TRANSACTIONS

OF THE

ROYAL
SCOTTISH ARBORICULTURAL SOCIETY.

SECRETARY AND TREASURER,

WILLIAM J. MOFFAT,

FELLOW OF THE BOTANICAL SOCIETY, EDINBURGH.

VOL. XII.

EDINBURGH:

PRINTED FOR THE SOCIETY.

SOLD BY DOUGLAS & FOULIS, CASTLE STREET.

1890.

CONTENTS OF VOL. XII.

The Society, as a body, is not to be considered responsible for any statements or opinions advanced in the several papers, which must rest entirely on the authority of the respective authors.

APPENDIX.

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VOL. XII.—PART I.

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TRANSACTIONS

OF THE

Royal Scottish Arboricultural Society.

The Council would earnestly draw the attention of the Members to the Abstract of the Society's Accounts for 1886-1887 on page 188, in which is shown an extra large amount of Subscriptions *due* and *unpaid* at the close of the financial year. Members will greatly facilitate the work of the Society, and save a considerable expenditure, by promptly remitting their Subscriptions as they become due.

The Council also respectfully request that those Members whose Subscriptions are in arrear, will make payment of them at their very earliest convenience.

By order of the Council,

W. J. MOFFAT

Royal Scottish Arboricultural Society.

SPECIAL NOTICE.

The Council direct the attention of Members to an arrangement made with the Proprietor of the *Farming World*, published at 63 Princes Street, Edinburgh, by which a Forestry Department has been added to that paper. The Council express the hope that Members, and all interested, will heartily support this effort to provide a useful weekly medium of Forestry intelligence, both by reading the *Farming World*, and by contributing Forestry notes to its pages.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY

FORESTRY IN HUNGARY.

(With Map.)

By Colonel F. Bailey, R.E.

CHAPTER I.

THE HUNGARIAN FORESTS.

Area, Elevation, Climate, Species, and Distribution of Trees.

The total area of the kingdom of Hungary, including Croatia and Slavonia, is 125,370 square miles, of which 35,459 square miles, or over 28 per cent., are forests, owned by the following proprietors :

	Square Miles.		
The State, ...	5,553	or 16	per cent.
Do., studs, railways, War Department,	170		
Departments and Communes, . .	8,200	or 23	,,
Corporations and Ecclesiastical endowments,	2,071	or 6	,,
Public foundations, ...	319	or 1	,,
Private do., ...	8		
Trustees, ...	1,999	or 6	,,
Joint proprietors, ...	5,101	or 14	,,
Joint Stock Companies, ...	654	or 2	,,
(A.)	24,075	or 68	,,
Private persons (B.)	11,384	or 32	,,
Total, . .	35,459	or 100	,,

This gives nearly 1½ acres of forest per head of the population.

Forests in Class (A.) must, under section 17 of the Forest Law, be managed in accordance with the provisions of a working plan, approved by the Minister of Agriculture, and framed on the principle that they are required to give a constant annual yield for ever. Consequently no portion of them can be disforested. But the private forests, about one-half of which are owned by a small number of proprietors, some of whose immense domains cover many square miles, are, unless they have been declared "Forests of Protection" under the law, worked according to the wish of the owner, who, however, may not disforest any portion of them which grows on a purely forest soil—that is to say, a soil which is incapable of being profitably cultivated, either as fields, gardens, or vineyards, or of being used as meadow land.

Section 2 of the law includes, under the head of Forests of Protection, all forests which are situated in high mountain regions, on loose stony soil, alpine plateaux, peaks, ridges, or steep slopes; also those which serve as a protection against landslips, inundations, and avalanches, and the removal of which would involve injury either to land or to lines of communication situated below them, as well as those which serve as a shelter against dangerous storms. The law provides that, within five years of its promulgation, a list of all such forests must be prepared; that they must all be demarcated; and that, no matter to whom they belong, they must be worked in accordance with the provisions either of a working plan, or of rules approved by the Minister of Agriculture.

The area of the State forests was much larger in former years than it is now—a loss of 20 per cent. having been experienced since 1878. This is mainly due to the commutation of rights, many of which have been got rid of by the surrender of land given in exchange for them; but there is still a good deal to do in this direction, though not nearly so much as has already been accomplished. The diminution from this cause of the area of the State forests between 1880 and 1884 amounted to 1427 square miles. The following areas are administered by the Forest Department, in addition to the State forests (5553 square miles) shown above, viz.:

		Square Miles.
In towns,		4
Unavoidably retained as being enclosed within forest boundaries,	Arable fields,	48
	Meadows,	63
	Pastures,	120
Alpine pastures,		325
Unproductive land,		153
	Total,	713

So that the total area in charge of the Department amounts to 6266 square miles.

The forests of Hungary are situated in the following zones of altitude:

Square Miles.		
5,206, or 15	per cent.	below 200 metres (656 ft.).
9,935, or 28	,,	between 200 and 600 metres (656 and 1968 ft.).
20,318, or 57	,,	above 600 metres (1968 ft.).
35,459		

Forty-two meteorological stations have recently been established in or near the forests, for the purpose of observing the temperature and degree of moisture of the air, the direction and force of the wind, and the amount of rainfall. The data furnished by these stations are collected and tabulated in the central office at Buda-Pesth. Observations recorded at altitudes varying from 16 feet (Fiume) to 2526 feet (Fajna in Mármaros) show that, in 1884, the maximum rainfall amounted to 63 inches (Fiume and Goszpics, both in the south); while the minimum, 4 inches, occurred at Petrozsény in the east. The maximum temperature rose to 100° Fahr. at Szolnok in Lower Hungary; and the minimum, 23° below zero Fahr., was registered at Szepes-Jglo in the north, at an altitude of 1525 feet. The highest mean temperature, 59° Fahr., was at Zeng, and the lowest, 40° Fahr., at Fajna in Mármaros.

The forests are thus classed, according to the quality of the soil on which they grow:

	Square Miles.
Purely forest soil, as above defined,	28,505
Soil adapted for other uses,	4,785
Plantations on moving sands,	420
Forests of Protection,	1,749
Total,	35,459

It is said that the various species of trees are found in the following proportion, viz.:

Oak (*Quercus pedunculata* and *Q. sessiliflora*),	22·28	per cent.
Oak (*Q. cerris*),	5·72	,,
Beech (*Fagus sylvatica*),	36·54	,,
Hornbeam (*Carpinus betulus* and *C. orientalis*),	9·13	,,
Birch (*Betula alba*),	2·39	,,
Carry forward,	76·06	,,

Brought forward,	76·06	per cent.
Poplar (*Populus alba, P. canadensis, P. nigra, P. pyramidalis, P. tremula*), Willow (*Salix alba, S. caprea, S. fragilis, S. purpurea, S. triandra, S. viminalis*),	2·38	,,
Ash (*Fraxinus excelsior* and *F. ornus*), Elm (*Ulmus campestris, U. montana, U. suberosa*), Maple (*Acer campestris, A. platanoides, A. pseudo-platanus*),	1·52	,,
Alder (*Alnus alpina, A. glutinosa, A. incana*),	0·47	,,
Acacia (*Robinia pseudo-acacia*),	0·39	,,
Lime (*Tilia argentea, T. grandifolia, T. parvifolia*),	0·09	,,
Spruce (*Abies excelsa*),	13·81	,,
Silver fir (*Picea pectinata*),	3·31	,,
Scots pine (*Pinus sylvestris*),	1·91	,,
Larch (*Larix Europæ*),	0·06	,,
	100	,,

The following trees and shrubs also occur in the forests, but not in sufficiently large numbers to be mentioned separately in the above list:—*Quercus pubescens, Q. Hungarica* v. *conferta, Castanea vesca, Corylus colurna, C. avellana, Sorbus Aria, Prunus spinosa, Juglans nigra, Platanus orientalis, Morus nigra, Rhus cotinus, Cornus sanguinea, Pinus austriaca, P. Mughus, P. Cembra, Juniperus communis, Taxus baccata.* Experiments with a view to the introduction of certain foreign species have been made in the State forests.

The areas actually covered by the principal groups of species are as follows, viz.:

	Square Miles.
Oak,	9,930
Beech and other broad-leaved species,	18,761
Conifers,	6,768
Total,	35,459

The following table shows the area occupied by each of the principal groups of species in the State forests, and their distribution throughout the three zones of altitude:

	Oak.	Beech and other Broad-leaved Species.	Conifers.	Total.	No. of permanent Springs.
Metres. Feet.					
Plains, 0 to 200 = 0 to 656,	515	310	1	826	100
Low hills, 200 to 600 = 656 to 1968,	380	906	92	1378	1,002
Mountains above 600 = above 1968,	51	1734	1564	3349	11,861
Total square miles,	946	2950	1657	5553	12,963

Management and Working.

Previously to 1848, when the feudal system still prevailed in the country, the Hungarian forests were, generally speaking, valued almost solely on account of the game which they harboured. They were very little worked, and their revenue was merely that obtained from grazing, from the collection of acorns, and from the sale of firewood; timber was used exclusively for local purposes. A few forests only, situated either near rivers, such as the Danube, Tisza, Garane, Vag, and Arva, or around mines and smelting furnaces, or in the neighbourhood of large towns, produced any considerable income to their owners. After the year 1850, when the feudal system had ceased to exist, the situation was extremely unfavourable to proprietors of land, who, a few years later, when, in consequence of the extension of railways, new markets were opened, tried, without thought of the future, to realise as much as they could from their forests, the importance of maintaining which they failed to understand. They did not, in most cases, possess the capital required to work them on their own account, and they therefore farmed them out, on from five to ten years' leases, to merchants and contractors, whose sole aim was to get the timber out at a cheap rate. The proprietors were unacquainted with the prices paid for wood in the market; they would not incur the expense of having their forests properly valued; and were ignorantly satisfied if they received considerable sums for forests of large extent, even though the rates paid to them were ruinously low. The first merchant who came carried off the finest timber, those who followed him taking, each in succession, his choice among the best of the trees which remained, and offering still smaller prices.

In this manner the wood was cleared out of the more accessible forests by slides, canals, and streams, and they rapidly became denuded; while the large quantity of waste-wood, resulting from a too prodigal felling for large timber, brought about a depreciation in the price obtainable for firewood in other forests. In consequence of this, and of the general absence of communications in the country, which caused the timber over the greater part of it to have little or no value, a large proportion of the best oak forests were ruined by continued grazing, and were reduced to the condition of forest pastures and acorn grounds; indeed, in many instances there was little left in them but old stumps; and where the cattle permitted the growth of young trees, the ground was taken possession of by beech and hornbeam. The oak forests will now gradually be restored; but very few of them, except in Slavonia, can be worked for a long series of years. It was formerly the practice to permit grazing during the fellings and the years immediately succeeding them, and numbers of cattle were bred who passed their whole lives in the forests; it must therefore be considered a fortunate circumstance, that, after the valuable trees were felled, a crop of shrubs was able to spring up here and there and afford some shelter to the ground. At the same time, valuable beech and pine forests, extending over thousands of acres, were cut or burnt down, with the deliberate object of turning them into pastures, which were then considered to have more value than forests yielding no revenue.

