *Transactions*,<sup>1</sup> the chemical aspects of this case were considered by Dr Lauder. It may be of interest to add to that article a short consideration of the botanical aspects, which present some points of considerable importance.

As already explained by Dr Lauder in the paper alluded to, the origin of the case was the fact that in the year 1877, coincident with the beginning of the calcination of ironstone by the Shotts Iron Company, the plantations on the lands of Glencorse began to show signs of damage, declared by the owner—Lord Justice-General Inglis—to be the result of the fumes evolved from the burning bings. A first arrangement was made between the parties whereby the process of calcination was to be carried on only during the winter months of the year, in the hope that the damage to vegetation would then be less; but ultimately, as the plantations showed signs of increasing damage, a lawsuit was begun early in 1881, which was later carried, on the appeal of the Company, to the House of Lords.

Taking first the points as regards the appearance of the plantations, we find that it was scarcely denied by the appellants, in the final case, that the plantations went back in 1877, but they attributed this fact especially to the cold and wet seasons of 1876 and 1877. With respect to the coniferous trees, which were most injured, they said that their condition was due to over-crowding, want of drainage, bad soil, climate, planting under deciduous trees—especially beeches—and also to the attacks of fungi and insects. While, however, maintaining that the unhealthy appearance of the plantations was due to these causes, they also asserted that the two years immediately preceding the appeal had produced an improvement in the appearance of the plantations.

In reply to these statements, the respondent naturally pointed out that if these causes were the sole causes, then it was remarkable that all should show themselves simultaneously in the year 1877, for the first time. He stated also that the fact that signs of injury became apparent all over the planta-

<sup>&</sup>lt;sup>1</sup> On p. 15 this case was erroneously called the *Loganburn* instead of the *Glencorse* Smoke Case.

tions, in trees of very various types and ages, tended to suggest the appearance of a new factor, such as the calcination afforded, rather than the cumulative effect of a series of minor causes, such as unfavourable soil, overcrowding, unsuitable climate, and so on. Further, the respondent brought forward a large body of expert opinion to controvert the statement that the observed damage could be ascribed to the attacks of insects and fungi. It would not appear that there was evidence of very extensive insect attacks, and therefore much of the expert evidence dealt with the question of fungoid attack.

The subject is of especial interest, because it will be recollected that at this date (1881-2) the subject of symbiosis had not been so thoroughly worked out as it was later. It was known that fungoid mycelia did occur round the roots of forest-trees, and that in some instances these fungi were pathogenic. On the other hand, it was not known that certain of the observed mycelial threads form what we now call mycorhiza, which is absolutely beneficial, enabling the tree to take advantage of the humus of forest-soil. The absence of this knowledge led to much wrangling among the expert witnesses, some of whom declared that the mycelial threads always meant the possibility of disease, while others emphasised the fact of observation that such mycelia could be shown to occur on the roots of perfectly sound trees. Much of this evidence is of value as showing how much progress in our knowledge of the conditions of plant life has been made in a period of less than thirty years, a fact which is full of promise for the future.

We shall give some account of the chief lines of evidence brought forward by the botanical experts. As was natural under the circumstances, the number of such experts brought forward by the respondent—who was constrained to prove that no other cause for the observed damage existed except that of the fumes—was much greater than that brought forward by the appellants, who laid greater stress upon the chemical difficulty of proving that the fumes had actually reached the affected trees.

The exact appearance presented by the trees in the plantations may be briefly noted. The first effect of the fumes was to produce a drooping appearance, as if the trees were suffering from want of water. This was followed by a change of colour in the leaves, which lost the green tint of

health, and became brownish, greyish, or yellowish, looking as though they had been scorched. Subsequently these leaves fell off, so that a marked characteristic of the injured trees was their poverty in leaves. Further, in contrast to the ordinary "dying back" of trees, it was noticeable that the browning and withered appearance did not appear at the top of the tree and spread downwards. It appeared at different points in the various trees, so that, in some instances, it was found that the middle branches were practically dead, while those above and below seemed quite sound. These facts could be readily explained if the observed effects were due to injurious vapours, which might be carried by the wind to certain parts of the trees only, but were not easily explicable on other grounds.

Again, not only were the leaves affected, but also the young shoots, which had a scorched appearance similar to that of the leaves, and subsequently fell off. The scorched appearance began at the tips of the young shoots and travelled downwards, this being stated to be very characteristic of damage by calcining fumes. In the leaves also there was similarly observed a travelling inwards of the damage from the tip towards the leaf-stalk. In addition to the browning, deposits of soot were observed upon the branches and trunks of the trees. Where the damage to the leaves and young shoots was extensive, it resulted in the death of the tree.

Beginning with the expert botanical evidence brought forward by the respondent, Lord Justice-General Inglis, we may take first the evidence of Prof. MacNab, of Dublin. He stated that he found on the leaves of the conifers a deposit of soot, which seemed to have injured the leaves, having in some cases destroyed the green colouring matter. On the leaves he found also a fungus (Torula pinophila), which occurred on both healthy and unhealthy trees, and is harmless. On the roots of some trees fungoid mycelia were found, but no injurious fungus was observed. This mycelium was found both on the roots of healthy and of unhealthy trees. No evidence of any extensive insect attack was observed by this witness, who considered that the evidence showed that the trees were being damaged as a result of the destructive effect of sulphurous acid on the leaves, as proved by their change in colour.

Mr W. G. Smith, the next witness, also emphasised the bad condition of the leaves. In cross-examination, the opposing

counsel dwelt especially upon the question as to whether it was or was not possible to distinguish between injurious root fungi and harmless ones. The witness gave it as his opinion that the injurious forms grew "upon the root," while fungi growing "about the root" were not "necessarily injurious."

Very definite and precise evidence was subsequently given by Dr Sidney Vines, whose acquaintance with De Bary's work on fungi gave him many advantages. Dr Vines had studied all parts of the trees, those above as well as those below ground. He found traces of fungi on all parts, but was able to show that there was no evidence of the fungal hyphæ penetrating to the internal tissues of the trees, and thus there was no evidence that they were injurious. He had cut sections of the roots, and these showed the absence of the hyphæ in the internal tissues. He was also able to show that there was no difference in the fungi found on the trees at Glencorse, healthy or unhealthy, and those found on the roots of healthy trees growing in localities other than Glencorse. His statement, however, "I was not able to ascertain the nature of the particular fungus which I found on the roots," reminds us how much work on the fungi still remained to be done at this time.

Dr Vines also pointed out that the crop of leaves in the woods was scanty, and that the leaves present showed evidence of damage. In his opinion, the suggestion that the damage was due to frost was negatived by the fact that the young shoots were not damaged. He therefore concluded that the trees were suffering from the effect of some injurious vapours in the air which acted upon the leaves. The cross-examination was especially directed to the question of the possibility of distinguishing between the fungi found by Dr Vines on the roots of some of the trees and injurious parasitic fungi. The absence of any penetration into the internal tissues by the hyphæ observed seemed, in this witness's opinion, to prove definitely that these hyphæ were not injurious or parasitic.

Subsequently Mr John Murray, of the British Museum, gave evidence as to finding putrefactive, or what we should now prefer to call saprophytic, fungi on the trees in Glencorse; but, as he showed, these were merely a result of the diseased condition of the trees, and not a cause of disease.

Prof. M'Kendrick, who followed, restricted himself chiefly in his evidence to the fungi question. In sum, his evidence

was identical with that of the previous observers, and, as before, the cross-examination resolved itself into a discussion of the question whether or not it was possible to distinguish between injurious and harmless root-fungi.

The evidence of the Rev. Miles Berkeley was taken on commission. It followed much the same lines as that of the previous authorities.

To sum up, the expert botanical evidence put forward on behalf of the respondent may be said to have established the following points:-The mycelia of unknown fungi occurred not infrequently in connection with the roots of many of the trees on the estates, but there was nothing to distinguish these mycelia from those found on the roots of healthy trees in other localities, nor was there any apparent difference between those found on healthy and on unhealthy trees at Glencorse. There was thus no evidence that the fungi forming these mycelia were injurious, and in no instance was any penetration of the internal tissues by these fungi observed, such as would be expected in the case of a genuine parasitic fungus. Further, neither on the roots nor on the other parts of the trees was there any evidence of attack, on any scale, by any recognisable parasitic fungus. Though there was evidence of insect attack in places, yet these attacks were on a small scale, and insufficient to account for the observed unhealthy appearance of the trees. The unhealthy appearance was especially due, as already indicated, to the condition of the leaves, which were few in number, and discoloured or otherwise injured, the injury being apparent even in the bud. In the opinion of the experts named, therefore, there was nothing to account for the appearance of the trees except the effect of injurious vapours on the leaves and unfolding buds.

Turning now to the evidence on the appellants' side, we may take first that of Mr Cooke, of Kew. Mr Cooke examined the roots of diseased trees, found fungi on these, and was able to show that penetration by fungi had occurred in the cases examined by him. He gave it as his opinion that the cause of the unhealthy appearance of the plantations was, first, overcrowding, and second, the attacks of root-fungi. It is to be noticed, however, that Mr Cooke examined only the roots of diseased trees. On cross-examination, he admitted that he had no evidence to show that the penetration observed by him

preceded the death of the root, and so could be reasonably regarded as the cause of this death. He was unable to state that he had seen any living portion of a root penetrated by the fungi observed.

Mr Cooke was followed by Prof. James Trail, of Aberdeen, who thought that the appearance of the plantations might be ascribed to natural causes. The soil seemed to him unsuitable, he observed signs of insect attack, and, like the other observers, he saw fungi on the roots. As to the fungi, he stated that he found fungi "on and under" the roots, and, on microscopic examination, found that some of the hyphæ had penetrated the roots. In cross-examination, Prof. Trail expressed a doubt whether fungi round the roots of a tree, even if they did not penetrate, could be described as inocuous. "If you find the young tender roots surrounded by mycelia or filaments, these roots cannot be doing their work." [We know now, of course, that this is not the case.] "I do not see where the fungus gets its nourishment, except from the roots, unless there be decaying matter." This witness further expressed the opinion that the fungi had penetrated before death, and that death had been, at least in part, due to their action. Prof. Trail did not however find evidence of any one sufficient natural cause which could be said to have begun action at a definite date, and which was capable of producing widespread injury. In the absence of any such single sufficient cause, apart from the sulphurous fumes, the mere occurrence of isolated cases of injury by insects, injury by fungi (if this had occurred), and so on, can hardly be regarded as sufficient to account for the proved facts.

In the case as tried in the Second Division of the Court of Session, Lord Young dissented from the finding of the Lord Justice-Clerk, this dissent being, no doubt, a factor in the decision come to by the Shotts Iron Company to carry the case to the House of Lords. This dissent was, in part, based upon legal points which do not affect us here, but is of interest to note the opinions expressed by Lord Young in regard to the damaged conifers. Lord Young stated that he considered that it had been proved that, since 1877, the conifers of the Glencorse estate had manifested symptoms of bad health. He considered, further, that it was proved that, in some cases, this diseased condition was due to the fumes of the burning bings. He considered, however, that all the observed damage done was

not due to this cause, and that some of it could be accounted for by natural causes. Though he did not state the fact expressly, it is permissible to conclude that his opinion was largely based upon the admitted difficulty of distinguishing, at this date, between pathogenic and inocuous fungi, the difficulty round which so much of the cross-examination of the experts centred It is, however, not easy for anyone acquainted with the conditions of plant life to believe that in extensive plantations, showing very well-marked and uniform diseased conditions, the disease could be due in one place to fungi, in another to insects, in another to fumes, and in another to unfavourable soil. To admit also that the fumes had caused some damage, made it difficult to avoid the conclusion that they were responsible for the observed difference in the appearance of the plantations before and after the beginning of the process of calcination. Now that further research on fungi has done much to remove the ambiguity which, in 1881, hung over the question of "root-fungi," it is difficult to come to any other conclusion than that which was reached by the various courts before which the case was tried—that is, that the trees were injuriously affected by the sulphurous fumes.