Subsequently to the year 1850, an inconceivable amount of harm was done, the forests near the principal lines of export, or situated in the vicinity of towns and manufactories, having been worked far too heavily. At this time also forests of large extent were conceded to communes, who, not sufficiently understanding their value, destroyed them; and the timber and even the soil of many forests, the property of joint owners, was sold by the co-proprietors, who ignorantly preferred the small sum of money they could then realise on them to the permanent revenue they might ultimately have yielded under the more favourable conditions of the future. Considerable areas also were cleared for cultivation, but the result was in many cases disastrous; as, for instance, along the banks of the Danube, the Tisza, and the Temes, where formerly fine oak forests grew, but the ground is now occupied by marshes. A recent case of this kind occurred near Arad, on the Maros, where, the forest growth having been cleared away, the soil rapidly deteriorated, and is now fitted neither for agriculture nor for forest.

Owing to the above causes, the condition of the forests, especially those which belong to communes and private proprietors, is at the present time very poor—excessive felling, imperfect regeneration, and uncontrolled pasturing having led in many localities to the most melancholy results; as witness the shrub forests on the higher mountains, the moving sands of the Alföld or great plain lying between the Danube and the Tisza, and the stony avalanches of the Karst between Trieste and Fiume, where the soil, when protected by forests, was extraordinarily fertile, but now the limestone rocks have been completely denuded; and if the country is to be allowed, even gradually, to recover itself, the exclusion of cattle, sheep, and goats from the whole area, by successive blocks, has become an absolute necessity.

But although, on the re-establishment of a constitutional Government in 1867, matters began to mend, little real progress was made until 1879, when the present Forest Law was passed, which not only ensures the proper management of the forests, but regulates the floating of loose logs and timber rafts, as well as the transport of forest produce by land, thus protecting both the owners of forests and the timber merchants, as well as the persons through or over whose property the produce passes; and the forests are now under proper control throughout the entire country.

The old way of working was not one calculated to develop a good system of sylviculture; but now, as the forests become thinner and wood dearer, while mountain sides are denuded and river banks undermined, the necessity for the early introduction of a better system is realised, and people begin to appreciate the new law, which, if it came at the last moment, did not come quite too late; and under it a good and certain forest revenue may still be looked for.

The excessive fellings practised between 1850 and 1880 so reduced the stock of timber in the forests, that they have not now, with comparatively few exceptions, sufficient to enable their rational management to be at once undertaken. It has been calculated that the stock remaining is not more than two-thirds of what it ought to be, and a due proportion of age-classes is rarely found. On the other hand, however, in about one-fifth part of the entire area, the forests, which here consist principally of beech, but partly also of conifers, cannot yet be worked on account of the absence of export roads, which, in many cases, it will not at present pay to make; and these will, as they are gradually opened out, supply the home and foreign markets for some years to come. The statement, then, which is often heard, that there is still a great stock of wood in the forests, is only true for parts of them. It is said that in the State oak and fir forests, the stock of timber falls short of what it should be by 575 and 649 millions of cubic feet respectively, while in the beech forests the stock is in excess by 1013 millions of cubic feet; and the condition of the forests owned by other proprietors is certainly not more favourable than this. The all-round density of the forests is probably not more than from 6 to 7, and the younger age-classes, where they exist, are, generally speaking, in an unsatisfactory condition. It used to be the custom to sell, in addition to the ordinary fellings, the ash, elm, maple, and other species found scattered here and there throughout the forests, and on this account it is now very difficult to obtain wood of these kinds at reasonable prices.

Until recently, then, rational treatment was, especially in the communal and private forests, almost completely neglected. Now the forests are managed as high forest, coppice, or coppice with standards, in the following proportion, viz. :

	Square Miles.
High forest, with a revolution of 80 to 120 years, extending, in rare cases, to 160 years in the oak forests, . .	25,367
Simple coppice, 10 to 60 years, ...	10,028
Coppice with standards—standards 80 to 120 years, coppice, 20 years, ...	64
Total, . .	35,459

In the State forests the proportion is as follows, viz. :

	Oak.	Beech and other Broad-leaved Species.	Conifers.	Total.
High forest, ...	924	2795	1493	5212
Simple coppice, ...	18	70	...	88
Coppice with standards, ...	2	1	...	3
Forests of Protection (selection method),	2	84	164	250
Total square miles, . .	946	2950	1657	5553

Regeneration by natural means is resorted to as far as possible; but both early and late frosts are very frequent, so that a crop of seed cannot be looked for oftener than once in five years, and since the year 1880 regeneration by planting or sowing has been largely practised. During 1884 the following areas in the State forests were regenerated by natural and by artificial means respectively, viz. :

			Square Miles.
Natural, ...			26
Artificial,	Sowing, . . .	8	
	Planting, . . .	11	19
	Total, . .		45

The total cost of the sowing and planting work was £4183, or 6s. 10d. per acre for sowing and 7s. for planting.

The spruce, *Abies excelsa,* is the most important of the conifers found in Hungary. It is, generally speaking, grown unmixed with other species, and the forest is clean-felled, the ground being restocked artificially two years afterwards. The advantages of growing forests composed of a mixture of species has not yet been fully recognised except in the State forests, where in suitable regions, when the production of large timber is aimed at, it is now the rule to mix spruce, silver fir, and beech in the following proportions, viz.:

50 to 60 per cent. of spruce.
20 to 30 ,, of silver fir.
10 to 20 ,, of beech.

There is a great deal to be done in the way of restocking bare ground; the funds hitherto granted for this purpose being insufficient to admit of satisfactory progress being made. But the State gives out plants *gratis* to proprietors of all classes, and nearly eleven millions of them have been distributed during the years 1883, 1884, and 1885. The species principally employed are as follows, viz.: The *Robinia pseudo-acacia*, which grows very rapidly, yields excellent firewood, vine props, and timber of small size; the Scots pine, which is planted out at a year old, but in some districts is without needles for a part of the year, and in the northern provinces suffers much from snow; and the black Austrian pine. The larch does very well in some districts, and considerable attention has recently been paid to it.

In former days forest management was directed principally to the production of firewood, and this is the case still on many properties. But as soon as the improvement of communications enabled timber to be carried to distant markets, even beyond the national frontiers, and the diminution of stock caused a rise in prices, attention began to be directed to the production of large timber of good quality. During the last ten or fifteen years, however, many young oak and spruce forests have been cut for tanning bark, and a good deal of harm has been done by over-cutting for this purpose.

The minor products are at present confined almost exclusively to grass, acorns, and nut galls; the various industries which usually flourish in the neighbourhood of extensive forests not having yet been developed to any considerable extent.

Grazing, is, however, an important question, both on account of the large number of cattle and other animals which have to be kept alive, and also on account of the revenue realised from it. The forest pastures are very extensive, and their existence is, as has previously been explained, one of the principal causes to which the present bad condition of the forests is attributable. It has been assumed that 1 buffalo, 1 horse, 3 donkeys, 3 pigs, 10 sheep, and 1 goat, each of them require as large a provision in grazing as 1 ox or cow—

3 oxen	under 3	years of age	being equal to	2	full-grown	animals.
2 horses	,, 3	,,	,,	1	,,	animal.
2 donkeys	,, 2	,,	,,	1	,,	,,
4 young pigs			,,	1	,,	,,
3 lambs or kids			,,	1	,,	,,

And on this assumption, the equivalent of 8,300,000 oxen has to be provided for. But it has been calculated that the non-forest grazing grounds do not, at the most liberal rate of production, yield enough grass for more than 5,300,000 oxen; and as stall feeding is very rarely practised, three millions of cattle have to be provided for in the forests. But if every acre were made available which could, without risk to the crop of trees, be opened for grazing, not more than one-fourth of the three millions of oxen could be properly fed; and this fully explains why the forest pastures are now being ruined by over-grazing, while the cattle are, generally speaking, in very poor condition. Legislation on the subject is urgently needed. People in Hungary, as well as in other countries, sometimes assert that the forests do not suffer from grazing; and they cite examples to prove that they have known very well, and carefully watched for the last twenty, thirty, forty, or fifty years, such and such forests, which have always been full of cattle, and still continue to exist. But, notwithstanding this evidence, it is certain that, even where forests too heavily grazed over have not disappeared entirely, they have suffered severely in their rate of growth and in the quality of the wood they produce, while their complete disappearance is only a matter of time.

The damage done by fires is not so serious in the north as it is in the south and east, where shepherds frequently devastate large areas by burning them over, in order to obtain fresh pasture for their flocks. Attacks by insects, principally *Bostrichus typographus*, are frequent, especially in the eastern provinces; here also dangerous storms very often occur. It is said that in 1884 the damage done in the State forests alone, by fires, wind, insects, and the like causes, was as follows:

	No. of instances.		Areas affected, Acres.	
Fires,	76	Broad-leaved forest,	1693	
		Coniferous forest,	34	
				1727
Inundations,	19			99
Wind,	51	(800,000 cubic feet of wood),		396
Frost and snow,	7	(88,000 ,,),		956
Rats,	12			405
Insects,	17			3415
				6998

In 1867 there were only 1390 miles of railway in the kingdom, now there is a network aggregating 5530 miles all over the country; and no less than 18 per cent. of the merchandise carried by goods train, and by the Danube Steam Navigation Company, consists of forest produce. Twenty miles of narrow-gauge railway have been constructed for forest purposes. There are also

4,460	miles of	State roads.
23,005	,,	Departmental roads.
35,983	,,	Communal roads.
1,799	,,	rivers and canals which can be used for floating wood.

The State roads are kept in good order, but those belonging to communes are not so. In addition to the above, the State has 148 miles of dry slides, and 65 miles of wet slides, with 93 reservoirs, constructed for floating purposes, holding 175,000,000 cubic feet of water. There are also 62 booms, aggregating 8040 yards in length.

The floating of timber from the mountain forests to the plains, and thence to the markets, is still largely practised, especially in the Carpathians, where, notwithstanding the huge quantity of timber, principally beech, consumed annually in the maintenance of river banks, the erection of weirs, and other works, it is considered cheaper than the construction and repair of cart-roads, which, as they are not required for other purposes, would have to be paid for entirely from the forest budget. The rates for transport by water are also, beyond comparison, lower than those for transport by road; and the latter would be enhanced if the large amount of wood now water borne were to be thrown on to the roads.

These considerations appear to justify the existing arrangements, in spite of the lavish expenditure of wood on works connected with the floating of timber, which must strike with astonishment every visitor to these regions.

When the quantity of snow on the ground does not render this impossible, the fellings are usually made in the winter; but otherwise they are effected after the snow has melted, say about the month of May, when the sap is beginning to rise. The trees are immediately barked, the top branches being left uncut, so as to draw up the sap from the lower part of the trunk, and thus facilitate its drying. In autumn, the timber is cut up and conveyed outside the limits of the block in which it was felled; and in the succeeding winter, it is moved down to the river side, so that it may, in the spring and summer, be floated down to the markets. As the works of various kinds which have to be constructed in connection with the floating arrangements are on a large scale, and involve a very heavy outlay, the forest officers are required to possess a complete knowledge of this branch of engineering.

Sufficient labour is, generally speaking, obtainable among the agricultural population for all ordinary work, such as sowing and planting, sliding, drawing, floating and sawing of timber, making of charcoal, and the like; but should large orders be received for cask staves, or railway sleepers, contractors bring additional workmen from the Austrian province of Carniola. It is customary to farm a portion of the forest produce to the commune, in return for the transport of a certain quantity of wood. The timber floaters are a strong hardy race, whom long practice has taught to work with safety upon the most difficult and dangerous rivers. The original workmen were Germans from the Black Forest; but there are now many "Szekelyek" from Transylvania, and Wallachians, who have learnt the business from the Germans.