# 30. Continental Notes-Germany.

BY BERT. RIBBENTROP, C.I.E.

(With Two Plates.)

The great fight over the educational question of the rising generation of forest officers in Germany is over; there is peace or at least an armistice. Both parties remain where they were at the outset of the contest, but the Academies have obtained a substantial gain in a more liberal financial support from their Government, owing to which their capacity, both as regards technical education and practical research, has been considerably enhanced. Whatever may be the general opinion on the comparative educational merits, between Academies and Universities, it cannot be gainsaid that the former are taking the lead in practical research regarding several of the most important forest questions of the time.

## Afforestation of Waste Lands.

In Dr Albert's interesting work on root disease in pines on old farm lands, a short notice of which was published in the *Transactions*, vol. xxi., p. 143, an identical disease was shown to be prevalent on heather tracts in the Lueneburger Heide and elsewhere; and it was even then accepted that only true forest soils could be considered to offer immunity from the root pest which attacks pine afforestation on all other lands.

This position was questioned, as was to be expected, and many instances were cited where afforestations on forest lands in the regions of the Lueneburger Heide had suffered in the same way as those on open heather.

Von Bentheim and Graebner, who are considered experts in silviculture on heather lands, hold this view. The former at a recent forest conference, held in Bremen, said: "The pine forests can, in their early youth, satisfactorily regulate the action on the soil of both moisture and heat, but are not able to do this when they reach a more advanced age, and it is for this reason that the early pole stage is such a critical time. We see, in all pine afforestation in the Lueneburger Heide, first isolated premature deaths, then a gradual thinning out of the crop, and finally a general breakdown of the forest, in short the regular course of the diseases which are still known under the collective name of root-rot; and this happens not only on newly reclaimed tracts but on old forest soils as well. This is a fact which has been verified by the most recent research."

In the face of such an authoritative assertion, the *possibility* could not be disregarded of the existence of a special climatic influence, or of other unrealised conditions of growth, inherent in and peculiar to the North-West German heather tracts; the more so as this theory had been for years adopted as *infallible* by many authors. However, as no special peculiarities, pertaining to the tracts in question, could be elicited by the most diligent inquiries, nothing remained but to test the accuracy of "the most recent research" quoted by Von Bentheim, and accepted by others.

A. Zimmermann undertook these inquiries on behalf of the Forest Academy of Eberswalde, and made careful and farreaching investigations into the forest history of the districts in question, in order to ascertain—firstly, whether and to what

extent the pine and spruce are indigenous to the Lueneburger Heide; and secondly, what were the forest conditions when the conifers were first artificially introduced on a large scale.

It would lead us too far were we to follow Zimmermann's investigations in detail, but the numerous documents consulted and cited, many dating back to before 1650, render it evident that both pine and spruce are indigenous in a considerable portion of the heather tracts of North-West Germany; and that, at some time, they encroached naturally on the then existing forests of broad-leaved species. The northern portions of these natural pine forests reached well within the areas in which the present calamity rages, and as regards these, at least, there can be no question of adverse climatic or other general conditions inherent in the locality. In the northern parts of the Lueneburger Heide conifers were evidently not indigenous: but it is proved, by the existence of numerous isolated old forests, that this cannot be accepted as being an effective barrier against their artificial introduction. These pine forests are scattered all over the country, and flourish on a great variety of situations and soils.

The history of the extensive mixed forests, mainly consisting of beech, hornbeam, and oak, which at one time covered a considerable portion of the Lueneburger Heide, as elicited from the very complete documentary evidence still in existence, is sad reading. Once again we need not follow Zimmermann through the vast number of documents he studied and quotes, but we briefly summarise the chronicle of the ancient Stueve Wald in the Harburg district, as representing the state of affairs throughout the length and breadth of the country.

In the middle of the seventeenth century this forest, although already considerably reduced in size by numerous settlements, still contained some 30,000 morgen of fairly well-stocked mixed forest. In 1680 the Government still derived some benefit from it, and spent money on its amelioration. However, during the next twenty years or so, the exercise of entirely undefined rights, on the part of thirty-one communities, had got absolutely beyond control. The wasteful extraction of timber and the general maltreatment of the forest was such that the stock of mature timber became entirely exhausted during the earlier part of the eighteenth century. The fact that the Government abstained for years from felling on their

own account delayed the evil day but little. When the mature timber was exhausted, the right-holders felled immature trees, and so it went from bad to worse. A commission was appointed in 1794 to inquire into the then existing condition of the forest. They reported that the Stueve Wald consisted of only 6000 morgen, covered with beech, scrub, and some small coppice-standards, and that the rest was barren and heather-clad. However, even then the course of destruction did not cease, and as no settlement could be arrived at, it ended only when there was nothing left to destroy. The great Druhe Wald in the Winsen district, favourably situated for export. was razed off the face of the earth even more rapidly, and quite as effectively.

The records of all districts in these heather tracts contain the same story. The danger was fully recognised, but the authorities were utterly powerless in the face of entirely unregulated rights of user, as exercised by a particularly independent and selfish peasantry, who resisted all attempts at settlement. The innumerable complaints and warnings which flooded every office remained ineffective for more than a century. When the conifers, pine and spruce, were first introduced into these regions, the great old forests of broadleaved species had practically disappeared and with the exception of some scattered remnants had ceased to exist. The old name alone remained.

The forests in these heather tracts have, doubtless, less recuperative power than those growing on more favourably situated and richer lands; for the heather sprouts, owing to the generous precipitates of moisture, even in the half shade of opened-out forests, and the natural reproduction of broadleaved species, with the exception of the birch, is thereby rendered impossible. The natural consequence was that not only was the growing stock of timber destroyed and wasted, but that all chances of recuperation, and with it the very forest soil itself, was lost.

It is not a matter of speculation, but of documentary evidence, that, with few exceptions, the first afforestations with conifers took place in such forests, of which only the name remained, and here the pest has naturally had full sway; but where, on the other hand, the records show that the pine and spruce were cultivated in the still existing scattered remnants

of the original forests, their roots were not attacked by the disease, and they grow quite normally in the midst of pest-stricken forests. The existence of such healthy forest-areas is not confined to the better classes of soils, nor to any special locality, nor to particularly favourable situations.

Zimmermann, by his painstaking practical investigations, has satisfactorily proved that the theories ascribing the early collapse of the pine afforestation to conditions of climate or soil peculiar to the Lueneburger Heide, are untenable, and that the statements made in support thereof, regarding the existence of the pest on forest soils, are based on wrong data and are contrary to the facts of the case.

The scarcity of timber in the Lueneburger Heide led to the afforestation of practically valueless waste lands with conifers, a hundred years before similar attempts were made in other parts of Germany, with the result that the root-pest was first observed in these parts and seemed to exist nowhere else. Under these circumstances it was natural and excusable, though unfortunate, that the reasons for the prevalence of the disease should be looked for in local conditions, and that, owing to this, investigations into its origin were started on false lines, leading into the quagmire of speculative and untenable solutions which, though impossible to prove, were put forward with the greatest authority in numerous publications.

Thus the raw humus (dry peat) has many adversaries, has been called the pest of the forest and other bad names. Graebner professes to find in it the direct cause of the root-rot, in that it closes the soil against the circulation of oxygen, but it is evident that dry peat has no relation, whatsoever, to the root-pest, which rages equally in the east of the Lueneburger Heide, where raw humus is almost entirely absent, whereas in some of the best and soundest pine forests it covers the soil up to a depth of 50 and even 80 centimetres. Experiments have moreover shown that dry peat, if properly applied, is the most effective manure for the pine.

Next as regards poverty of soil, to which many ascribed the failure of the afforestation in the heather tracts, P. Graebner, a botanist of note, writes in his handbook on heather culture: "It must strike everybody, who, even casually, passes through the heather tracts of North-West Germany or in other countries, that a cultivated plant which enjoys a complete normal develop-

ment is but rarely found." This is not borne out by facts, as regards the Lueneburger Heide. It is proved by statistics that the percentage of absolutely poor soils in these regions is no greater than in many parts of Prussia east of the Elbe, and that, probably owing to more generous precipitation of moisture, the results of agriculture are considerably higher than on similar lands further in the interior. Even beet can be cultivated, at a profit, on pure sand soils; and all agricultural plants, with the exception of the potato, are particularly free from disease of any kind. To all of this I can testify from personal observations, as, in my youth, I spent several years in various parts of the Lueneburger Heide, occupied during a portion of this time on these very afforestations, which are now dying out.

Numerous analyses have moreover been made during recent years of the soils in these heather areas, showing that they were by no means so bad as had been universally believed without sufficient evidence. Only the almost entire absence of lime is typical. However, both pine and spruce are extraordinarily independent of this mineral, a fact which is proved by an analysis of the soil in the Luess forest, where conifers of the largest dimensions exist, and have existed as far as records go back, though the soil contains only the sixtieth part of the amount of lime which has been accepted for a pine soil of even the fifth class.

When Graebner's handbook was publically challenged by a practical forester, who for upwards of fifteen years had been in charge of one of the heather-tract forest divisions, the author replied that the critic made too much of his secondary statement regarding the poverty of soils, though, throughout his book, his arguments were prominently and almost entirely based on the peculiar climatic conditions of the heather tracts; and that in this he was supported by the opinion of all authors who had earnestly and seriously studied the heather question. This is true enough, and the position of the school supporting this argument was somewhat unassailable, until it was shown that identical failures took place, and with the same certainty and regularity, in afforestations of waste lands with conifers, in localities which had none of the characteristics of the Lueneburger Heide, or other heather tracts, and even on gneiss and limestone soils.

So long as it was believed that the calamity was purely a local one, the origin of it was naturally looked for in local

conditions. The start was made in the wrong direction, and, though none of the various theories promulgated could at any time have stood the test of a really searching inquiry, they were accepted for want of something better, and it became merely a question of follow the leader.

The merit of having effectually disturbed this condition rests with Drs Albert and Zimmermann, of Eberswalde. Their labour is characterised by careful, painstaking, and unprejudiced research; and the position that the root-pest attacks, almost invariably, all afforestations with pine and spruce and almost all other conifers, on every description of waste land, and that only bona fide forest soils offer immunity against this disease, is more firmly established than ever, But why this should be the case is as yet an unsolved problem, for Zimmermann found, in the course of his investigations, at least one instance where the soil in a diseased forest grown on heather land had an entirely satisfactory porosity.

The question naturally arises, Do micro-organisms exist in forest soils which protect the pine roots from this particular form of disease? Or are there others in waste lands which attack the roots of certain species, or which render them liable to attacks by the fungi, present as Saprophytes in all forest soils, but assuming dangerous characteristics in waste-land soils? This of course is pure speculation, but one fact seems to stand out, and to indicate the way further inquiries might take, viz., that those trees are immune from root-rot, which, in spite of the vast amount of nitrogen they use up in their formation, not merely maintain the original percentage of nitrates in the soil, but increase it. It is self-evident that this can only be effected by a direct assimilation of the inexhaustible supply of the nitrogen in the air, and it has been ascertained by the Hungarian scientists Zemplén and Roth, that the organs having the power of absorbing nitrogen direct from the air (a power first discovered by Jamieson) are more evident on broad-leaved species than on conifers, and show a much more pronounced albumen reaction. This, however, by no means precludes the correctness of the bacterial and mycological theory; they may co-exist and supplement each other. There is still much to learn in this respect.1

<sup>&</sup>lt;sup>1</sup> A German, fairly comprehensive, extract of the work by Dr Géza Zemplén and Julius Roth, under the title "Beitraege zur Stickstoff Aufnahme des Waldes," appeared in the *Erdezeti Kiserletek*, in Selmbanya, Hungary, and is well worth studying.