A bad feature in the present system is that, partly from long custom, and partly from the prevalence of a false idea that the stock is very abundant, the cutting up and working out of the produce is wastefully conducted, thus causing a loss of from 30 to 40 per cent. of the wood. As the stock of timber decreases, and prices rise, an improvement in this respect will doubtless be effected; and, when the workmen are better trained, much of the present waste will be avoided. The State employs 2933 permanent, and 19,840 temporary, hands. The former, who act as instructors to the latter, are a most useful class; and some colonies of them, founded during the last century, now form prosperous communes on the borders of the State forests.

The rates paid for daily labour are usually from 1s. to 2s. 6d. for a man, and from 3s. to 8s. for a cart and two horses. But most kinds of work is, as a rule, executed by contract, or by piece-work, at fixed rates.

Administrative Organisation.

Before 1881, the direction of all forest affairs was vested in the Minister of Commerce; but in that year it was transferred to the Minister of Agriculture; and at the same time the administration of the forests was confided to a special branch, which was relieved of the management of the State agricultural property, and rendered completely independent of all other work. Within the office of the Minister, forest business is dealt with by the Director General of Forests, who, acting as his delegate, decides, with certain exceptions, all questions that are submitted to him. His office is divided into three sections, which take up matters referring to the State forests, working plans, and inspections respectively. Each section is under a forest councillor. Section 17 of the law prescribes that the proprietors whose forests come under its provisions, must employ the number of managers and guards fixed by the working plan, and this forms the basis of the organisation of the Hungarian Forest Service.

The State forests are now divided into 18 Conservatorships with an average area of 310 square miles, each of which is controlled by a superior administrative officer, corresponding to a Conservator, who is in direct communication with the Director General. The Conservator directs, inspects, and controls. His circle is formed by the aggregation of a number of divisions, the officers in charge of which are under his orders. Among his various prerogatives may be mentioned the following, viz. :—He can engage subordinates and fix their rate of pay; grant leave within certain limits to persons of all grades employed within his circle; approve of contracts for one year relating to the conversion or carriage of forest produce; and order experiments or purchases of plant or stock to the value of £80. He can also sanction the annual sales of forest produce, in accordance with the tariff approved by the Minister, and order the erection and repair of buildings to the value of £160.

The officers in charge of divisions, of which there are 167, with an average area of 33 square miles, act under the instructions of the Conservator, to whom it is their duty to submit proposals on all subjects relative to the management and working of their forests. Authority in certain matters is delegated to them, but they are not permitted to exceed their ordinary powers, except in cases of emergency. The division is subdivided into beats, each in charge of a forest guard. There are 1272 of such beats, their average size being $4\frac{1}{3}$ square miles.

Forests which come under the provisions of section 17 of the law, but are not the property of the State, are managed under the authority of the administrative committees of the sixty-four departments and fourteen free towns into which Hungary is divided; and each of these acts through a sub-committee of three members, chosen either from its own body or among other persons skilled in forest business. The State exercises control over the actions of these committees by means of inspectors, of whom there are twenty in Hungary, each having two or more entire departments assigned to him. The committee has power to decide, in accordance always with the provisions of the forest law, all questions that are from time to time submitted to it by the communes or other proprietors; but it is compelled to take the advice of the inspector, subject to an appeal by them or by him in case of disagreement to the Minister of Agriculture. In urgent cases, the inspector, as the minister's representative, has power to stop fellings or other operations which he considers detrimental to the forests; and in such cases the administrative authorities and local police are bound to support him. In case the committee habitually fails in its duty, the minister can replace it by a State commissioner; and this has once been done. The twenty inspectors, with their twenty assistants and offices, cost the State £8932 in 1884, and £9360 in 1885. The supervision exercised according to law by these officers is not at present liked by the proprietors, especially by those among them who desire to enrich themselves at the expense of future generations; but the good advice they have received has added many thousands of pounds to the value of their forest capital. Experience continues to show the necessity for the maintenance of the existing system; and the inspectors are now called upon to redouble their efforts in order to safeguard the public interests, and to correct the errors of the past.

The State will take charge of, and manage through its own officers on behalf of the owners, the communal forests in any department the administrative committee of which applies for this to be done; and many of the departments have availed themselves of this privilege with the most satisfactory results. Small private proprietors may associate themselves together for the payment of the establishment prescribed by the law; and, similarly, communal forests of limited extent may be grouped together for purposes of management, and the overcharging of their budgets be thus avoided. But if they neglect to provide in some manner the necessary managers and guards, the departmental administrative committee or Minister of Agriculture has power to appoint them.

The number and distribution of the superior officers and subordinates employed by the State is as follows:

	Superior Officers.	Subordinates.	Menials.	Total.
Central Office,	27	...	...	27
Inspections,	40	...	...	40
State forests,	505	1342	264	2111
Communal forests managed by the State,	12	1	...	13
Higher school,	7	...	...	7
Lower school,	6	3	...	9
	597	1346	264	2207

The superior officers are of the following classes, viz.:

	No.	Yearly rate of Pay, and Allowances for lodging, Office, Servants, and Horses.
Officers corresponding in rank with Conservators,	28	£172 to £332
Secretaries,	5	110 ,, 116
Superintendents of Working Plans,	9	115 ,, 164
Assistant ditto,	2	60
Deputy Conservators,	27	98 ,, 142
Assistant ditto,	60	94 ,, 106
Sub-Assistant ditto,	140	76 ,, 98
Storekeepers and Paymasters,	35	60 ,, 84
Engineers,	4	84 ,, 152
Inspectors of Depôts,	13	57 ,, 83
Probationers,	26	44
Apprentices,	74	29 ,, 38
Doctors,	14	51 ,, 90
Registrars,	8	56 ,, 68
Accountants,	60	48 ,, 200

In addition to their yearly pay and allowances, these officers receive from 25 to 60 loads of firewood, and are permitted to cultivate from 5½ to 28½ acres of land, according to their grade. The pay and lodging allowance of subordinates ranges from £18 to £42 a year; they receive from 17 to 25 loads of firewood, and are allowed to cultivate from 4¼ to 5½ acres of land, according to grade. The annual cost of the above establishment is about £93,550, or about 6½d. per acre.

The Inspectors receive as yearly pay, lodging, and office allowance, from £180 to £204, with £80 in addition as travelling allowance.

The Assistant Inspectors receive from £80 to £112, with £56 as travelling allowance.

The scale of pay for officers in the State service corresponds with that fixed, during the last century, for other officials of similar rank; but it is considered too low, and will probably be raised. These officers are entitled to pensions under rules passed in 1885. When necessary, officers and subordinates are accommodated with houses in the forest, the number of buildings erected for this purpose being as follows, viz. :

For superior officers, 1 to 3 rooms,	69
Ditto, more than 3 rooms,	239
For superior officers and guards,	867
For guards,	680
Offices,	27
	1882

The service of the managers and guards employed under the departmental administrative committees, is, like that of the State officials, permanent, and under fixed rules. They cannot be discharged except under a prescribed procedure. The great private proprietors usually pay their *employés* at a rate which is from 25 per cent. to 50 per cent. higher than that of corresponding grades in the State service; but their appointments are not so well secured to them, and they have no regular pensions to look forward to.

In order to obtain an appointment as forest officer or manager in any of the forests which are, by the provisions of section 17 of the Forest Law, under the immediate control of the State, a candidate must be a Hungarian subject, who has completed his studies at the High School, and passed as Bachelor of Letters or Bachelor of Science. He must either undergo the course of instruction at the academy at Selmeczbánya, or pass the final examination there, or be trained in some foreign school of the same class in which all the required subjects are taught. He must then, after serving two years on probation, pass the State Forest Examination, held at Buda-Pesth, which he cannot do unless he is qualified as above. The proprietors of forests which are under the provisions of section 17 cannot employ officers or managers who have not duly passed this examination. Section 37 of the Forest Law provides that no guard can, ten years after the promulgation of the law, continue to be employed in these forests unless he has passed a prescribed examination. He must, in the first place, either pass through one of the secondary schools, and then serve for a year on probation, or he must show himself to be proficient in reading, writing, and arithmetic, and serve for three years on probation; after one or other of which tests, and as soon as he has attained the age of 24 years, he is eligible to pass the Forest Guards' Examination, held periodically in various towns throughout the country. Guards are permitted to perform their military service after they have completed their course of instruction and probation.

All officers, managers, and guards are sworn in, and they then wear a uniform, prescribed, in the case of the State forest service, by the King, and otherwise by the Departmental Administrative authorities. Up to the end of 1884, the following number of officers and subordinates in Hungary had been sworn in:

Superior Officers.

In the service of the State, ...	318
In the service of other proprietors whose forests are under section 17,	695
Ditto, ditto, are not under section 17,	589
Total, . .	1602

Of these, 449 have passed the State Forest Examination.

Subordinates.

In the service of the State, ...	1,323
In the service of other proprietors whose forests are under section 17,	14,593
Ditto, ditto, are not under section 17,	6,926
Total, . .	22,842

Of these, 690 only have passed the Forest Guards' Examination. About one-third of the entire number of subordinates have other employment in addition to their forest duties. There are 360 sworn superior officers and 2400 subordinates in Croatia and Slavonia. *Employés* of both grades can prosecute cases of forest offences, and, if they have been duly sworn in, their depositions constitute a complete proof against the offenders.

Private proprietors, whose forests are not under section 17 of the law, can employ whom they please; but their men must be of good character, and sufficiently instructed to be able to do their work efficiently. They have, however, at the present time, very few competent foresters.

Working Plans, Produce, and Sales.

All the forests included in Class (**A.**) (see page 1), being under the provisions of section 17 of the Forest Law, must, as before stated, be managed in accordance with the provisions of a working plan approved by the Minister of Agriculture. A period of five years, which expired on the 14th June 1884, was allowed for the submission of proposals on this subject; but up to that date very few had been received, and most of the proprietors have had to ask for the extension of three years, which can legally be granted when sufficient cause is shown. In as many as possible of these cases, however, the Minister of Agriculture has, in the manner prescribed by the law, approved of temporary plans to regulate work for the next few years. These plans have been prepared by the inspectors from data furnished by the proprietors.

The regular working plan consists of three parts—

1. *A statement of the present condition of the forest.* This gives all information relative both to the forest itself and to its surroundings, which is likely to influence the management—such as its situation, its owner, the rights of other persons in it; the wood markets and export lines; the managers, guards, and workmen employed; the previous system of working, the results of survey, and valuation of the growing stock.

2. *The use to which the forest is to be devoted.* This must be determined on the assumption that it is to give a constant annual yield for ever, but, subject to this condition, the wishes of the proprietor must be considered.

3. *Management and yield.* This part of the working plan deals with the species to be cultivated, the system of management to be adopted, the revolution, manner of regeneration, and division into blocks and compartments, as well as the working out of the produce, and such like matters. The law lays down that the revolution for high forest cannot be less than 60 years, and for simple coppice less than ten years. The annual cuttings are always to be determined by area, not by a consideration of the cubic contents of the stock and the rate of growth. All quantities of wood are

to be expressed in cubic metres. The smallest scale permissible for the working map is $\frac{1}{144,000}$, or 4·4 inches to the mile. For small forests, not adapted to regular treatment, more simple working plans may be framed. For Forests of Protection the Minister of Agriculture determines the system of working; but there can be no clearing, clean-felling, nor collection of dead leaves, grass, or herbs within them, and, generally speaking, they are closed against grazing.

In the State forest service, the Working Plans Branch is an entirely separate one. In each Conservatorship there is a Working Plans' officer, with the necessary staff, who is immediately subordinate to the Director-General, from whom alone he receives instructions; but he is attached to the Conservator, and is obliged to furnish him, from time to time, with such information as he may require. The special branch undertakes all valuations, surveys, maps, and working plans; it prepares all temporary plans and rules, and takes cognisance of any deviations from them or from the regular working plan; it is consulted when the alienation of any forest land is proposed, whether in commutation of rights or otherwise.

The procedure is as follows—viz., a draft of the proposals having been drawn up on the lines above indicated, it is submitted to a committee of five members, consisting of the Conservator, the next senior forest officer, the divisional officer, the officer in charge of the neighbouring division, and the Working Plans' officer. All other officers and guards, who are in the place where the committee sits, are present, but have not the power to vote. The report of the committee, which includes all opinions which are not in accord with the general views it expresses, is submitted to the Director-General, and is returned, after approval, in order that the details of the proposed plan may be worked out. When this has been done, the committee again assembles, and, having discussed them, submits the report to the Director-General. From his office the working plan is returned to the Administrative Committee of the Department, to be examined in accordance with the Forest Law; and, after a further examination by the Inspector, it is finally approved, and its provisions are carried out. During 1885, 44 superior officers, 20 temporary *employés*, passed students of the forest academy, and a staff of chain-men, flag-men, and labourers were engaged in the work. The expenditure, in addition to salaries and allowances, was £3989.

In the case of the communal and other forests, which are under section 17 of the law, the working plan must pass through the hands of the Inspector, and, after discussion by the Administrative Forest Committee of the Department, be submitted to the Minister of Agriculture, by whom, on the report of the Director-General of Forests, it is approved. All working plans are to be revised periodically.

The following statement, which does not include the provinces of Croatia and Slavonia, shows the progress made, up to the end of 1884, in the preparation of working plans:

	Square miles.
Regular working plans approved,	395
Temporary ,, ,,	4746
Felling stopped pending the approval of the working plans,	1462
Total,	6603

This represents rather more than 22 per cent. of the forests in Hungary alone. The areas set forth above are owned as follows, viz.:

		Proportion to the total area of each class.	
By the State,	254	5·6	33·3 per cent.
By communes and public institutions,	6344	41·5	
By private proprietors (forests of protection),	5		

The small proportion of the State forests which has been dealt with is remarkable. It is, however, expected that the work will be completed within the next twelve years.

The mean annual yield of the Hungarian forests in wood, including that cut as thinnings, is as follows, viz.:

	Cubic feet.	
From high forest,	753,001,177	= 46½ per acre.
,, ,, coppice,	244,722,038	= 38 ,,
,, coppice with standards,	2,267,367	= 56 ,,
Total,	999,990,582	

This is equivalent to 63½ cubic feet per head of the population. The working plans approved to the end of 1884 show the annual yield as 942,605,282 cubic feet, the surface to be cut over each year being 396,952 acres. These figures give 2370 cubic feet per acre cut over, and 59 cubic feet per acre of the whole forest area.

It is said that the proportion of timber and firewood obtained from the three principal groups of species is as follows, viz.;

	Timber.	Firewood and Charcoal.
Oak, ...	25-40 per cent.	60-75 per cent.
Beech and other broad-leaved species,	3-15 ,,	85-97 ,,
Conifers, ...	70-85 ,,	15-30 ,,

In the State forests the mean area clean-felled over during the three years from 1882 to 1884 was 22,981 acres, and the produce was—

	Cubic feet.
Timber, ...	32,664,860
Firewood and charcoal, ...	53,163,882
Total, ...	85,828,742

with 3200 tons of bark.

The mean imports and exports of forest produce during the three years from 1882 to 1884 were as follows, viz.:

	Tons.	Value.
Imports, ...	139,666	£450,647
Exports, ...	618,182	2,165,864
Exports exceeded imports by .	478,516	£1,715,217

The figures do not include considerable imports of wood from the Austrian provinces of Galicia, Carniola, and Styria; so that the excess of exports over imports is not really so great as it would appear to be from the above statement—96 per cent. of the recorded imports and 42 per cent. of the recorded exports are transactions with Austria. Sawn deal and oak timber is exported to Germany, France, Holland, and Belgium, and large quantities of cask staves have been sent to France; but as the customs-duty in Germany has been raised during the last few years, the exports to that country have considerably diminished. The present rate of export, which, however, forms a very small proportion of the timber annually imported by the other European States, cannot be maintained much longer, and it is indeed already beginning to fall off. The supply of cask staves sent to France from Slavonia will certainly be greatly diminished within the next ten or fifteen years. It is a noteworthy fact that the principal timber exporting countries of Europe, Russia and Sweden, are, like Hungary, commencing to reduce the quantity annually sold beyond their frontiers.

The purchase and sale of wood forms an important branch of

Hungarian commerce. There are in the kingdom 499 dealers in timber, 1601 in firewood, 25 in tanning bark, 221 in charcoal, and 36,798 carpenters, cartwrights, caskmakers, turners, parquet makers, and others. The sixty principal wood merchants have an average capital of over £8000, some of them having as much as £80,000; eighty others have an average capital of £4000. Some of these dealers buy the trees standing in the forest, which is the system most frequently employed, though it is considered to be prejudicial to regeneration, and they cut them up into logs; others buy the logs, and convert them into boards and scantlings, which they dispose of generally to a lower class of dealers, with small capital, who retail them to the consumers. Although the sale of timber standing in the forest is largely practised, a considerable proportion of that from the State forests is sold in depôts, to which it is taken either by departmental agency or by a contractor; and it is there sold, ordinarily by auction but sometimes by private contract, to one or more of the principal merchants, who pay for it at first class or second class rates, according as the depôt is within or beyond 12 kilometres, or 7½ miles, from a certain point fixed upon for this purpose in each district.

The railways require 1½ millions of sleepers a year; and, together with the Danube Steam Navigation Company, use wood to the amount of nearly 21 million cubic feet. There are 2533 mines, smelting furnaces, and manufactories, consuming wood, which among them take annually about—

4,270,000	bushels of charcoal.	
14,772,000	cubic feet of firewood.	
2,971,000	,,	mine props.
1,230,000	,,	scantlings.
124,000	,,	planks.

The annual export of coal is 2,362,000 tons, and the mean imports and exports of coal and coke during the three years, from 1882 to 1884, have been—

	Tons.	Value.
Imports, ...	370,715	£313,069
Exports, ...	75,523	26,904
Imports in excess, . . .	295,192	£286,165

The manufacture of iron, which is very largely developed in Hungary, consumes large quantities of wood in the form of charcoal. On an average, 157,000 tons of iron are manufactured annually ; and 56 million cubic feet of wood are consumed by the smelting furnaces. The mean imports and exports of iron, during the three years from 1882 to 1884, were as follow :

	Tons.	Value.
Imports,	105,008	£1,580,500
Exports,	46,408	468,320
Imports in excess,	58,600	£1,112,180

There are 1470 saw-mills, viz. :

				Thousand cubic feet of timber.
179	Steam mills,	working 320	frames, each of which can cut up annually,	140 to 175
69	Water mills, large,	,, 103	,, ,,	70 ,, 106
1242	,, small,	,, 1242	,, ,,	14 ,, 18

They are together able to cut up annually over 88 million cubic feet of deal, or from 50 to 60 per cent. of that quantity of hard wood.

The rates obtained in 1884 for building timber, sold standing in the State forests, were as follows, viz. :

	Pence per cubic foot. Above $13\frac{3}{4}$ inches diameter.	Below $13\frac{3}{4}$ inches diameter.
Oak,	3·1	2·3
Beech,	1·5	1·3
Ash, Maple, Elm,	2·9	2·3
Spruce,	1·8	1·5
Silver fir,	1·8	1·5
Larch,	3·4	2·4
Scots pine,	2·9	2·2

The average rate for timber of this class was therefore about 2·2d. per cubic foot, and about 8s. 10d. per load of 50 cubic feet, which is an extremely low rate in comparison with that obtained for such timber sold from the French forests. Firewood is sold in the forest at from one farthing to one half-penny a cubic foot.

The mean nett revenue of the whole of the forests taken together is £777,000, or $8\frac{1}{2}$d. per acre. The actual receipts and expenditure for the State forests during 1884 and 1885 were—

	1884.	1885.
Receipts,	£493,805	£499,754
Expenditure,	331,889	331,684
Surplus,	£161,916	£168,070

The average annual surplus for the four years from 1881 to

1884 was £180,000, or about 1s. an acre, which is not more than one-seventh of the surplus per acre realised from the French forests. But the figures given above do not include the charges for the maintenance of the forest branch of the Minister of Agriculture's office, amounting to £2992; nor do those for 1885 include the sum of £14,640 expended on new buildings, and if this be added, the surplus of that year is reduced to £150,438. The capital value of the State forests has been calculated on the assumption that the mean nett revenue of £180,000 represents 2 per cent. thereof; and, thus taken, it amounts to £9,000,000, or about £2, 10s. per acre as compared with £20 in France.

The following appear to be some of the principal reasons for this remarkable difference, viz.:—the much larger proportion of the total area of the country which is occupied by forest (28 as compared with 17 per cent.), the smaller population (125 as compared with 181) per square mile, the less prosperous condition of the mass of the population, and the remoteness and inaccessibility of a large proportion of the forests. These circumstances tend, on the one hand, to a comparatively small local consumption; and, on the other, to a reduction in the quantity of produce exported, and in the prices which merchants can afford to pay for it to forest proprietors.

Rights of User, Forest Offences, Game.

The rights which existed prior to 1848, and related chiefly to firewood and pasture, but sometimes also to timber, have in a great measure been commuted; but much remains to be done in this direction, there being still 514 communes to deal with. Before 1884, however, the rights held by 628 communes in the State forests, had been commuted or regulated, and negotiations were pending in 147 others. It appears from the record that there are now only 6 communes, holding rights in the State forests, in which the question has not yet been taken up. As compensation in lieu of grazing rights, many communes received forest-land with trees growing on it; but, in a large number of cases, they had hardly entered into possession when they proceeded to clean-fell the timber; and the consequence is that these areas, which, if properly managed, would have afforded ample fodder for the cattle, and a certain amount of wood also, are almost completely ruined, and scarcely produce any grass. It is said that, even when all rights have been commuted as far as practicable, it will be necessary to leave from 30 to 40 per cent. of the entire forest area open as forest pasture; but if this be the case, measures must be taken to protect the trees, so as to prevent the soil from deteriorating.

Under the head of Infringements of Rules (*Contraventions*) are classed all acts and omissions provided against by the forest law, which are committed by the proprietor, his family, agents, or workmen. For instance, if a proprietor treats his forest in such a manner as to endanger its existence; if he cuts down a Forest of Protection, or a forest of any sort, on ground incapable of being used as fields, meadows, gardens, or vineyards, he is guilty of an act of infringement. The proprietor of a forest under section 17 of the law, who cuts more timber than is allowed by the working plan, has to pay a heavy fine, and to replace the excess quantity cut, by refraining for the necessary time from the ordinary annual fellings. All other contraventions of the provisions of the working plan, the extraction of stumps and roots, pasturing of cattle, and the collection of dead leaves, grass, or herbs, are punishable by fine. Among punishable omissions may be mentioned the following, viz. :—non-submission of proposals for the working plan, non-employment of the necessary establishment, non-exercise of proper supervision, omission to re-plant or re-sow to the extent prescribed by law. Heavy fines can be inflicted for such omissions, as well as for neglect to report the resignation or dismissal of an *employé*, and for failure to observe the standing orders for the prevention of forest fires, and attacks by insects, or the regulations regarding the transport of rafts and logs.