From a scientific point of view I cannot imagine a more interesting problem than the solution of this question, but it is not of the same vital importance for the practical silviculturist.

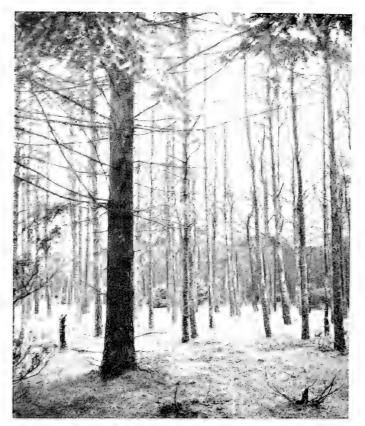
The general conditions of the Lueneburger Heide are, from a forest point of view, by no means so complicated as they were believed to be, but are on the contrary particularly simple when stripped of the speculative theories by which they were so long shrouded and befogged. The one all-prevailing fact that neither pine nor spruce can be grown, with any reasonable expectation of success, on any other but true forest soil, was unknown till quite recently; but, since this has been discovered to be the case, the future rehabilitation of the forests in the Lueneburger Heide, by rational forestry, looks by no means so gloomy as it did a few years ago. It is naturally a sad thought that all efforts made in this direction during nearly 150 years have had so few permanent results, and that there is so little to show for the millions of money spent all over Germany in the innumerable attempts to afforest waste lands with pine, spruce, and other conifers. The seriousness of the position is fully realised in Germany, but the question which occupies the forester of the day is what is to be done in the future. They take forestry earnestly in that country.

The one fact which stands clearly out is that forest-soil conditions can be created in a comparatively short time, by planting the waste areas in the first instance with broad-leaved species, which are not attacked by the root disease, and that, when the ground has been for some time under cover, conifers can be introduced without danger. The abandoned fields and heather lands at Rosengarten, a Government possession, were cultivated with beech, oak, and hornbeam about 1750. Thirty to fifty years later both spruce and pine were introduced, grew up to healthy maturity, and are still partly in existence.

The intermixture of broad-leaved species, preferably of beech, accacia, and hornbeam, has, generally speaking, given good results, though there have been failures. The thinning out of the coniferous crop on the ground and the inter-planting with species unaffected by the disease, has proved efficacious in a good many cases, but the results are by no means certain, more especially when the disease has already set in. In such cases, the only radical cure of the evil seems to be a gradual, but entire elimination of the diseased conifers, these being replaced



# PLATE III.





Continental Notes -Germany. (For explanation see Text.)

for the time being by broad-leaved species. In addition to broadleaved species, the silver fir has so far proved to be free from infection, but on heather lands this tree has not maintained its character as a soil improver. It entirely changes its original root-system in these localities, and instead of the deep-growing roots which it developes in its natural habitat, and which so materially aid the circulation of air by loosening the soil, it only grows far-stretching surface roots. The Douglas fir also is believed to be unaffected by the root-rot, for as yet no trace of the disease has been found where the tree has been cultivated on waste lands; however, the tree is not as yet very plentiful in the heather tracts, and the oldest specimens, though they look strong and healthy and show a magnificent development, even on inferior soils, are only forty-five years old. The Douglas was planted in considerable numbers thirty years ago by the late Mr John Booth (a gentleman who acquired a reputation as a practical forester in Germany) in the midst of a pest-stricken pine forest. Till now none of these shows any signs of the disease, and they are finely-grown trees. Some foresters hail this tree as the possible saviour of the situation, at least in the Lueneburger Heide, where the precipitation is much greater than farther inland. The Douglas has proved to be a decided soil improver. Its well-developed root-system not only loosens the soil, thereby facilitating air circulation, but seems also to have a pronounced exciting influence on the activity of useful bacteria in the soil. Comparative experiments with soils, in regard to nitrifying bacteria, proved negative in the case of pine soils, but showed nitric acid in the Douglas soils within forty days. The latter soil also produced, under equal conditions, double the quantity of ammonia with a solution of peptone. However, I notice in the discussions on Dr Nisbet's paper on Afforestation in these Islands, read at the last meeting of the Royal Society of Arts, that in Scotland the Douglas fir had, in a good many instances, been attacked by a rather serious fungus disease.

A matter of such importance must, under existing circumstances, be of the greatest interest to our fellow foresters in Germany, and I would be grateful for any information which any of your readers may be able to impart regarding the character of the disease, and especially whether it has occurred on waste-land soils only, or whether it has been observed also on trees growing on true forest soils.

Both pine and spruce afforestations on waste lands frequently escape the disease where the natural water-level is not more than 3 to 4 feet from the surface, but in these cases they show a very characteristic root formation, entirely different from the usual development of their root-system. They send down a number of separate bunches of roots to the water-level.

Two plates are annexed. The upper figure in Plate III. represents a healthy Douglas fir, growing on an inferior soil in the midst of a pest-stricken pine forest fifty-five years old; the Douglas is only thirty years of age, but already measures 40 centimetres diameter at breast-height.

In the lower figure-

- (a) Represents the root-system, with the tap-root cut off, of a healthy Douglas fir, thirty years old, growing in the same locality. The roots were in actual contact with diseased pine roots.
- (b) Represents the roots of a diseased pine fifty-five years old, grown in the immediate vicinity of the Douglas.
- On Plate IV., (c) Shows the peculiar development of the roots of a healthy Scots pine, grown on old fields, but with a natural water-level of 3½ feet below the surface.
  - (d) Exhibits the peculiar formation of the root-system which the silver fir assumes on heather lands.

(The German Notes will be concluded in the January issue.)

## ERRATA.

CONTINENTAL NOTES—FRANCE.

By A. G. HOBART-HAMPDEN, p. 46.

On p. 47, line 11, for "value" read "volume."

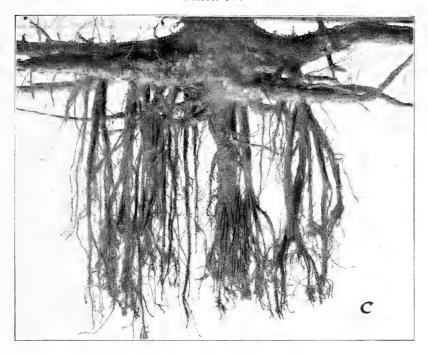
On p. 51, line 7 from bottom, for "silviculture" read "silvicultural."

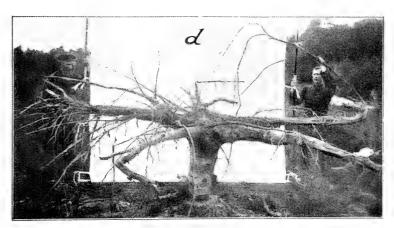
On p. 53, line 16, for "Thuya" read "Tsuga."

On p. 23, line 20, for "11° Fahrenheit" read "-11° Fahrenheit."

On p. 55, lines 3 and 4, for "of extreme durability . . . stag-headed" read "the trees continue to grow to a great age, even though stag-headed."

# PLATE IV.





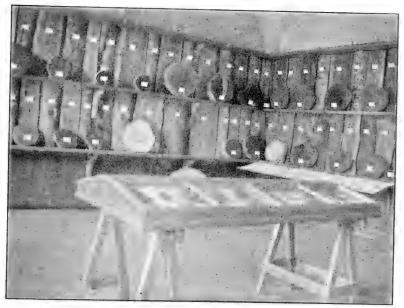
CONTINENTAL NOTES—GERMANY. (For explanation see Text.)



# NOTES AND QUERIES.

FORESTRY MUSEUM: MURTHLY ESTATE.

This museum (see figure), which has now been in existence for about five years, is intended for the exhibition of interesting objects connected with forestry, and consists of a general collection, as complete as possible, of specimens of the natural products on the estates.



The collection at present consists of:

- (1) Specimens of over fifty varieties of the timber of coniferous and of broad-leaved trees, arranged to show longitudinal and transverse sections and bark, each labelled with its common and its scientific name.
- (2) A collection of fungi, larvae, insects and scale, injurious to forest trees, named and arranged for easy inspection, together with examples of many of the fungoid diseases affecting the foliage of broad-leaved trees.

- (3) A collection of cones and foliage of some of the trees on the estates.
- (4) A collection of 167 varieties of tree seeds, which was shown at the Edinburgh Exhibition; and a design of sixty-three different kinds of timber in longitudinal sections, named and mounted in a frame.
- (5) Models of a water-gate to be erected across a river or broad stream, as a fence for farm stock; and of a self-acting rabbit-proof water-gate for ditches or small streams, suitable for plantation inclosures, etc.
- (6) As natural products, there are forty species of wood grasses—almost a complete local collection—neatly mounted, with the common and the scientific names, and the natural habitat.
- (7) As curiosities are shown natural ingrafting, excresences, contorted roots, and several other specimens of minor importance.

Specimens are being continually added to the museum, and every effort is being made to make the collection as complete, attractive, and instructive as possible.

A Reading Room and Library,—with writing materials for note taking, – are combined with the Museum for the benefit of workmen on the estate, and also for others interested from neighbouring estates. The room is commodious, and lighted by electricity, with the specimens neatly arranged.

The library includes all the most modern books on Forestry, Forest Botany, Cryptogamy, and Entomology, also sets of the *Transactions* of the Royal Scottish, and Royal English Arboricultural Societies, together with several useful weekly and monthly periodicals. There are also provided model specifications of all ordinary descriptions of wood and iron fencing, and dyke building, with the probable cost of erection; and also of field and plantation drains, road making, the conditions of sale of timber, etc.

It is the intention, from time to time, to have lectures on forestry and kindred subjects delivered by experts. Meetings are held weekly, and are largely taken advantage of by local men interested in the subject.

It is difficult to overestimate the benefits to be derived by those taking full advantage of the opportunities thus provided for them. Young foresters in particular, can hardly fail, with application and daily practical experience, to acquire a degree of proficiency which it would be difficult otherwise to attain. The museum should thus be of material advantage to them in obtaining, and creditably filling, appointments of importance in their profession.

A. Murray.

[We are glad to publish the above interesting account of an estate forest museum, and trust that the example set by Murthly may be followed on other Scottish estates.—Hon. Ed.].

# REVIEWS AND NOTICES OF BOOKS.

Illustrations of Conifers. By H. CLINTON BAKER. Vol. 1. 12+75 pp., with 66 beautifully executed full-page plates showing foliage and cones. Printed privately by Simson. Hertford, 1909.

Mr Clinton Baker has done a real service to the innumerable people in this country who are interested in trees, whether as professionals or as amateurs.

This is the first occasion when exact reproductions by means of photography of the fruit and branchlets of practically every known conifer have been issued. The photographs have been taken with such care as to render identification from them an immeasurably easier matter than by means of the highly technical botanical descriptions to be found in text books. One only wishes that it might have been possible to place side by side with the pictures of cones and needles, portraits of the living trees from which they came.