Among Forest Offences (*délits*) are classed thefts of unfashioned produce, if its value, and that of the damage caused, are together not more than 30 florins (£2, 8s.); damage of any sort to the value of less than 30 florins; dangerous acts and omissions, without regard to value; and the purchase or sale of produce, the sale of which has been prohibited. Such offences may be disposed of administratively by the mayor or head of the police. But thefts and damage to the value of more than 30 florins, acts and omissions which have resulted in a forest fire, thefts of fashioned produce, or the unauthorised collection of seeds, are offences which are punishable under the ordinary law only. They are to be tried at once, taking precedence before all other cases. The delinquent pays the value of the stolen goods, as well as compensation to the amount of from one-quarter to the whole of the estimated damage he may have done; and, except in cases of theft of dry wood, branches, shrubs, broken pieces of wood, bark, acorns or other fruit, he pays also an amount equal to the sum of both these together, into the Forest and Charitable Funds.

Between 1881 and 1884, the following cases of Infringement of Rules and Offences occurred :

	Infringements.	Offences.
Acquitted on appeal, . . .	17	5,830
Confirmed, ...	171	36,179
Total,	188	42,009

The fines amounted to £7070. The number of such offences in the State forests alone, dealt with in 1884 and 1885, was 49,529, and the fines amounted to £9812.

There is a great deal of game in the country ; and it is, owing to the introduction of laws for its preservation, decidedly on the increase. In the Carpathian Mountains are found the bear, wolf, lynx, red-deer, and roe-deer, besides hares, partridges, capercalzie, black game, and others. Before 1872, proprietors of land had not the right to prevent other persons from pursuing game over their property. But in that year it was enacted that the right of shooting and hunting belonged solely to the owner of the land, and a close time for each kind of game was fixed. A law passed in 1883, however, does not allow this right over a property of less than 200 *arpents* (284 acres) in extent ; but small proprietors, owning not less than 50 *arpents* (71 acres), may unite together to make up the required area, and they can then secure the sole right to pursue game over it. Proprietors who have less than 50 *arpents*, or do not join with others to make up 200, must farm their shooting with that of the communal land, and they then receive a proportional part of the income derived from it. Guns are taxed, and shooting licenses have to be taken out, while poaching is severely punished. Sworn forest *employés* are exempt from the gun and license tax ; but they can only shoot within the limits of their own charge, and with the consent of the proprietors of the land.

It is said that during 1884 over about one-third of the Hungarian territory, 1,102,926 head of game valued at £53,200, and including 280 bears, were killed ; and it is probable that the game killed in the entire country was worth nearly £100,000.

There is a national sporting society, with 1200 members, which watches over the interests of the chase. It has recently introduced the wild sheep (*moufflon*) and the wild turkey into Hungary.

Forest Schools.

The Academy at Selmeczbánya.—The institution at Selmeczbánya was opened as a school of mines in 1770, but a forest class was added in 1808; some idea of the development of which may be obtained from an inspection of the following figures, showing the numbers of forest professors and students at various periods :

	Professors.	Students.
1808- 9,	2	22
1809-10,	2	57
1814-15,	2	5
1821-22,	2	29
1833-34,	2	13
1865-66,	2	82
1867-68,	5	35
1872-73,	6	96
1873-74,	6	134
1882-83,	6	222
1884-85,	6	287

This branch is now by far the most important, there being 325 forest students, and only 80 miners. A forest officer of high rank has charge of it, under the control of the Director, who is a mining engineer.

Young men who have completed their studies at the High School, and passed as Bachelors of Letters or of Science, are eligible for admission. The ordinary course of studies extends over three years, but candidates for appointments as forest engineers remain an additional year, in order to complete their studies in mechanics and architecture. All regular students must go through the entire ordinary course, and are examined every six months before a special commissioner, in order to test the amount of progress they have made. Fees are not charged, and twenty scholarships, of £24 each, are given to those among the poorer students who are found to have done the best.

The courses of mathematics, physics, geometry, and architecture, which are conducted by professors belonging to the school of mines, are the same for the miners and the foresters, and there are no special professors for chemistry and forest botany. In the opinion of the heads of the Forest Department, the present organisation is unsatisfactory, the following being the principal objections taken to it. The school is under the Minister of Finance, instead of under the Minister of Agriculture, as it should be; for he is charged with the control of both the forests and the mines. The subjects common to both branches are taught rather from the miners' than the foresters' point of view, to the prejudice of their application by the forest students to their profession. The Forest Department hopes that these drawbacks will be considered by the Government, and the school reorganised on a new basis.

There is a magnificent library, and a museum containing splendid collections of various kinds, such as minerals, rocks, botanical and entomological specimens, samples of raw and manufactured produce, with models of forest engineering works, kilns, tools, apparatus for felling and converting timber; a collection to illustrate the diseases of trees, especially those caused by fungi of various kinds; sections of wood, and many other things. Some forests near the school are placed under the control of the Director for purposes of instruction, and the students make annually one or two forest tours with their professors.

There is a second school, with about 50 students, at Körös in Slavonia, but it is not in a satisfactory state, and is about to be reorganised.

Mention has previously been made of the State Forest Examination, which, in addition to that of the academy, must be passed by all candidates for the superior service before they can be appointed. The committee under which this examination is conducted is composed of twenty members, nominated every six years by the National Forestry Society, from among State or other forest officers, but appointed by the Minister of Agriculture. The president, who has the right to select annually from among the members of the committee three commissioners to actually undertake the examinations, is the Director-General of Forests. The candidates, who pay an entrance-fee of £2 each, are examined in the following subjects, viz. :—Sylviculture, working of forests, valuation surveys and working plans, construction of machines and buildings, forest protection, control of hunting and shooting, organisation of the forest service, functions of the various grades of officials, forest law, and the commutation of rights; they are also required to show themselves capable of taking independent charge of a forest estate. On passing this examination, they receive a diploma. Of the 210 candidates who were examined during the five years from 1880 to 1884, 160 passed, and 50 were rejected. Every year one of the most promising among the young forest officers who has passed the examination is sent abroad to study forestry in other countries. He receives an allowance of £80 towards his expenses.

Secondary Schools.—Two secondary schools are supported by the National Forest Fund, one at Királyhalom, near Szeged, opened in 1883, and the other at Vadászerdö, near Temesva, opened in 1885. A third is about to be established in Transylvania. The course of instruction, which lasts two years, is both theoretical and practical; the students, of whom twelve are admitted annually to each school, being taught the science of forestry to a sufficient extent to enable them to perform their duties satisfactorily, and to train and guide the workmen employed under them. They are maintained at the school either by the State, or from the National Forest Fund, or by private persons, as the case may be. Those sent up privately pay a yearly contribution of £12 for their lodging, food, and clothes. The age of admission is from seventeen to thirty-five, and candidates must be of sound health, particularly as to hearing and sight, and have a good knowledge of reading, writing, and arithmetic. Each school has a staff of three forest officers, one of whom acts as director. An increased number of schools is required, especially in the north and west of Hungary.

It has been previously said that forest subordinates are required to pass the Forest Guards' Examination. This is held in various towns throughout the country, before a committee of forest officers, presided over by the local inspector. Of the 976 candidates who were examined during the five years from 1880 to 1884, 827 passed, and 149 were rejected.

The National Forest Fund.

This fund is mainly supported by the payment into it of four-fifths of the fines levied from persons convicted of forest offences, the remaining one-fifth being paid to the communal charitable fund, so that the commune is interested in the conviction of offenders; but if the proprietors of forests which are under the provisions of section 17 of the law compound offences, they must pay one-half of the sums so received into it.

The receipts and expenditure of the fund during 1884 and 1885 were as follows, viz.:

	1884.	1885.
Receipts, ...	£2000	£2080
Expenditure, ...	2400	2668
Deficit, . .	£400	£588

The law provides that one-fifth part of the gross income must be annually capitalised, so that in the course of time the revenue will be increased by the interest on the money so invested. The fund has now a capital of £8800, including about £3200 worth of school and other buildings. Its revenues are devoted to the following purposes, viz. :—The cultivation of plants for stocking bare ground; the maintenance of secondary schools, including the salaries of the professors and the support of a portion of the students; the expenses incurred on the State Forest Examination and on the Forest Guards' Examination; and the publication of professional works. The revenues are not, however, sufficient to cover all these charges, and the deficiency is made good from the general forest budget of the State.

The National Forest Society.

The society, consisting at the present time of about 1500 members, was founded in 1866, and has a capital of £16,000. It renders excellent service to the cause of forestry in Hungary, by giving an annual prize of £44 for a work on a professional subject, as well as by publishing a monthly journal, and in other ways. It grants an allowance to the widows and orphans of forest officers who have been members for five years, if they have been left in poor circumstances.

CHAPTER II.

A TOUR IN THE CARPATHIAN FORESTS.

General Description.

We reached Buda-Pesth on the 29th June 1886, and next morning proceeded to the office of the Director-General of Forests, where we were received with great kindness, and the final arrangements for our tour were made; a detailed programme, showing where we were to go, and what we were to see each day, being drawn out, and circulated to the forest officers concerned. Next day we were received by Baron Gabor Kemeny, Minister of Communications; and the Acting Director-General of Forests, M. Rouai, very kindly offered to allow M. Albert de Lavotta, an assistant Inspector, to accompany us on our tour, in order to arrange our journey, and act as Hungarian interpreter.

Accompanied by this accomplished forester and linguist, as well as charming companion, we left Buda-Pesth on the evening of the 2d July, and travelled by Miskolcz, Sátorallya-Ujheli, and Kiraly-háza, to Mármaros-Sziget, which lies at the foot of the Carpathian range, in the north-eastern part of the kingdom. Between Miskolcz and Sátorallya-Ujheli, we passed through the celebrated Tokay wine country; and then crossed a vast plain, with very poor soil, on which *Robinia pseudo-acacia* is now being successfully cultivated. In the neighbourhood of Kiraly-háza, we twice crossed the Tisza, on which we saw many rafts slowly making their way down to the Danube.

We were about to visit four Conservatorships, viz.:—Mármaros-Sziget, at the head of the Tisza; Bustyaháza, on the Taracz; Sipto-Ujvár, on the northern slopes of the Alacaony range of hills, which run parallel to, and to the south of, the general line of the Carpathians; and Beszterczebánya which lies round the head waters of the Garam river. The conditions in the four districts are sufficiently alike to make it possible to give one general description of them all.

The total area is 1635 square miles, of which 1329 square miles are actually under forest, and the remainder consists of fields, meadows, and unproductive ground. Of the former, 1203 square miles are situated above the elevation of 2000 feet. The main crop is composed as follows, viz.:—oak, 34 square miles; beech and other broad-leaved species, 412 square miles; conifers, 883 square miles. The whole of this area, with the exception of 95 square miles of Forests of Protection, managed on the selection system, are maintained as high forest, with a revolution of from 80 to 120 years. The average annual revenue, expenditure, and surplus, during the four years from 1881 to 1884 were—

Revenue, .	. . .	£191,157
Expenditure,	. . .	129,484
	Surplus, .	£61,673 = 1s. 2d. per acre.

The four Conservatorships are formed by 40 divisions, averaging 41 square miles, and 196 guards' beats, averaging 8 square miles. There are 144 officers of the superior staff, and 318 subordinates; the total annual cost of this establishment being £24,435, or 5½d. per acre of the entire area.

Provisional working plans have been framed for the whole of the forests. The area annually felled over is 6677 acres; 6805 acres were replanted in 1884, and 422 acres were regenerated naturally by successive fellings. The annual yield is somewhat over $16\frac{1}{2}$ million cubic feet of timber, nearly $14\frac{1}{4}$ million cubic feet of firewood and charcoal, and 3100 tons of tanning bark.

With a view to avoid the flooding of the local markets by the sale of excessive quantities of State timber, and thus lowering prices to the injury of private interests, it has been arranged to export at least one-half of the timber from the Mármaros-Sziget Conservatorship to beyond the Hungarian frontier. Most of the wood coming from it, and from Bustyaháza, down the Tisza and Taracz rivers, is floated by way of Szolnok and Szeged, where a good deal of it is sold, to the Danube at Belgrade, and thence to Orsova, for sale to merchants from the Balkan provinces. But a part of it goes by rail to Austria and Germany, and a part to France and Italy, by way of Fiume. From Sipto-Ujvár, the main line of export is by raft down the Vág to the Danube, and thence to Buda-Pesth and Orsova. From Beszterczebánya it is down the Garam to the same destination.

At Sipto-Ujvár there is a large tanning factory, which takes annually nearly 25,000 tons of bark, principally of spruce. About one-half of this quantity is resold raw, while the other half is boiled down, and yields 3000 tons of extract, which is exported to other European countries, and also to America and Australia.

The prices realised in 1884 per cubic foot of wood standing in the forests were as follows, viz.:—oak, $1\frac{1}{2}$d. to $5\frac{1}{4}$d.; beech, 1d.; other broad-leaved species, $1\frac{1}{2}$d. to $3\frac{1}{2}$d.; spruce and silver fir, 1d. to $2\frac{1}{2}$d.; larch and Scots pine, 2d. to 3d.; firewood from a nominal price to $\frac{1}{3}$ of a penny. 2140 permanent, and 6300 temporary, workmen are employed in the forests. For the accommodation of the officers, and guards, and for offices, the following buildings have been erected:

For officers only, first class houses of more than three rooms,	83
,, second class houses, ...	12
For officers and guards, ...	359
For guards only, ...	250
Offices, ...	9

There are 149 communes having rights in the forests; in 81 of them the rights have been commuted or regulated, and the question is in process of settlement in the 68 others. The number of forest offences committed in 1884 was 5267, and the fines inflicted amounted to £1713.

The figures which follow relate to three of the Conservatorships only, as information regarding Bustyaháza was not obtained. During 1884, 15 acres of forest were burnt, 38 acres were carried away by inundations, 142 acres of oak were destroyed by the caterpillars of the processionary moth, *Cnethocampa processionea*, Stephens; 216 acres of spruce by the typographer beetle, *Bostrichus typographus;* and 412,000 cubic feet of timber were blown down or crushed by snow. The comparatively small amount of damage done by fire is explained by the limited extent to which grazing is practised in the forests or these hills.

There are in these three Conservatorships—

1135 miles of first and second class roads.
139 miles of wet and dry timber slides.
494 miles of river used for floating.
17 miles of canals used for floating.
43 reservoirs containing 114,000,000 cubic feet of water, and 30 booms aggregating 3844 yards in length.

Mármaros-Sziget.

On reaching the department of Mármaros, we ascended the valley of the Tisza, and arrived at Mármaros-Sziget on the afternoon of the 3d July 1886. Here we were hospitably received at the house of M. Belhazy, Forest Secretary, and at once conducted over the great saw mills, which have been established by private enterprise on the bank of the canal just outside the little town. As we entered the extensive yard we were greatly astonished at the vast quantities of timber by which we were surrounded. Piles of logs, few of them of remarkably large diameter, covered the ground in every direction; the canal was crammed with rafts, the timber forming which was, we were told, not more than a single day's supply for the saws, while, within one month, the whole yard-full would be placed on the benches, fifteen in number, on which from 18,000 to 21,000 cubic feet of wood are cut-up daily. The machinery appeared to be old-fashioned, the saws cutting on the down stroke only, and being sharpened by hand. The occurrence of a conflagration in the yard would be disastrous; but as a precautionary measure, a large vat constructed in a central position, is kept full of a fire-extinguishing fluid. A fire of waste wood, lit for the occasion, was extinguished in our presence, in order to show us the effect of its use. The timber, which is almost entirely spruce, and comes from the State forests near the head of the Tisza, can be delivered by the Forest Department at the mill for 1d.

per cubic foot, which rate includes all charges for felling, logging, and transport by water, over a distance of 56 miles; and as the proprietor of the mills pays 2d. per cubic foot for it, there is a surplus of 1d. for the maintenance of the forest, and as profit.

Accompanied by M. Halázy, the acting conservator, we left Mármaros-Sziget early the following morning, and drove up the valley of the Tisza, stopping for a short time to look over the Crown Prince's shooting-box at Lonka, which is near the bottom of the valley, and surrounded on all sides by hills covered with forest, chiefly of beech. Spruce was tried, but it was unable to withstand the summer heat. After a brief halt, we continued our journey up the valley, meeting a great many rafts on their way down to the saw-mills. Here, in the lower part of the valley, the crop is principally beech, mixed with some oak, spruce, and other trees. Oak and spruce are the only kinds of wood that it at present pays to export; beech is girdled, and if it cannot be sold as fuel, it is left to die in the forest; and as the oak does not float alone, it is either mixed with the fir logs to form the rafts, or laid on the top of them, and thus conveyed down stream. Further on we reached the spruce forests, which are here almost pure; that is to say, unmixed with other species. They suffer very much from storms, which do an enormous amount of damage; the roots of the tree are very superficial, and it is consequently very liable to be thrown down. Something like one-half of the forests in the conservatorship are stocked with spruce, and it is said that in July 1885, during a storm which lasted 36 hours, half a million of trees were overturned. In the place where we were the storm had been severely felt, the entire forest having been laid low over considerable areas, and the barked stems lying in masses on the ground, like so many spilikins. The course of the wind could easily be traced down the valley; here it had struck a spur on the right side of the stream, whence, after knocking over every tree in its path, it was diverted to the opposite side, and thence back again; and it thus pursued its downward zigzag course, completely destroying the forests alternately on the right and on the left side of the valley. It is easy to imagine that such occurrences interfere very seriously with the provisions of the working plan, the regular fellings having to be postponed in consequence of them. The dread of these storms prevents the Hungarian foresters from regenerating their pure spruce forests by the natural process; for if the crop were removed by successive instalments, and the wind were thus permitted to enter, the trees left standing after the first felling would be at once blown down. Hence there is nothing to be done but to clean-fell and regenerate artificially. This is effected two years after the felling, either by sowing in vertical lines of patches—a gang of men moving up hill in a line—or by planting seedlings of from three to four years old. But in oak forests, which are rarely seen here, the regeneration is effected by natural means, one seed and two secondary fellings being made. When trees have been felled or blown down, the bark, which is exported for tanning, has to be removed from the trees at once, or they would be attacked by insects (usually *Bostrichus typographus*), and the timber must be got out as soon as possible. This is done by means of earth slides, and dry and wet wooden slides, which are used to convey it to the bank of the stream. We saw many such structures, principally temporary dry wooden slides, formed, in cross-section, of six or eight round poles, disposed in the form of a trough, with a downward inclination of 5° or 6°; the poles at the sides have a larger diameter than those at the bottom, and the outer side of the trough is raised at the bends, so as to prevent the logs from jumping out. At one place a slide of this kind was carried across the stream, and the logs were projected by it on to a piece of flat ground on the opposite bank. A stout pole or tree-stem, one end of which rested on the ground, while the other was raised on a pair of legs, was ingeniously used to cause the logs, after striking against it in their fall, to fly off in any required direction, and thus prevent their forming an unmanageable heap round the mouth of the slide.

After going some distance further up the easterly branch of the Tisza, we entered the spruce forests, and near the head of the valley, at an altitude of 2930 feet, reached the Hoverla reservoir. We were now not more than 2½ miles from the watershed of the Carpathian range, which, rising to a height of about 6600 feet, here forms the boundary between Hungary and Galicia. The stream, which is shallow and rocky, with a mean fall of about 1·20 per 100, is, in its ordinary state, unfitted for floating purposes; and the system here adopted is to arrest the water coming from the upper valleys, by means of a dam, which forms a reservoir. When this becomes full, the water entering it at the upper end passes the dam by an escape, which is always kept open, and the stream below has then, of course, its natural depth. The Hoverla dam, which is 39 feet high, is formed of timber and stones, turfed over and faced with clay on the upper side. There are in it two outlets for the water, at different levels, each provided with a wooden sluice gate raised by levers. When the reservoir is about to be used, some 30 rafts, of from 12 to 24 trees each, are collected below it, lying in the shallow water, and anchored to the bank. The sluice gates are then opened, and, when the head of rushing water has passed the leading raft half an hour, the latter is let go, and the other rafts are loosed in succession at intervals of five or six minutes. The reservoir empties itself in about four hours, the temporary flood thus caused increasing the depth of the stream by about $2\frac{1}{2}$ feet, which enables the rafts to float easily over the stones and rocks with which the bed is lined, until they reach the larger river. Meanwhile the sluice gates having been closed, the reservoir is allowed to refill itself.

The workmen engaged in forming the rafts use a very conveniently formed lever for moving the timber down to the water's edge, where the small ends of the logs are laid down stream, and then firmly secured by means of a stout wooden cross-piece, pegged down to a level bed axed out to receive it; the ends are rounded off below so as to facilitate the passage of the raft over sunken rocks and other obstacles. The heavier extremities of the logs are not fixed in this manner, but are loosely attached by means of willows, oak saplings, or spruce branches, which, after having been passed through the fire, are twisted into ropes, and then forced into holes drilled into the logs; they are kept there by means of pegs firmly driven in beside them. There are usually three such ropes, one from each outer log to the fourth or fifth log counting inwards, and a third joining these two across the middle of the raft. The heavy ends are thus allowed sufficient play to enable them to pass over rocks which they might otherwise catch on. A wooden pivot for an oar to work on is erected at each end of the raft.

On our way back from the reservoir we paid a visit to the married priest of the Russian church, who received us most hospitably, and after dining with the officer in charge of the division, we went down to the forest house at Raho, where, having driven sixty-nine miles during the day, we passed the night.

We left Raho on the morning of the 5th, in a shower of rain, and ascended the valley of the northern branch of the Tisza, where a few silver firs were seen mixed among the spruce. The latter tree is ordinarily felled at the age of from 100 to 120 years, when it has in this locality a diameter of from 18 to 20 inches; but the present being the first fellings since the framing of the working plan, the trees are taken as they come, and those recently felled were not more than from sixty to seventy years old. We saw the remains of an old dry slide, made of round timber, and said to be five miles long; and further on, after passing through a forest where the broad-leaved trees were being cut out, in order to favour the growth of the young spruce under them, we entered a small saw-mill driven by water, the proprietor of which had an excellent set of drawings on the walls of his shed, showing how to cut up logs of various diameters in the most advantageous manner.