Many of the species included in this volume must be altogether unknown to any but a select few among arboriculturists; for instance, how many members of the Scottish Arboricultural Society have seen the fruit and leaves of *Pseudotsuga Japonica*, or indeed know of that tree's existence? Since the publication of this work, however, the reviewer has

seen a few small specimens at Kew, where they have just been introduced.

One most interesting point is well brought out by these photographs, namely, the difference in the appearance of the fruit and foliage of some species as produced in this country from that of the same trees in their native land; in *Pinus ponderosa*, for instance, the specimen figured in this work is clearly from an English-grown tree, as the leaves are produced so much more thickly, and the cones are so much more acuminate than is the case with the native of Oregon or California. Also in the case of that finest of all pines, *P. Lambertiana*, the cone illustrated is not more than half the length of most native specimens, though doubtless the exigencies of space had to be considered.

A short description of each species, which will greatly assist in identification, is printed facing its photograph. The native habitat of the trees is also given, and the dates of discovery and introduction. An index to the pages would be a most useful addition, but probably this will appear at the end of Vol. II., which is to contain figures and descriptions of *Abies, Picea, Larix*, and other smaller genera.

The nomenclature of conifers in most British collections is notoriously defective, and if Mr Clinton Baker has done nothing else, he has given us a book which will render it a much easier matter than it has hitherto been to identify our specimens with the same accuracy as he has done in his most interesting pinetum at Bayfordbury.

F. R. S. B.

Schlich's Manual of Forestry. Vol. V., "Forest Utilisation." By W. R. FISHER, M.A. 2nd Edition.

In the notice which appeared at p. 119 of the present volume, we should have stated that this book is the translation of a new edition of Karl Gayer's work, written by W. Mayr, and contains much new matter. The new edition contains 66 additional pages. It reproduces the whole of Gayer's plates with the addition of 87 others, and there are also two additional full-page plates.





# Royal Scottish Arboricultural Society.

## Instituted 16th February 1854.

PATRON.

HIS MOST EXCELLENT MAJESTY THE KING.

### PROCEEDINGS IN 1908-Continued.

## THE GENERAL MEETING.

The General Meeting of the Royal Scottish Arboricultural Society was held in the Concert Hall of the Scottish National Exhibition, Saughton Park, Edinburgh, on Wednesday, 5th August 1908, at 2 P.M. There was a good attendance of Members. The Chairman at the beginning of the proceedings was Sir Kenneth J. Mackenzie, Bart. of Gairloch, President of the Society, and afterwards Mr John Methven, Vice-President.

#### MINUTES.

The Chairman intimated that the Minutes of last Annual Meeting had been printed and circulated amongst the Members, and asked that they should be held as read, which was agreed to.

#### ACCESS TO MOUNTAINS BILL.

The Chairman explained that the Council had sent a representation to the Secretary for Scotland in connection with this Bill, and had forwarded certain information with regard to Forest Fires. The Bill had now been withdrawn, but the

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Committee of the Council in charge of the matter had been continued, in view of the possibility of similar legislation being proposed next year.

### FORESTRY EXHIBITION AT ABERDEEN.

The Secretary intimated that in connection with the Forestry Exhibition in the Highland and Agricultural Society's Showyard at Aberdeen, the Judges had made the following awards, of which the Council had approved, namely:—

# Competition No. I.

Specimens of Timber of Scots Pine, Larch, and Norway Spruce.

## OPEN SECTION.

1st Prize, £2, 1os., J. A. Stirling of Kippendavie. 2nd Prize, £1, 1os., Duke of Richmond and Gordon. 3rd Prize, £1, Captain Stirling of Keir.

## LOCAL SECTION.

Ist Prize, £1,
2nd Prize, 15s.,
3rd Prize, 1os.,
Sydney J. Gammell of Drumtochty.
Duke of Richmond and Gordon.
Earl of Aberdeen.

# Competition No. II.

Specimens of the Timber of any Three Coniferous Trees other than above.

#### OPEN SECTION.

1st Prize, £2, 10s., H. R. Baird of Durris. 2nd Prize, £1, 10s., , , , , , 3rd Prize, £1, , , , , , , , , ,

#### LOCAL SECTION.

1st Prize, £1, H. R. Baird of Durris. 2nd Prize, 15s., ,, ,, ,,

# Competition No. III.

Specimens of Timber of Ash, Oak, and Elm.

J. A. Stirling of Kippendavie and Captain Stirling of Keir
 Equal, £4; £2 each.

## Competition No. VII.

A Gate for Farm Use.

## Competition No. XIII.

Specimens illustrating the Effects of Dense and Thin Crops in Branch Suppression and Quality of Timber.

H. R. Baird of Durris, . . No. 1 Silver Medal.

## Competition No. XV.

Collection of Fungi injurious to Forest Trees and Shrubs. H. R. Baird of Durris, . . No. 2 Silver Medal.

# Competition No. XVI.

Examples of Damage caused by Squirrels, etc.

H. R. Baird of Durris, . . No. 1 Silver Medal.

# Competition No. XVIII.

Any approved Article either wholly or mainly made of Wood.

Tom Strachan, Keir, Dunblane, (No. 2 Silver Medal, for Model of Farm Gate.

In addition to the Prizes awarded in the Competitive Section, the Judges recommended, and the Council approved of, the following awards in the Section for Articles for Exhibition only:—

H. R. Baird, Esq. of Durris, . No. 1 Silver Medal,

For general collection of Spars of Exotic Conifers grown in Close Plantation, together with samples of Cones and Foliage, and hand specimens of the Timbers.

John Michie, Esq., M.V.O., No. 2 Silver Medal,

For Logs of Scots Pine, with samples of Soil on which the trees were grown exhibited in glass jars; also Table Top made of Scots Pine.

Right Hon, the Earl of No. 2 Silver Medal,

For collection of Beech Seedlings, showing diversity of variety resulting from seed taken from a Fern-Leaved Beech; specimens showing results of Pruning, etc.

Wm. Smith & Son, Aberdeen, . No. 2 Silver Medal, For collection of Conifers, Cones, and Forest Tree Seeds, etc.

Ben Reid & Co., Aberdeen, . No. 2 Silver Medal, For collections of Forestry Tools, Conifers, etc.

On the motion of the Chairman a hearty vote of thanks was awarded to the Highland and Agricultural Society for their generous contribution to the Prize Fund, and for the free space and other facilities given for the Exhibition. The Judges and Exhibition Committee were also warmly thanked for their services.

# JUDGES' REPORT ON ESSAYS.

The Secretary intimated that the Judges on the Essays had made the following awards, namely:—

#### CLASS I.

The Woods and Plantations of Sutton Park, Warwickshire, by Henry Harlond, Park Forester, Sutton Coldfield, Warwickshire—No. 2 Silver Medal.

## CLASS II.

- Collection of Ten Notes of Sylvicultural Interest, by WILLIAM HALL, The Terrace, Tockwith, near York—Bronze Medal.
- A Young Forester's Experiences of Forestry, by Frederic G. Moore, Clarence Villa, Mostyn Road, Colwyn Bay—Bronze Medal.

The Report was approved, and the Judges were thanked for their services.

# THE SOCIETY'S EXHIBIT IN THE SCOTTISH NATIONAL EXHIBITION.

Mr Massie, Convener of the Committee, said he was sure that all the Members would feel gratified by the excellent display of Forestry which the Committee, through the kind-

ness of the Members of the Society, had been enabled to bring together in the Scottish National Exhibition. He thought the outlay had been well spent, and he was glad to inform them that the amount was well under the estimate given. A short report, containing a list of the Exhibitors, had been printed in the last *Transactions*, but it was proposed that a full report should be prepared for publication in January, which would form a permanent record of the Exhibition.

#### EXCURSION.

Mr Buchanan, Convener of the Excursion Committee, said that the Excursion in which they were now engaging had been taken advantage of by a considerable number of Members of the Society, and, so far as they had gone, they had been favoured with excellent weather, and everything pointed to a successful outing. The Council had agreed to the Committee's recommendation, that they should endeavour to arrange for a tour next year in South Germany. Dr Borthwick, the Society's Hon. Cryptogamist, was to be in Munich in the course of a week or two, and, at the Council's request, he had kindly agreed to being back a report as to whether a suitable excursion might be held in that neighbourhood. The Report was approved of, and this concluded the business.

#### LECTURE.

The Right Hon. Sir HERBERT E. MAXWELL, Bart., then delivered his lecture on "The Forest Resources of the United Kingdom," which was illustrated by a large number of excellent views.

Mr Munro Ferguson moved a vote of thanks to Sir Herbert for his lecture, who in responding, said that he would be very pleased to have a discussion on any points which he had not made clear, and to answer any questions that might be asked. A discussion was thereupon opened by Mr Gammell of Drumtochty, and was taken part in by Mr William Wilson, Auchenleck, Mr George Leven, Auchincruive, Mr J. Grant Thomson, Grantown, and Mr John Methven. Sir Herbert briefly replied to the questions that had been raised. A report of the lecture and discussion will appear in the *Transactions*.



# Royal Scottish Arboricultural Society.

## SYLLABUS OF COMPETITIONS-1909.

[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 15th May 1909. Each such Essay, Report, Model, or Article must bear a Motto, and be accompanied by a sealed envelope bearing outside the Same Motto, with the Class to which the Competitor belongs, and containing a Card with the Name and Address of the Competitor.

Essays should be written on one side of the paper only; the left-hand quarter of each page should be left as a blank margin. The lines should not be crowded together.

Judges cannot compete during their term of office.

Successful Competitors may have either the medals or their converted values, which are as follows:—Gold, £5; No. 1 Silver, £3; No. 2 Silver, £2; No. 3 Silver, £1; Bronze, 10s.]

The following subjects are named for competition in 1909:—

## CLASS I .- FOR OPEN COMPETITION.

I. An account of the Broad-leaved and Coniferous Trees, especially of the more recently introduced Species, which the writer has found from experience to be most suitable as Forest Crops on high and exposed situations. The method under which such a Crop has been raised to be fully described. (Five Guineas offered by W. H. Massie, Esq., of Messrs Dicksons & Co., Nurserymen, Edinburgh.)

II. Suitability of any exotic Conifer for cultivation as a Forest Crop, and nature of the locality found, in the experience of the writer, to be most suitable for it. (*Five Guineas* offered by David W. Thomson, Esq., Nurseryman, Edinburgh.)

III. The relative powers to bear shade of some or all of the following species:—Douglas Fir, Menzies Spruce (Picea sitchensis), White American Spruce, Sequioia Sempervirens, Lawson's Cypress, Abies grandis, Giant Hemlock (Tsuga Mertensiana), Thuya gigantea; and the order in which the above Species should be placed in a list of shade-bearing trees comprising also Silver Fir, Beech, Spruce, Hornbeam. The Report to be based on personal experience only. (Five Guineas offered by John Methven, Esq., of Messrs Thomas Methven & Sons, Nurserymen, Edinburgh.)

IV. Successful raising, by the writer, or on the Estate with which he is connected, of a Young Forest Crop by the method of "Direct" Sowing. The conditions of Soil and Soil Covering to be fully stated. (A Medal.)

V. Comparative results obtained by various methods of Planting, with various Species and Sizes of Plants, up to the time at which the Young Crops have become thoroughly established. (A Medal.)

The Report to be based on actual experience; soil and other local conditions to be fully described.

VI. The use, on an Estate with which the writer is, or has been, connected, of Timber of any British-grown exotic Conifer, for House Carpentry and other Estate purposes. (A Medal.)