We were now once more approaching the line of water-shed and the Galician frontier, immediately beyond which, among the northern slopes of the Carpathians, are the sources of the Pruth, and we made a short halt at the village of Körösmezö. The valley is here wide and fertile, some of the houses being fairly commodious and well built, but most of them are mere hovels. We were taken to see the Russian church, where we were very politely received by the parish priest, and after breakfast were driven on by the forest officer in charge of the division, in his own carriage, drawn by a first-rate pair of horses. We passed through the village market, and then, after stopping to examine a shed for drying spruce seed, we traversed a forest where fourteen years ago the trees were all blown down. It happened to be a very good seed year, and the result has been that there is now an excellent crop of young, self-sown spruce on the ground; but such good fortune is not often experienced. About this part of the valley there were immense quantities of windfalls. It might, indeed, almost be said that the wind both regulates the fellings and executes them; for on account of the enormous number of trees blown down, the regular fellings provided for in the working plan can seldom be carried out. We looked over a nursery of spruce and silver fir, with some Scots pine and larch. The silver fir, which cannot be raised out in the open, can only be grown in localities where natural regeneration by means of successive fellings can be practised.

Our attention was next called to a "river slide," constructed for passing the rafts over a steep rocky part of the river. The entire bed and sides of the stream were lined with fir poles, laid lengthwise, the bottom being formed in broad low steps, over which the rafts pass to the foot of the huge staircase thus formed. At the lower end of the structure there is a deep pool, on which the last step floats, hinged by chains to its predecessor. When the rafts are shot down on to this floating platform or table, which "gives" somewhat under their weight, they pass on in a horizontal direction down stream, instead of, as they would otherwise do, diving to the bottom of the pool.

Here we again studied the construction of the rafts. The minimum diameter of the logs at the thin or front extremity is 6¼ inches, and midway between the two ends, or between the points nearest to each end at which the tree is sound, a mark is cut, the girth over which regulates the sale rate; but this system does not prevail in all districts. The length measurements are effected with a rough pair of compasses, formed by a bent wand, kept in position by a tie-piece, and furnished with metal points. The withes used for connecting the logs at the thicker ends are prepared by taking green spruce branches or young trees, ten feet long, and passing them through a fire, in which they are turned round on their axis and burned or roasted. The thin end is then fixed by means of a peg into a hole at the foot of a stout post, when the butt is split, and a picket being introduced crosswise and secured with a bark rope, the branch or young stem is twisted, the workmen walking at the same time round the post, up which the withe winds itself spirally. After this treatment it is sufficiently tough and flexible to be used in the manner previously described. The men who navigate the rafts wear pointed leather shoes, of almost exactly the Indian pattern, under which they are obliged to bind a sort of iron clog with four spikes to prevent their slipping on the wet rafts when passing over dangerous places.

On leaving the rafts we inspected an earth slide, down which the logs are brought from the forest to the river. In order to prevent their foremost ends from burying themselves in the ground at its foot, a staging of poles is there erected, with a gentle downward slope, its lower end standing a few feet above the ground. As the logs come down they are received on this platform, and from it they are shot out in a nearly horizontal direction. Near this point we saw a remarkable sight. On a spur above us there had once been a mixed forest of spruce and larch. A violent storm overturned the shallow-rooted spruce, not a single tree of this species being left; but the deeper and stronger roots of the larch enabled them to resist the force of the wind, and they were all left standing. They are now kept for seed.

Towards evening, after travelling a distance of twenty-eight miles, we reached the forest house at Apsinecz, where we were to pass the night, and where several other forest officers awaited us. Here there is a large reservoir, covering an area of 16 acres, and having a depth at the dam of 42 feet. It contains over 14,000,000 cubic feet of water. We descended the shafts in order to see the sluice gates. They and the galleries weaken the dam at the part where the pressure of the water has the greatest force, and it is a pity that the galleries cannot be dispensed with. The two extremities of the dam are constructed of earth, with a wall of clay inside it and a rough stone facing on the upper side; but the central portion is made of wooden frames filled with stones, the slope towards the water being faced with timbers. The joints between these are closed by battens, secured with a peculiarly-shaped double nail, which grasps and fastens them down very closely. The escape channel is constructed to carry rafts, so that when the reservoir is full, timber can be floated from higher up the valley over its surface and thence down country. The stream, which is here only a few yards wide, has a fall of about 6 in 100, and looks like a small Highland trout-stream, numerous stones standing up in its bed; but when flushed by means of the water in the reservoir it can carry rafts of large timber. Before going in to dinner we went to look at the forest at the back of the house. Wherever windfalls had occurred there was excellent natural reproduction, and in a place where the young poles had grown up to a height of about 25 feet some thinnings had been made, the felled stems being left on the ground, as they are not saleable. Deeper in the forest there appeared to be a dense crop of pure spruce, standing so close together as almost to exclude the light of day. The altitude of the reservoir is 2900 feet. The thermometer is said to descend during the winter to 20° below zero, Fahrenheit. But in 1879-80, which was an exceptionally cold year, it went down much lower.

Bustyaháza.

Leaving the house the next morning on horseback, we followed the forest road, beside the stream, leading up the valley. At first our route lay through a forest of pure spruce, which clothes the hills in dense masses on either side; but further on we met with the mountain-ash, the maple (*Acer pseudo-platanus*), the willow (*Salix caprea*), and higher still, in the marshy ground, the alder (*Alnus alpina*). The scenery was lovely, and the path was covered with the tracks of red deer, which abound in these forests, the shooting being reserved for the royal family. Arrived at the head of the Tisza valley, we crossed the ridge (3946 feet) into the valley of the Tarácz and the Conservatorship of Bustyaháza, and were met by the officer in charge of the forest division we were entering. On our way down, a portion of an area of 9 square miles of spruce forest was pointed out to us as having been completely destroyed by insects (*Bostrichus typographus*) in 1862; and we then passed through a forest where, six years ago, the large beech trees, then standing over the young spruce, were cut out; the latter are now making most satisfactory progress. There are a great many petroleum wells on the northern slopes of the Carpathians, in Galicia; and search, which has proved fairly successful, is now being made for the oil on the Hungarian side.

We continued to descend the valley until we reached the Turbat reservoir, the construction of which occupied six months, and cost £960. It contains $8\frac{1}{2}$ million cubic feet of water. The dam is 36 feet high, 170 feet long, and is furnished with a sluice gate, which a single workman can easily open and close by means of a lever. This system, which is a new one, has answered so well, that it will now be adopted in all new works. The timber from these forests is floated a distance of 93 miles down the Tarácz, to its junction with the Tisza, six reservoirs being provided, all in the upper portion of the valley. The highest of these is at Turbat, and the others, which are constructed in side valleys, are used to afford the needful depth of water further down, where the bed has become wider. The first raft is not let go at Turbat until the reservoir has been opened for one hour. At Hoverla the time allowed was half an hour only; but there the slope was only 1·20 per 100, whereas here it is from 8 to 10 per 100; consequently, as the rafts go faster than the water, a longer time is required to elapse before the first raft is let go. The bed is very rocky, and the floating work is both difficult and dangerous, scarcely a year passing without loss of life by one or more of the men employed on it. The starting of the rafts is a remarkable sight. They are moored to the bank; and when all is ready, the men stand, almost naked, upon them. Suddenly the expected sound of the rushing water reaches them from above, when all cross themselves and fall on their knees in prayer. The forester holds his watch, and when time is up he gives the word; the crew of the first raft then spring up, seize their axes, and cut away the moorings, the raft being at once carried down on its perilous voyage. Then, after the proper interval, the word is given to the second raft, and so on till all have been dispatched. The reservoir empties itself in from 6 to 8 hours, and the water, which increases the depth of the stream by 40 inches, is sufficient to carry down from 30 to 40 rafts. If the reservoirs in the side valley are also made use of, 100 rafts can be sent down. Between 5 A.M. and 6 P.M. of the first day, they go 60 miles, and the remaining 33 miles of the journey are accomplished the second day, when, the fall being less, the rafts travel much more slowly. During the melting of the snow in spring, the reservoir fills itself in three days; but in the dry weather, seven days are required. When we were there it was opened twice a week.

The trees in these forests are larger than those in the Tisza valley, the rafts being usually composed of twelve stems, 60 feet long, with a mean diameter of from 18 to 26 inches; but we did not see trees of a remarkably large size in any part of the Carpathian forests. Where the slope is very steep and rocky, river slides of the kind previously described have been made; and, provided that the rafts are kept sufficiently far apart, they pass down them without much difficulty. At bends where they are likely to come in contact with the sides of the stream, the latter are revetted with logs, so as to present a comparatively smooth and even surface to the rafts, and thus prevent their being checked in their course. The trees are brought down to the river bank, during the winter on sledges running over the snow; the cost, including barking and logging, being about $\frac{8}{10}$ of a penny per cubic foot; while that of floating the timber down the 93 miles of river is only $\frac{3}{10}$ of a penny per cubic foot.

We stopped to inspect some rafts in process of construction, and noticed that the system adopted differs, in some respects, from that in vogue on the Tisza. Here a pole is laid across the stream, and on it the small or foremost ends of the logs are placed, and held together by means of a half-round cross-piece, countersunk into their upper surface, and pegged down to each of them. At a short distance behind this a withe passes across the raft, and is attached to each log by a forked peg, which grasps it. A similar withe at the rear end is attached to the outside and some of the intermediate logs.

We stopped for breakfast at the new forest house at Turbacziel, the stream passing which is full of good-sized trout. Magnificent forests clothe the hills on all sides; they have been a good deal damaged by wind, but there was a very fair show of young self-sown seedlings, where the conditions were favourable.

After leaving Turbacziel, we passed a large river slide with its floating platform; it is 670 feet long, has an average fall of 14 in 100, and its construction cost £240. Below this point the bed is very bad in many places, the slope being so steep, and the numerous bends so sharp, that one can hardly imagine it possible to float rafts over it, even with the aid of the artificial flood produced by the opening of the reservoirs. A little further on, the Bertyánka stream joins the one we were following, and the two go on together under the name of the Tereszulka. In this neighbourhood there are a great many earth-slides and dry-slides of round timber, one of which passes across the river, but, unfortunately, none of them were in use when we were there. On nearing Brusztura we were shown another river slide, the passage of which forms the most dangerous part of the floating route in this part of the hills; and we then drove into the village, where we were most courteously and hospitably received by the Conservator, M. Kellner, who entertained us at dinner, and then drove us to Kiralymezö, where we were to sleep, and where, to our great regret, M. Halazy left us. The next day was not one on which, in the ordinary course of work, floating would go on; but the Conservator very kindly ordered some of the reservoirs to be opened, so that we might have an opportunity of witnessing the interesting spectacle of the rafts passing down the Brusztura slide. He also gave orders for the opening of other reservoirs on the following day, in order that we might be enabled to perform a part of our journey to Taraczkös on one of the timber rafts. Before reaching our halting-place, we had travelled over 34 miles of road since the morning. Next day, on leaving the house, we noticed that the alluvial banks of the Tarácz were protected by revetments, from which the projecting tops of tree-branches stood out to break the shock caused by the rafts striking against them. We drove up a side valley, in a north-westerly direction, to Nemet Mokra, to the house of M. Ritter, a forest officer, who kindly conducted us over a most interesting settlement there. We were told that, 110 years ago, twelve families of German workmen from the Black Forest marched here with a banner borne before them, and settled. They were welcomed by the Hungarian Government, and granted certain privileges, which they still possess. They are given free sites for building their houses, which, however, they have not the power to sell; and the State provides a church and school, paying the priest and schoolmaster. The men are principally employed on forest engineering work, including slides and the revetment of river banks; but they are excellent and very skilful workmen, who can turn their hands to almost anything, and they receive good wages and pensions. There are now sixty-three families, in each of which there are, on an average, eight children; they still speak German, and do not intermarry with other races. We visited one of their houses, and found it most remarkably clean, comfortable, and well arranged. There were five rooms on the ground floor, and an attic above. The rooms were furnished with wardrobes, in which the clothes and spare bedding, which is collected for the daughters on their marriage, were stored; and the clean white-washed walls were adorned with a clock and pictures. We also visited a second house, which, if not quite so comfortable as the first, was equally clean; and it was evident that the settlers were prosperous, happy, and contented. On Sundays they put on a picturesque holiday attire, but, unfortunately, we had no opportunity of seeing it. The priest took us over the church, which is beautifully kept, and showed us the original silken banner brought from Germany by the first settlers.