Besides giving information as to the specific uses to which the timber has been put, the writer should give details, such as the age of the trees from which it was taken, the soil on which they were grown, and whether the trees were raised in the open, or in woods of ordinary density. Statistics to be given, as far as available, of the comparative durability of this timber and the timber of British coniferous trees.

VII. Details of Measures successfully adopted, on an Estate with which the writer is, or has been, connected, to prevent or mitigate the destructive effects of Gales. (A Medal.)

VIII. Successful raising, by the writer, or on the Estate with which he is connected, of a Young Forest Crop in a frosty locality, with details as to Soil Covering, Species, and Measures of Protection adopted. (A Medal.)

- IX. An approved Report on the Woods of which the competitor is Forester. Reporter to state the extent of the woods, the species of trees grown, soil, situation, age, management, etc. (A Medal.)
- X. Successful Underplanting of Larch or other Lightcrowned Species, on an Estate with which the writer is, or has been, connected. (A Medal.)
  - The Report to be based on experience, the cases referred to being cited.
- XI. Details of Measures successfully practised by the writer to exterminate any important Parasitic Fungus, or to mitigate the Damage done by it. (A Medal.)
- XII. Details of Mechanical means employed by the writer, or on the Estate with which he is connected, for moving Timber from the interior of Woods to their margins, or to roads. (A Medal.)
- XIII. The erection and maintenance of a Saw-mill (either temporarily or permanently placed) or of any Wood-working Machinery, used by the writer, or on the Estate with which he is connected, for the Manufacture of Timber, with details of outturn and cost. (A Medal.)
- XIV. Details of Measures successfully adopted for the natural regeneration of a timber-crop of Scots Pine, Larch, or other species. (A Medal.)
- XV. For an approved Essay on the Botanical characteristics of typical Coniferæ. The Essay to be accompanied by Illustrations, and to be of an educational character. (A Medal.)
- XVI. For an approved Essay on Soils:—(a) preparation prior to planting; (b) the advantages of soil-protection accruing from density of crop; (c) the improvement to the soil arising from mixing the main crop with various classes of shade-bearing trees. (A Medal.)
- XVII. For an approved Essay on the best method of Planting at high altitudes and in exposed situations, together with the best Species of Trees to plant there for procuring (a) shelter for stock, and (b) a profitable timber-crop. (A Medal.)

XVIII. Report on the comparative Durability and Suitability of various kinds of Timber for Fencing after being creosoted in open tank. (A Medal.)

XIX. The best collection of ten short Notes of silvicultural interest based on personal observation. (A Medal.)

XX. An approved Essay or Report on any other subject connected with Forestry. (A Medal.)

### CLASS II. - FOR ASSISTANT FORESTERS ONLY.

I. Details of the Measures successfully practised by the writer to exterminate any important Insect Pest, or to mitigate the Damage done by it. (A Medal.)

II. The best collection of five Notes of silvicultural interest based on personal observation. (A Medal.)

III. An approved Essay or Report, based on personal experience, on any practical work connected with Forestry. (A Medal.)

> ROBERT GALLOWAY, Secretary.

19 CASTLE STREET, EDINBURGH,

October 1908.

# Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON

HIS MOST EXCELLENT MAJESTY THE KING.

### PROCEEDINGS IN 1909.

### THE ANNUAL MEETING.

The Fifty-sixth Annual General Meeting of the Royal Scottish Arboricultural Society was held in the Goold Hall, 5 St Andrew Square, Edinburgh, on Friday, 5th February 1909, at 2 P.M. Siz Kenneth J. Mackenzie, Bart. of Gairloch, President, in the Chair.

SIR HERBERT MAXWELL ON FORESTRY AND SMALL HOLDINGS.

Before beginning the business of the Meeting, the Chairman said that to meet the convenience of several of the Members, and especially of Sir Herbert Maxwell, who was deeply interested in afforestation, he proposed, with the consent of the Meeting, to alter the order of business so as to admit of Sir Herbert making some remarks then, instead of at a later stage, and he called upon Sir Herbert to speak.

Sir Herbert Maxwell expressed satisfaction that there seemed at last to be a prospect of practical action being taken by the State with regard to forestry. On the recommendations of the Commission on Coast Erosion there might be some divergence of opinion, but the general trend of the Report must, he thought, be regarded as satisfactory. There was one point upon which he would wish to say a word, because, in the present state of

public opinion, it was one to which their attention might be profitably directed—the connection, as pointed out in the Report, between the occupation of land in small holdings and the employment of woodmen. In the Report it was stated that in a great part of the German Empire the majority of the woodmen employed had each small holdings, on which they were occupied during the summer months, and that in winter, when the work was most active in the forest and most inactive on the land, they obtained regular employment. Our Government had directed their attention, and had made several proposals, with the view of establishing a class of small holdings. One result, as far as it had gone, of the old age pension scheme, had been to show the futility of expecting a family to be maintained in decent circumstances upon a very small area of ground. The number of Highland crofters who had received pensions under the scheme showed that their means of living derived from the crofts alone were very inadequate. But it became a totally different matter when the industry of the crofters was supplemented by regular employment during half or more than half of the year; and the point he wished to submit particularly for consideration was how far the afforestation industry, once it was started, would not only help to keep people on the land, but would enable them to live on the land in comfortable circumstances?

The CHAIRMAN thanked Sir Herbert Maxwell for his remarks.

### MINUTES.

The Minutes of the General Meeting, which was held in the Exhibition on 5th August 1908, and which have been printed and issued along with the *Transactions*, were held as read and approved.

#### REPORT BY THE COUNCIL.

The Secretary then read the Report by the Council, as follows:—

# Membership.

At last Annual Meeting the Membership of the Society was 1212. In the course of the year 204 new Members have been elected, but 103 have either died, resigned, or lapsed, leaving a total Membership at this time of 1313. Amongst those who have been removed by death may be mentioned, the Marquis of Linlithgow, a former President of the Society; The Earl of Leicester; Major Chadwick; Mr Gordon Wemyss of Torrie;

Mr John Booth, Berlin; Mr J. Burn-Murdoch of Gartencaber; Sir James Gibson Craig of Riccarton; Sir Charles Dundas of Dunira; and Mr Thomas Braid, Factor, Durris.

# Syllabus and Prizes.

The Syllabus of Competitions for 1908 was issued along with the January part of the *Transactions* of that year. It included 21 subjects for Essays, but only 3 Essays were received in competition, and none of them were for the more valuable prizes offered. The awards given were—one No. 2 Silver Medal and two Bronze Medals. The Syllabus for 1909 was included in the January part of the *Transactions* recently issued to Members.

#### Donors.

The thanks of the Society are due to the Directors of the Highland and Agricultural Society for renewing their grant of £20 for home-grown timber to be exhibited in the Forestry Exhibition in the Show-yard at Stirling, and to the Executive Committee of the Scottish National Exhibition for granting free space to the Society for their exhibit of Forestry in that Exhibition during the past year. Thanks are also due to Messrs Massie, Thomson, and Methven, for again renewing their offers of prizes for subjects in the present year's Syllabus.

## Transactions.

The Council feel that the Honorary Editor and the *Transactions* Committee are to be congratulated upon the punctuality with which the *Transactions* now appear on the due date, and they believe that the work of the Honorary Editor and his Committee is much appreciated by the Members.

#### Local Branches.

The Aberdeen and Northern Branches continue to do excellent work, as will be seen from the reports to be submitted to the Meeting at a later stage.

# Forestry Exhibition.

The Annual Forestry Exhibition was last year held at Aberdeen. The Judges on that occasion were Messrs Gillanders, Annand, and Munro, and their report was, as usual, printed in full in the proceedings of the General Meeting, which was held in Edinburgh on 5th August. A report of the Exhibition will also be found on page 89 of Vol. XXII. of the *Transactions*. There were fewer entries than usual under the exhibits of timber; and only £14 of the £20 offered by the Highland and

Agricultural Society, and  $\mathcal{L}_4$  of the  $\mathcal{L}_9$  offered by the Society, were awarded. In addition to the money prizes, the following Medals were awarded, namely:—four No. 1 Silver Medals and seven No. 2 Silver Medals. The Exhibition is to be held in Stirling this year, and the revised Schedules detailing, as last year, Open and Local Sections in the Timber Exhibitions, are now in the hands of Members. The Local Section is again confined to timber grown within the area of the Show. The prizes for the timber exhibits are  $\mathcal{L}_{20}$ , offered by the Highland Society in the Open Section; and  $\mathcal{L}_9$ , offered by this Society in the Local Section. Medals are also offered for other exhibits.

## General Meeting.

The General Meeting was held, by courtesy of the Executive Committee of the Scottish National Exhibition, within the Concert Hall of the Exhibition, Saughton Park, Edinburgh, on Wednesday, 5th August. A full report of the proceedings was, as usual, printed and bound up with the last part of the *Transactions*. Sir Herbert Maxwell delivered an interesting address on "The Forest Resources of the United Kingdom," which was illustrated by lantern views. An interesting discussion, which was taken part in by a considerable number of Members, followed the lecture. A full report of the lecture will be found in the *Transactions*.

## Annual Excursion.

The Annual Excursion was last year held in the district surrounding Edinburgh, on the 4th, 5th, 6th, and 7th August—the Carlton Hotel, North Bridge, being the headquarters for the time. The estates visited were Dalkeith, Newbattle, Dalhousie, Arniston, The Inch, Melville, Hawthornden, Roslin, and Penicuik, in Midlothian; and Raith, Donibristle, and Fordell, in Fifeshire. The Edinburgh Parks, Messrs Dicksons & Co.'s Nurseries at Craigmillar, and the Scottish National Exhibition, were also visited. A report of the Excursion will be found in the Transactions. On the return of the party, the thanks of the Society were, as usual, formally conveyed to the proprietors for the privilege of visiting their estates, and for their hospitality to the Members.

It has been decided by the Council that in the course of the summer an Excursion shall be made to Bavaria, and the necessary arrangements are being proceeded with. Members who wish to get further particulars regarding this Excursion are requested to send their names and addresses to the Secretary, on the postcard which was issued with the billet calling this Meeting. With regard to this Excursion, the Council has passed the following resolution, namely:—"The programme of the

Excursion to Bavaria, next summer, shall be confined strictly to Forestry matters, with the exception of two days, viz:—Saturday and Sunday, when in Munich, which shall be considered off days at the disposal of Members. In joining the Excursion, Members must undertake to adhere to the official programme as prepared by the Committee. Any Member who fails to observe this condition shall, in the option of the Committee, at once forfeit his interest in the Excursion."

## Scottish National Exhibition.

Two reports of this Exhibition have already appeared in the *Transactions*, on page 217 Vol. XXI., and page 77, Vol. XXII., and without going further into the details dealt with in these reports, it may be mentioned, that the total sum expended by the Society to date does not exceed the estimate. It is gratifying to be able to report that it will be unnecessary to make a call on those Members who so generously guaranteed the balance of the expense, and the Council propose now to make a formal intimation to them to that effect

In connection with the Exhibition, the Committee thought it a suitable time to make a special effort to add to the Membership of the Society. An appeal, signed by the President, was accordingly sent to about 1500 landowners, who were not then Members of the Society. A copy was also issued to Members, along with the *Transactions*, in July last. The Council are glad to say that the response to this appeal has been very encouraging.

In the course of the Exhibition, which was open from May to October inclusive, the Society's pavilion was visited by many distinguished visitors, including His Grace the Lord High Commissioner, and the Secretary for Scotland, and by large and interesting crowds of spectators from all parts of the country.

## Library and Museum,

A list of the additions to the Library since last Annual Meeting is appended to this Report. The Council would take this opportunity of reminding Members that the Society is now renting a room at 19 Castle Street, Edinburgh, for the accommodation of the Society's books and papers, and that gifts of books on forestry subjects will be gladly received and acknowledged by the Secretary. Members having books on loan will oblige by returning them to that address.

## Register of Foresters.

Members are reminded that the Register is in operation, and it is hoped that greater use will be made of it by both proprietors and estate men.

## Access to Mountains Bill.

A representation was sent by the Council to the Secretary for Scotland in connection with this Bill, and certain information as to forest fires, kindly supplied by Members, was sent to Members of Parliament who were on the Committee dealing with the Bill. The Bill was ultimately withdrawn, but the Council thought it advisable to continue their Committee in view of the possibility of other proposals, dangerous to forestry, being brought forward.

## Probationers for Indian Forest Service.

On the suggestion of Dr Nisbet, the Council forwarded a letter to the Indian Office urging that probationers for this service should be chosen from young men of liberal education, such as can only be obtained after two or three years of collegiate study, and who hold either the B.Sc. degree or a University diploma.

## Correspondents.

The Council have delegated to the *Transactions* Committee power to appoint correspondents of the Society for one year, who will be entitled to receive the *Transactions* free of charge. Such appointments require to be confirmed by the Society, in terms of the laws. So far no appointments have yet been made.

## Resolution.

The Resolution which was reported at last Annual Meeting was sent to the Prime Minister, the Chancellor of the Exchequer, the Secretary for Scotland, the President of the Board of Agriculture, the Lord Advocate, and the Commissioners of Woods and Forests, and duly acknowledged by them. At their meeting, on 5th December last, the Council revised and amended the Resolution, which now reads as follows:-"The Council of the Royal Scottish Arboricultural Society would again urge the Government to give effect to the Report of the Departmental Committee on Forestry, so far as regards Scotland, by providing suitable Demonstration Areas, Example Plots, and other Educational facilities. They would also again specially press for the creation of a Board of Forestry for Scotland, or a Commission under the Board of Agriculture, with an adequate annual grant, for the purpose of fostering and promoting State and private afforestation throughout the country, by surveying and indicating all land suitable for afforestation; by purchasing and afforesting from time to time suitable areas of such land as may become available; by giving advice and financial assistance on suitable terms to landowners

to enable them to afforest their lands; and by such other means as are consistent with sound silvicultural principles." This Resolution has also been sent to the Prime Minister, the Chancellor of the Exchequer, the President of the Board of Agriculture, and the Secretary for Scotland. The Council also resolved to suggest to the Annual Meeting that a deputation should be appointed to press this Resolution upon the attention of the Government. In view, however, of altered circumstances, caused by the publication of the Report of the Royal Commission on Coast Erosion, the Council felt that a deputation should be appointed to press a further motion, which will be submitted in place of the Resolution of 5th December.

## Luncheon.

A Luncheon has been again held this year, instead of a dinner, and has been well attended.

The Report was approved.

## FINANCES.

Mr John Methven, Convener of the Finance Committee, submitted the financial Reports on the Society's General Accounts, the Dunn Memorial Fund and the Excursion Fund. (See Appendices A, B, and C.) He pointed out that in spite of the heavy expenditure, the funds had been increased by £272, which he thought was very satisfactory. The amount of revenue at the credit of the Dunn Memorial Fund was now £18, 12s. 6d. and of the Excursion Fund Account £35, 18s. 11d. The Accounts were adopted.

## ABERDEEN AND NORTHERN BRANCHES.

The Reports and Financial Statements received from these Branches were also read by the Secretary, and on the motion of Mr J. W. M'HATTIE were adopted. (See Appendices D-G.)

## CHAIRMAN'S REMARKS.

The Chairman, in the course of his remarks, referred to the Report of the Royal Commission on Coast Erosion, which was published about the middle of January. He said there were some points in the Report with which they might not agree; but the Society could heartily endorse the main objects and suggestions of the Commission, which were that a national system of State Forestry should be entered upon. The Society

had been advocating that policy for many years, and in view of that Report the Council thought it judicious to pass a Resolution on somewhat different lines from that passed on 5th December, and referred to in their Report. The Resolution he would now submit was in the following terms:-"The Royal Scottish Arboricultural Society heartily recognises the impetus given to afforestation by the Report of the Royal Commission on Coast Erosion; it would again urge the Government, as an essential preliminary to any great scheme of national afforestation, to create a Board or Commission of Forestry in order that a survey may be made forthwith of lands suitable for silviculture; that large Demonstration areas be purchased and other facilities provided for a regular system of silvicultural training and research." He moved that this Resolution be adopted, and the following deputation be appointed to wait upon the Chancellor of the Exchequer, and other Ministers, namely: -The President, the Hon. Secretary, Sir John Stirling-Maxwell, Sir Hugh Shaw Stewart, Sir Herbert Maxwell, Mr W. Steuart Fothringham, Mr A. T. Gillanders, Mr John Michie, Mr John Crozier, Dr Borthwick, Mr Grant Thomson, Mr G. U. Macdonald, Mr Adam Spiers, Mr D, F. Mackenzie, and the Presidents of the Aberdeen and Northern Branches. Mr D. F. MACKENZIE seconded the Resolution.

Mr Munro Ferguson, speaking in support of the Resolution, said there were two objects it was well to bear in mind-to secure combination between the practical forester and the expert. and between the State and the private owner. Whether as foresters or as experts, they always had a "guid conceit o' themselves"—sometimes better, perhaps, than they had of one another. The expert and the practical forester had to be blended in order to do their part in carrying out any great system of afforestation. So also with the private owner and the State, who would have to combine in one scheme for the national interests. They must look before they leap in that matter, and while they were very grateful to the Coast Erosion Commission for the interest their Report had excited, before that huge undertaking could be set about they must have the machinery by which it might be made a success. At the present moment it would be unwise to set off at once, because whatever had been done in Scotland was the result of private initiative. Even in England, he thought, many of their foresters would be

ashamed of what had been done if they had been responsible for the condition of the State forests, as these were seen a few years ago. Private owners in Scotland had experimented in testing the various kinds of plantation. In this the State would find guidance, and by attending to these object lessons it could only hope to make its own undertaking a success. Therefore, the State might be fairly called upon, and would do well in its own interest to encourage the work of the owners of private woodlands, so that while it was getting its own machinery into order, it would better understand, from an examination of that work, what was required of it in the large operations which lay in the future. He believed that it was in new areas that the State would find its chief sphere of action, and in order to ascertain what lay before it, it would have to survey all land in Scotland suited to silviculture, and to draft some forest plan. The State could provide the continuous good management which was necessary for working large areas upon fixed lines, whilst the private owner would be more fertile in individual expedients.

Dr Nisber said he agreed with everything that had been stated by the Chairman, and with most that Mr Munro Ferguson had said. He did not think that although the money suggested by the Royal Commission was granted they were meantime in a position to utilise it. The system of technical instruction available was not what it ought to be, or what it might have been had the authorities carried out the recommendations of the first Forestry Commission, or even of the 1903 one, of which Mr Munro Ferguson was chairman. They had lost time, and it was important that the deputation should press this matter upon the Secretary of State. Already they had a Forestry school in England, and there was also a very good one in Ireland, but in Scotland they had nothing of the sort. They would never get it unless they kept agitating. Inverliever had been mentioned, but he was not sure that it was suitable for the purpose. Inverliever swarmed with black cock, and the black cock was particularly fond of larch buds and silver fir. Mr MacDonald of Dunach, in November last, shot a black cock returning from the feeding grounds, and while the crop no doubt contained a good many heather tips, it also contained a great number of larch buds and silver fir buds. It was a mistake to assume that all the wellmanaged forests of Germany and France were State owned. A great many of them-indeed the largest part-were owned by private owners. He thought the deputation should urge that a Departmental Committee should be appointed to consider the whole matter as affecting Scotland. Nothing really useful could be done until they had a survey of the whole country, county by county, to see exactly what land was available. In making such a survey, County Councils should be represented as well as the Government and the private landowners.

Mr Caddell of Grange said it was not only desirable to have a survey of land available, but to know what land was suitable for afforestation and what was not. The Geological Survey might be made of great use to them in this connection. They knew the formations of the different parts of the country. From personal experience, he knew that some classes of land were not suitable for growing trees.

The Resolution was adopted and the deputation approved.

## Office-Bearers.

On the motion of Mr Buchanan, Sir Kenneth Mackenzie was unanimously re-elected President. On the motion of Mr Johnstone, the following appointments were made, namely:—Vice-Presidents—John Maclachlan of Maclachlan and W. H. Massie. Councillors—Charles Buchanan, A. T. Gillanders, John D. Crozier, James Whitton, D. F. Mackenzie, W. S. Haldane of Foswell, and Fred Moon. The Hon. Secretary, the Secretary and Treasurer, the Hon. Editor, the Auditor, and the Honorary Consulting Officials and Local Secretaries were re-elected. (For list of Office-Bearers for 1909 see Appendix H.)

## EXCURSION.

MR BUCHANAN, Convener of the Excursion Committee, said that Members would no doubt have read in the circular calling the Meeting about the proposed Excursion to Bavaria next summer. There was difficulty in fixing the exact date, but the Council had decided that on the whole it would be more convenient that the tour should begin about the 29th or 30th July, and should last for above a fortnight. He mentioned that a considerable number of Members had already sent their names to the Secretary, and he hoped that others, who desired to get particulars of the trip, would send their names without delay, as particulars would only be furnished to those who sent their names for that purpose.

FORESTRY EXHIBITION IN THE HIGHLAND AND AGRICULTURAL SOCIETY'S SHOW.

Mr Adam Spiers drew attention to the Schedules which had been issued to the Members with regard to this Show, and expressed the hope that as Stirling occupied a central position there might be a large number of entries for the prizes offered.

## SCOTTISH NATIONAL EXHIBITION.

Mr W. H. Massie, Convener of the Society's Committee in connection with this Exhibition, reminded the Members that the question of the expenses had caused some of them considerable anxiety at the beginning, but at that time he had expressed the view that it had only to be mentioned to be overcome, and he was glad to say that they had been well supported in every way. Many had sent valuable exhibits at considerable expense to themselves, some had sent donations towards the expenses, and others had sent guarantees. The Committee felt that the Exhibition had been an excellent lesson, and that they had been educating a number of people who, perhaps, had not before had their attention drawn to forestry. On behalf of the Committee, he thanked all who had assisted them in any way.

The President said that he had taken a great deal of interest personally in this Exhibition, and was satisfied that it had excited a great deal of interest in the subject, and, on his motion, the Committee were heartily thanked for their services.

A cordial vote of thanks to the Chairman closed the business part of the Proceedings.

## MR BALFOUR'S LECTURE.

Mr F. R. S. Balfour, Dawyck, then delivered a lecture on the "Trees of California." The lecture, which was a continuation of the one given by him at last Annual Meeting, was illustrated by excellent views, and was highly interesting and instructive. A report of the lecture will be published in the *Transactions*.

On the motion of the President, Mr Balfour was accorded a very hearty vote of thanks for his lecture.

# APPENDIX A.—Abstract of Accounts for Year ending 31st December 1908.

## I.—CAPITAL.

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1. Proportion of Life Members' Subscriptions transferred to Revenue, Lagon b b c of Full Life Subscriptions, £108 b c of Commuted Subscriptions, £108 b c of Commuted Subscriptions, 18 3 3	2. Cost of furnishing Society's Room, 3. Funds, etc., at 31st December 1908, £500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 1073, £500 Caledonian Railway Company 4 per	cent. Debonture Stock, at 1143, 2400 North British Railway Company 3 per cent. Debenture Stock, at 854, Purniture, etc., in Society's Room, at cost,	Bank of Scotland, Ltd.,		II.—REVENUE.  DISCHARGE.  266 2 5 1. Printing, Stationery, etc., Authors Reprints, 402 13 6 Vol. XXI. Part II. of Transactions, £77 12 Authors' Reprints, Authors' Reprints, General Printing and Stationery, Porestry Periodicals, Binding, etc., Less Receipts for Advts. in Trans.,	
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1. Funds at 31st December 1907, £500 Caledonian Railway cent, Guaranteed Ann 2, at 1074.	क्षेत्र	2. Life Members' Subscriptions in 1908, . New Members, . Ordinary Members by commutation	3. Increase in Value of		CHARGE  1. Balance in hand at 31st December 1907, 2. Ordinary Members' Subscriptions,  Arrears at 31st December 1907,  Add Arrears written off but since recovered,  Less Received in 1907,  Subscriptions for 1908,  Subscriptions for 1909,  Subscriptions for 1909 received in 19	
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12	23	

£15

Less for Old Material.

Wages, Shed, Benches, Etc.,

4. Expenses re Scottish National Exhibition.

Rent of Pavilion, .

Wages, Judges' Expenses,

9

12 19

Arrears at 31st Decem-

ber 1908.

£15 18

December 1908,

Cancelled or written off as irrecoverable at 31st

Deduct-

£26 14

2. Frizes (Money, £18, 10s.; Medals, £8, 4s. 8t.), Less from the Highland and Agricultural

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14

£9 14 2 2 7 2 8 19 4 12

Extra Tabling, Racks, Etc.,

3. Forestry Exhibition at Aberdeen

Society, .

Printing, Advertising,

Proportion of Life Members' Subscriptions transferred from	Life	Mem	ers' Su	bscriptic	ons trans	sferred	from			
Capital,		٠	•		٠		٠	126	126 S 9	σ.
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Note.—Balance of Capital as above,	£213 4 5	مثم	10	
Balance of Income as above, .	264 0	0	**	
	£477 4 8	-	x	
Consisting of—				
Sum in Deposit Receipt of National				
Early of Scotland,				
Limited,				
Sum at credit of Account				
Current with National				

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Note. - £5 of Outlay, included in last Account,

making total £124, 18s 8d.

SO

£125 18

221

Insurance, and Sundry Outlays, .

Printing,

Less Donations,

£119 18

Rent (including Half Year of Room, £10),		6. Expenses of Management.	
Auditor		£12 8 0	.00
Hon. Editor for Assistant, £25; for German		)	
Notes for Part II. Vol. XX	l., £5,	30 0 0	09
Advertising and Insurances, and Miscel-	nd Miscel.	2001	
laneous Payments, , ,		11 17 1	_
Ξ.	Vol. XXI.		
of Transactions, . General Postages and Petty	£20 0 0		
Outlays,	32 4 11		
		- 58 11 5	70
	**	£215 19 6	9

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Balance of	ment of cost,
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£858	er 1908, of ed to me.
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JOHN T. WATSON, Auditor. EDINBURGH, 20th January 1909.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December the above is an Abstract, and have found them correct. The Securities, representing the Society's Funds as above, have also been exhibit

£858 11 11

£177

01 00  $\begin{array}{cc} 41 & 6 \\ 0 & 18 \end{array}$ 

Sum in Treasurer's hands,

Limited,

Bank of Scotland,

## APPENDIX B.

## ABSTRACT OF ACCOUNTS

IN CONNECTION WITH

THE MALCOLM DUNN MEMORIAL FUND, 1908.

## RECEIPTS.

Balance in Bank at close of last Account,	£15 15	6
Dividend on £100 3 per cent. Redeemable Stock		
of Edinburgh Corporation, payable at Whit-		
sunday and Martinmas 1908, £3, less Tax 3s.,	2 17	0
	£18 12	6

## PAYMENTS.

Nil.

Balance	carried	forv	vard,	bei	ng	sum	in			
Nation	al Bank	of	Scotla	ınd	on	Acco	unt			
Current	t, .					•		£18	I 2	6

Note.—The Capital belonging to the Fund consists of £100 3 per cent. Redeemable Stock of Edinburgh Corporation.

EDINBURGH, 20th January 1909.—Examined and found correct. The Certificate by the Bank of above balance, and Edinburgh Corporation Stock Certificate, have been exhibited.

JOHN T. WATSON,

Auditor.

## APPENDIX C.

## EXCURSION ACCOUNT.

Abstract	of	Accounts-Year	1908.
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Balance brought from last Year,			£32	6	4
Deduct— Auditor's Fee, 1907, .				2	0
			£,30	4	4

Excursion to Midlothian and Fife.

## RECEIPTS.

Contributions to Common Purse, . £126 10 0

## PAYMENTS.

PATWENTS.						
Carlton Hotel, Edin-						
burgh, £61 2 8						
Driving—						
Midlothian (three days), 22 15 0						
Raith and Donibristle, 14 0 0						
Railway fare to Thornton, 6 o o						
Tea at Inverkeithing, . 2 10 0						
Scottish National Exhibi-						
tion: 62 week tickets,						
at 2s., 6 4 0						
Printing, 4 I 3						
Gratuities and Sundry Out-						
lays, 4 2 6						
120 15 5						
5						
Balance carried forward to next Account,						
being sum in National Bank on Account						

EDINBURGH, 20th January 1909.—Examined with Vouchers and Memorandum Book and found correct. Bank Certificate of above balance of John T. Watson, Auditor.

Current,

7

£35 18 11

## APPENDIX D.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY (ABERDEEN BRANCH).

## REPORT 1908.

The Committee beg to submit the Third Annual Report of the Branch.

During the year, interest in the Society's work in the area comprised in the Branch has been well sustained, and increased interest in Forestry has been manifested among all branches in the community.

During the year, two meetings of the Branch have been held, one on 23rd May, when a paper was read by Mr William Dawson, M.A., B.Sc., Lecturer on Forestry in the Aberdeen and North of Scotland Agricultural College, on "German Forestry"; and the other on 23rd July, at the Highland and Agricultural Society's Show in Aberdeen, when a paper was read by Mr Gillanders, Forester, Alnwick Castle, Northumberland, on "The Educational and Economic Value of Forestry Exhibitions." One Excursion was also held to the Estates of Forglen and Hatton. A report of the Excursion will be submitted to this meeting by Mr C. S. France.

A most successful Exhibition, under the auspices of the Society, was held in connection with the Highland and Agricultural Society's Show at Aberdeen in July. The number of exhibits was not so large as the Committee had hoped, but this may be fully accounted for by the Forestry Pavilion maintained by the Society during the Scottish National Exhibition in Edinburgh. The arrangements for the Exhibition at Aberdeen were carried out under a Committee of the parent Society, consisting chiefly of Members of the Branch. The thanks of the Branch are especially due to Mr C. S. France, for the efficient way in which he looked after the arrival, arrangement, and despatch of the exhibits.

The number of Members of the parent Society resident in the counties of Aberdeen, Kincardine, and Banff is at present 108. Of these the number who are actual Members of the Branch is 57. The subscriptions of some Members—who cannot for this

reason be counted in the number as stated above—are in arrear, and the Committee wish to impress upon those Members the duty they owe to the Branch to remit their subscriptions as soon as asked, so as to save needless trouble and expense, and to further point out that all Members of the parent Society resident in these Counties—of whatever class—are equally eligible for the Membership of the Branch, and would urge all Members who have not already done so, to definitely become Members of the Branch so as to strengthen the hands of the officials, and to help forward the cause of Forestry in this locality.

During the year, 24 new Members have joined the parent Society, and 10 the Branch. The Committee will be glad to see both these figures still further increased.

The Committee wish to record their sense of the loss the Branch and the parent Society have both sustained by the death of Mr Thomas Braid, Factor, Durris, who had been a Member of Committee of the Branch since its inception, and was a valued and respected colleague and friend of many of the Members. They also wish to express the thanks of the Branch to Professor James H. Trail and the University Authorities, for the use they have so willingly given of the Botany class-room for the meetings of the Branch; and to Messrs William Smith & Sons, Seedsmen, for accommodation for the Committee at their meetings.

Sydney J. Gammell.

## APPENDIX E.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY—ABERDEEN BRANCH.

## STATEMENT OF ACCOUNTS, YEAR 1908.

	nute of 2 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		£16 14 3	arsion, $\mathcal{L}_2$ to 0 I 4 4	£3 14 4
EXPENDITURE	To Cash paid Wm. Mutch, Printer, per Receipt, ,, Cash paid Honorarium to Secretary, per Minute of 7th December 1907, ,, Cash paid charge on Mr Galloway's cheque, ,, Cash paid postages for the year, ,, Rahme at credit carried to Abstract,		£16 14 3   RIND	To Cash paid expenses Hatton, Forglen Excursion, per Receipt, ,, Balance at credit carried to Abstract,	4 4 ABSTBACT
	£7 14 2	3 17 0 5 0 0 0 3 1	£16 14 3	Forglen 2 10 0	£3 14 4
	2 0 7 0	1 50	• •	, Forglen	' '
INCOME	Balance at credit of last Account,  By .Cash Subscriptions—57 Members at 1s. each, £2 17 0 Loss taken credit for in last Year's Account, 0 2 0	By Cash Arrears of Subscriptions, 1906-07, 1 2 ,, Cash Grant from parent Society, ,, Cash Savings Bank Interest,		Balance brought forward from last Account,  By Cash from 20 Members — Hatton, Forglen Excursions,	

COWIE MAINS, STONEHAVEN, 12th December 1908.—I have examined the foregoing Statement of Accounts of the Aberdeen Branch of the Royal Scottish Arboricultural Society. I have found the same correctly stated and fully vouched. The balance at the credit of the Branch at this date, amounting to Thirteen pounds two shillings and fourpence, is deposited with the Aberdeen JOHN HART, Auditor. Savings Bank.

£13 2

Balance at credit of Branch (per Savings Bank Pass

Balance at credit of General Account, Balance at credit of Excursion Fund, Book, No. F 648), .

## APPENDIX F.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY (NORTHERN BRANCH).

Report by the Committee of the Proceedings of the Branch to 31st December 1908.

The Branch has now completed at least one year of its existence, having been inaugurated on 4th May 1907, and in terms of the Constitution, the Committee now have the honour to submit their Report for the year 1908.

During the year the Branch had two meetings. At one of these, on 20th June 1908, Mr Wm. Dawson, Lecturer on Forestry in Marischal College, Aberdeen, delivered an interesting and instructive address on "Forestry in Continental Countries," which formed the basis of an interesting discussion.

The second meeting was held at Brahan, on the kind invitation of Colonel Stewart-Mackenzie of Seaforth, when the Members attending went through the Brahan woods and policies, and spent a delightful day under the leadership of Colonel Stewart-Mackenzie, who most hospitably entertained the Members. The Committee desire to record their thanks to Seaforth for his kindness.

In consequence of the very wide area from which the Membership of the Branch is recruited it is not easy to have many meetings, and it is therefore always attempted to make the meetings which are held as instructive as possible.

The Membership of the Branch at the date of this report is 73, less three who have died during the currency of the year. They are Sir George Macpherson Grant of Ballindalloch, Bart.; Captain Alex. Brodie of Lethen, Nairn; and Major Robert Chadwick, Findhorn House, Forres; leaving a Membership of 70, or two more than at this time last year.

The income of the Branch to the date of this Report is  $\mathcal{L}_{16}$ , 5s., of which  $\mathcal{L}_{10}$  sterling has been received from the parent Society, and  $\mathcal{L}_{6}$ , 5s. from the Members in subscriptions. From the Statement of Accounts appended to this Report, it will be seen that there is a sum of  $\mathcal{L}_{7}$ , 17s. 6d. at the credit of the Branch, which sum is lodged in Bank in name of the Treasurer for the Branch.

On behalf of the Committee of the Northern Branch of the Society,

ALEX. FRASER,

Secretary and Treasurer.

## APPENDIX G.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY-NORTHERN BRANCH.

Receipts and Expenditure from 4th May 1907 to 31st December 1908.

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£16 5 0
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E. and O. E.

ALEX. FRASER, Treasurer.

## APPENDIX H.

Office-Bearers for 1909:—

## PATRON.

His Majesty THE KING. .

### PRESIDENT.

Sir Kenneth J. Mackenzie, Bart. of Gairloch, 10 Moray Place, Edinburgh.

## VICE-PRESIDENTS.

W. Steuart Fothringham of Murthly, Perthshire. Sir John Stirling-Maxwell, Bart. of Pollok, Pollokshaws. John Methven, Nurseryman, 15 Princes Street, Edinburgh. James Johnstone, F.S.I., Factor, Alloway Cottage, Ayr. Maclachlan of Maclachlan, 12 Abercromby Place, Edinburgh. W. H. Massie, Nurseryman, 1 Waterloo Place, Edinburgh.

## COUNCIL.

ROBERT ALLAN, Factor, Polkemmet, Whitburn.

JAMES COOK, Land Steward, Arniston, Gorebridge.

ROBERT FORBES, Overseer, Kennet Estate Office, Alloa.

SIMON MACBEAN, Overseer, Erskine, Glasgow.

G. U. MACDONALD, Overseer, Haystoun Estate, Woodbine Cottage, Peebles.

GEORGE MACKINNON, Overseer, Melville, Lasswade.

ADAM SPIERS, Timber Merchant, Warriston Saw-Mills, Edinburgh.

Dr A. W. BORTHWICK, Royal Botanic Garden, Edinburgh.

GEORGE LEVEN, Forester, Auchincruive, St Quivox, Ayr.

JOHN BROOM, Wood Merchant, Bathgate.

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## APPENDIX I.

Presentations to the Society's Library since the publication of last List in Volume XXI. Part 2.

## Books.

- 1. Forest Entomology. By A. T. Gillanders, F. E.S.
- Sylva. By John Evelyn, F.E.S. With Essay on Life and Works of the Author. By Dr Nisbet. 2 vols.
- Trees: A Handbook of Forest Botany. Vol. iv.—Fruits. By the late Professor Marshall Ward.
- 4. Soil. By Hall.
- Schlich's Manual of Forestry. Vol. v.—Forest Utilisation. 2nd Edition. By Professor Fisher.
- 6. Mosses and Liverworts. By T. H. Russell, F.E.S.
- 7. Country Gentlemen's Estate Book, 1908.
- 8. The New Zealand Official Year-Book, 1908.
- 9. Our Forests and Woodlands. New and revised Edition. By Dr Nisbet.
- The Practice of Forestry; concerning also the Financial Aspect of Afforestation. By Percival T. Maw.
- 11. Kew Gardens. Bulletin 1908.

## Societies' Reports, Transactions, Etc.

- 12. Transactions of the Highland and Agricultural Society, vol. xx., 1908.
- The 86th Report of the Commissioners of Woods, Forests, and Land Revenues, London, 1908.
- Transactions and Proceedings of the Perthshire Society of Natural Science, vol. iv., part 5, 1907-08.
- Transactions and Proceedings of the Natural History Society of Glasgow, vol. viii., part 1, 1905-06.
- 16. Annals of the Andersonian Naturalists Society, vol. iii.
- Journal of the Royal Horticultural Society, vol. xxxiii., part 2, and vol. xxxiv., parts 1 and 2.
- Journal of the Massachusetts Horticultural Society, 1907, part 2, and 1908, part 1.
- Journal of the Department of Agriculture, etc., for Ireland, No. 4, vol. viii., July 1908.
- Report of the Chief Conservator of Forests, Cape of Good Hope, to December 1907.
- Economic Proceedings of the Royal Dublin Society, vol. i., parts 12-15.
- Scientific Proceedings of the Royal Dublin Society, vol. xi., Nos. 21-30 inclusive.

- 23. Scientific Transactions of the Royal Dublin Society, vol. ix., Nos. 7-9.
- 24. Report of the Department of Lands, New Zealand, 1907-08.
- 25. Report of the Survey Operations of New Zealand, 1907-08.
- Report on State Nurseries and Plantations of New Zealand, 1907-08.
- 27. The Factors' Magazine, part 4, vol. viii., and part 1, vol. ix.
- 28. Proceedings and Transactions of the Nova Scotian Institute of Science, vol. xi., parts 3 and 4, vol. xii., part 1.
- 29. Memoirs of the Royal Caledonian Horticultural Society, 1908.
- Transactions and Proceedings of the Botanical Society of Edinburgh, vol. xxiii., part 3.
- Various Bulletins from the Central Experimental Farm, Ottawa, Canada.
- 32. Various Bulletins from Pennsylvania State College.
- 33. Indian Forest Records, vol. i., parts 2 and 3.
- Indian Forest Memoirs. Part 1—Chemistry Series. Part 1—Forest Series. Vol. i.
- 35. 9th Report of the Woburn Experimental Fruit Farm, 1908.

## BULLETINS OF THE BUREAU OF FORESTRY, U.S.A.

- 36. The Timber Pines of Southern United States, 1897.
- 37. The Western Hemlock, 1902.
- 38. Conservative Lumbering in Sewance, Tennessee, 1903.
- 39. A New Method of Turpentine Orcharding, 1903.
- 40. Seasoning of Timber, 1903.
- 41. The Woodlot, 1903.
- 42. Timber, 1895.
- 43. Check List of the Forest Trees of the United States, 1898.
- 44. Practical Forestry in the Adirondacks.
- 45. A Short Account of the Big Trees of California, 1900.
- A Forest Working-Plan for Township 40, Hamilton Co., New York State Forest Reserve, 1901.
- 47. Notes on the Red Cedar, 1901.
- 48. A Working-Plan for Forest Lands near Pine Bluff, Arkansas, 1902.
- 49. A History of the Lumber Industry in the State of New York, 1902.
- A Working-Plan for Forest Lands in Hampton and Beaufort Counties, South Carolina, 1903.
- The Diminished Flow of the Rock River in Wisconsin and Illinois, and its Relation to the Surrounding Forests, 1903.
- 52. The Redwood, 1903.
- 53. Forest Planting in Western Kansas, 1904.
- 54. Forest Resources of Texas, 1904.
- 55. The Forests of the Hawaiian Islands, 1904.
- 56. The Timber of the Edwards Plateau of Texas, 1904.
- Cross-Tie Forms and Nail Fastenings, with Special Reference to Treated Timbers, 1904.
- 58. Chestnut in South Maryland, 1904.
- 59. The Luquillo Forest Reserve, Porto Rico, 1905.

- Timber Physics. Part 2—Results of Investigations on Long-Leaf Pine, 1893.
- 61. Federal and State Forest Laws, 1904.
- 62. Forest Conditions of Northern New Hampshire, 1905.
- A Working-Plan for Forest Lands in Berkeley Co., South Carolina, 1905.
- 64. The Maple Sugar Industry, 1905.
- Report on the Examination of a Forest Tract in Western North Carolina, 1905.
- 66. Terms used in Forestry and Logging, 1905.
- 67. Grazing on the Public Lands, 1905.
- The Natural Replacement of White Pine on Old Fields in New England, 1905.
- 69. Loblolly Pine in Eastern Texas, 1905.
- 70. Forest Belts of Western Kansas and Nebraska, 1905.
- 71. A Working-Plan for Forest Lands in Central Alabama, 1905.
- 72. The Red Gum, 1906.
- 73. Sugar Pine and Western Yellow Pine in California, 1906.
- 74. Advice for Forest Planters in Oklahoma, 1906.
- 75. Effect of Moisture upon the Strength and Stiffness of Wood, 1906.
- 76. Rules and Specifications for the Grading of Lumber, 1906.
- 77. Wolves in Relation to Stock, Game, and the National Forest Reserves, 1907.
- 78. Grades and Amount of Lumber sawed from Yellow Poplar, Yellow Birch, Sugar Maple, and Beech, 1906.
- 79. Forest Products of the United States in 1905.
- 80. . . . . . . . . . . . 1906.
- 81. Circulars of the Forest Service of the U. S. Department of Agriculture, including "Douglas Fir, a Study of the Pacific Coast and Rocky Mountain Forms," etc.

## REPRINTS, ETC.

- 82. Cratagus in Southern Ontario. By C. S. Sargent, 1908.
- 83. Cratagus in Missouri. By C. S. Sargent, 1908.
- Some Additions to the Flora of Western New York. By C. S. Sargent, 1908.
- Bulletin No. 10. Reproduction Series No. 6 of the Lloyd Library, Cincinnati.
- 86. Working-Plan of Chopwell Woods. By J. F. Annand, 1908.
- General Description of the Woods on the Oban Estates. By J. D. Sutherland, Oban, 1908.
- Catalogue of the Edinburgh and East of Scotland College of Agriculture, 1908-09.
- 89. Catalogue of Armstrong College, 1908-09.
- 90. ,, West of Scotland Agricultural College, 1908-09.
- 91. ,, ,, Ohio State University, 1908.
- 92. Various Bulletins of Ohio State University, 1908.
- 93. Report and Proceedings of Ohio State University, 1907.

- 94. Proceedings of the 48th Annual Commencement of the Pennsylvania State College, vol. ii., No. 4, 1908.
- Catalogue of the 48th Annual Commencement of the Pennsylvania State College, vol. ii., No. 4, 1907-08.
- 96. Indian Forest Pamphlets:-
  - Note on the Utilisation of Khair Forests in Eastern Bengal and Assam, 1906.
  - (2) The Bark-Boring Beetle Attack in the Coniferous Forests in the Simla Catchment Area, 1908.
  - (3) Glossary of Technical Terms for Use in Indian Forestry, 1908.
- 97. Report of the Departmental Committee on Irish Forestry. Appendix to Indian Forester, July 1908.
- 98. Quarterly Journal of Forestry. London.
- 99. Forestry Quarterly. New York.
- 100. Forestry and Irrigation. Washington.
- 101. Journal of the Board of Agriculture for Ireland.
- 102. Journal of the Board of Agriculture. London.
- 103. Skogsvårdsföreningens Tidsskrift. Stockholm.
- 104. Tidsskrift for Skogbrug. Kristiania.
- 105. Timber Trades Journal. London.
- 106. Journal da Commerce des Bois. Paris.
- 197. Timber News. London.
- 108, Estate Magazine.
- 109. Tropical Life. Monthly.
- 110 Agricultural Economist. London.
- 111. Indian Forester. Allahabad.
- 112. L'Alpe. Bologno, October 1908.
- 113. Revue des Eaux et Forêts. Paris. (By purchase.)
- 114. Allgemeine Forst- und Jagd-Zeitung. ( ,,
- 115. Zeitschrift für Forst- und Jagdwesen. ( ,, )

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