We then retraced our steps to the river slide, near Brusztura, and awaited the arrival of the rafts. The total length of this work is 270 feet; it is 30 feet wide, and has a fall of 15 in 100—two floating tables, one in front of the other, being attached to the lower extremity to receive the descending rafts. This slide is dangerous, and its navigation exceptionally difficult on account of its steep slope and curved form. Soon after our arrival, the flood, caused by the opening of the reservoir, commenced, and presently the first raft, manned by six men, appeared. It was carefully steered by means of two oars in front and one behind, so as to enter the slide at the inner side of the curve; and, dashing down with frightful rapidity, was safely landed upon the floating tables, and thence launched out into the natural current on the outer side of the curve. It did not come in contact with the sides of the slide until it reached the second table. It was a really splendid sight. The men, who were drenched to the skin, had to keep their wits about them, and maintain their footing on the slippery logs, or they would certainly have been killed. They wore spiked clogs strapped under their feet, as they are not allowed to attempt the descent without them.

On the morning of the 8th we started at 5 A.M., and drove two miles down stream, where we found a raft, fitted up in the most luxurious manner, awaiting us. Accompanied by the Conservator and M. de Lavotta, we went on board at once, and after saying good-bye to the other kind friends who had escorted us thus far, we weighed anchor, and commenced our voyage of 16 miles, which distance we covered in about three hours. The passage down the river was most enjoyable, the scenery being beautiful, and no formidable difficulties being encountered. On landing at Dombó, which is very largely composed of thatched houses, built and inhabited by Jews, we drove to the railway at Taraczkös, halting midway to inspect a forest railway, which was in process of construction, over a distance of 14 miles, to that place. We then left by train for Kássa, where we arrived late at night.

Lipto-Ujvár.

Leaving Kássa on the morning of the 9th at 6 A.M., we took the train to Lipto-Ujvár. We travelled up the valley of the Hernád, through fine oak, beech, and birch woods, which further on give way to cultivation, surmounted on the higher slopes by forests of spruce and silver fir.

In this neighbourhood there are numerous iron, copper, silver, and antimony mines; and the line of railway passes close by a group of smelting furnaces, the sulphurous smoke from which has completely destroyed and kept down all traces of vegetation for some distance around them. We noticed several noblemen's castles, with their distinguishing double roofs. The estates in which they stand were, generally speaking, granted with the patent of nobility, and the proprietor lives surrounded by the residences of the junior branches of the family, and by his tenantry and retainers, quite in the old feudal style. All members of the family use the name of the estate as a prefix to their surname. On leaving the valley of the Hernád, we passed over a high plateau near Poprád, which drains, on one side, by way of the Hernád, Tisza, and Danube, into the Black Sea; and on the other, by some streams which we crossed, into the Vistula, and thence to the Baltic. From near this point we had hoped to see the splendid view of the highest peaks of the Carpathians, which, at a distance of nine miles from the railway, rise to an elevation of nearly 9000 feet; but, unfortunately, the hills were covered with clouds, under which we could barely distinguish some patches of snow. We were sorely tempted to stop at Poprád, for the sake of paying a visit to the celebrated ice-cave at Dobsina, and also at Csorba to see the lake; but our time was very limited, and we had not been able to include even this, much less the longer tour from Poprád through the high mountains to Csorba, in our official programme, to which we were obliged to adhere rigidly, as the arrangements made for us at all points of our route would otherwise have been disturbed. Hence we ran straight on to Lipto-Ujvár, following the course of the Tekete Vág, on which we saw many rafts floating; piles of timber covering the ground near most of the railway stations.

On arrival, we went at once to the house of the Conservator, M. Kossányi, who, after breakfast, drove us through some magnificent forests of spruce, silver fir, larch, Scots pine, and other trees, up the valley of the Tekete Vág, which is extensively used for floating timber, until we reached the commodious and comfortably furnished forest house, occupied by the officer in charge of the division, M. Adrianyi and his family, under whose hospitable roof we passed the night.

On the morning of the 10th we made an excursion higher up the valley, stopping to look at some spruce, silver fir, Scots pine, and larch nurseries, situated at an altitude of 2600 feet. The plants are not only used in the State forests, but are also given *gratis* to communes and private proprietors. The demand for them is said to have been very heavy this year, all over the country; and it is estimated that, if the present rate of issue be maintained, the large number of 25 million plants will be distributed from the State nurseries. Prizes are given by the State to private proprietors for successful planting operations. We noticed that the Scots pine plants were very much larger than spruce of the same age; and that the latter appeared to flourish much better at the edges than in the centre of the seed bed, probably because they had more light and room. In planting on these hills it is customary to employ 60 per cent. of spruce, 25 per cent. of larch, and 15 per cent. of silver fir. Scots pine is not much used. The plants are all put out directly from the beds, without being previously transplanted; and the larch is planted at two years old, when it is found to succeed much better than if allowed to remain longer in the nursery. The larch trees in these forests are particularly fine; many of them are 110 feet high, and the quality of the wood is said to be better even than that of the trees grown in Styria.

The logs felled at the higher levels are sent down on earth or timber slides, to the bottom of the valley, whence they are drawn by horses to the river side. At one point of the road, we noticed that the base of the hill was apparently thickly studded with piles, driven into the flat ground immediately skirting it. These turned out to be the ends of stems or logs, which, after sliding down from above, buried themselves deep into the soft soil, and then either broke or were cut off. An arrangement for avoiding this, by receiving the ends of the logs on a wooden staging, similar to that previously described, seems to have been required here. We saw many dry timber slides; and the banks of the river for long distances are revetted with poles, to facilitate the passage of the rafts. Much damage is here done by the ice, which, during the winter months, frequently collects at various points in the stream, thus forming a temporary barrier, which dams back the current; and when this bursts, the works are liable to be either washed away, or seriously injured. The floating work begins in the spring, when the river is fuller than at any other time, loose round logs about 16 feet long, intended to be sawn up into planks, being the first timber launched on it. In the summer, the rafting commences, the reservoirs being used when necessary; and later in the year, when the supply of water in them is failing, loose pieces of firewood are floated down.

The prevailing winds sweep down the side valleys which descend from the south-east; and the trees standing on the opposite side of the main stream are liable to be overturned by them; but there are not nearly so many windfalls here as in the Mármaros-Sziget and Bustyaháza forests.

A few years ago, the young pine stems, taken out in the course of thinning, could be sold for use in the smelting furnaces; but nowadays the consumption of them for this purpose is less than formerly, and it is very difficult to dispose of such produce.

We inspected the Rasztoki reservoir, which lies near the head of the valley, and contains 1½ million cubic feet of water; it has a canal alongside of it, down which the water, entering at the upper end, can be diverted, when it is desired to float loose pieces of timber from forests lying higher up. They are carried over the dam, by a canal slide with a steep fall, into the stream below. On our return to the forest house, we visited some plantations of spruce, which were put out by clumps of two or three in each hole.

In the afternoon we went down the river on rafts to Lipto-Ujvár, passing through the most beautiful scenery, and shot down two river slides, the descent of which, if not so difficult and dangerous as at Brusztura, was sufficiently exciting, and gave us a good wetting. We landed at the wood depôt, and proceeded at once to the house of the Conservator, with whose family we afterwards went to a ball, and were much interested by witnessing the Czardás or national Hungarian dance.

Selmecz-bánya.

Leaving Lipto-Ujvár by train on the morning of the 11th, we travelled westward, following the course of the Vág, on which many rafts were seen, to Ruttka, and thence, turning southward, up the Turocz stream, crossed a low ridge, and descended through the most picturesque country, past the charmingly situated village of Körmöcz-bánya, to the valley of the Garam river. The scenery here equals, if it does not surpass, anything we have ever beheld; and we were fortunate enough to see it at a most favourable time, when the lights and shades were at their very best. At Berzenze, where we left the main line, we entered a small carriage on the miners' train, and made our way to Selmecz-bánya, the seat of the celebrated forest and mining college. We were received at the railway station by the college authorities, and driven to the house of M. Sóltz, head of the Forest Branch, where, after visiting the botanical gardens, and being entertained at supper in the council hall by the Director, M. Torbaky, we passed the night. The gardens contain a good collection of trees, among them a deodar. Many of the species are American.

The college, at which there are at present 325 foresters and only 80 miners, supplies trained candidates, not only for the State, but also for private proprietors and companies. It used to be attended by students of many nationalities, the number sometimes exceeding 1000; but, for the last few years, all instruction has been given in the Hungarian language, and on this account, foreigners do not now enter the school. The young men live in the town, and attend the lecture halls, which, with the museums and halls of study, occupy seven large houses situated in various parts of it. The erection of a magnificent set of new buildings has been sanctioned; the plans, which were shown us, have been approved, and the work will be undertaken immediately. The director and the head of the school of mines are the joint inventors of a system of accumulator, for use with the electric light; it is employed in the main building of the college, and is believed to surpass any that has previously been brought out. The light is perfectly steady, and the electricity can be stored for an almost indefinite time.

Early on the morning of the 12th we were shown over a part of the college, including the magnificent and complete collection of models of slides of all kinds, of rafts, weirs, booms, reservoirs, and sluice gates, as well as of tools and other implements connected with the felling, cutting up, and export of timber. The models, which are on a large scale, are beautifully made, and have been arranged by M. Szécsi, the professor in charge of this branch of the instruction, who very kindly explained the most important of them to us, and presented us with a copy of his illustrated work on the subject. He also took us over the splendid collection of forest produce, raw and manufactured, including models to show the method of making charcoal, and of extracting potash and tar from wood, as well as many other things. Unfortunately, we had not time to visit the natural history museums, which are believed to contain the best collections of minerals, rocks, botanical specimens and insects to be found at any such institution in the world. On these collections, which have been gradually brought together, no pains or expense appear to have been spared; and they are well worth what they have cost, as they enable the instruction in these branches to be given in the most complete manner.

We attended an examination at the school of mines, and inspected the models and collections of surveying and other instruments connected with that branch of the college, after which we went over the library. One excellent feature in the method of instruction pursued at Selmecz-bánya is, that splendid sets of figured tables, and clear large scale drawings are provided; so that the necessity for making rough sketches, and drawing out figured tables on the blackboard during the lectures, is avoided.

We regretted very much that, as we were obliged to continue our journey in the afternoon, we had not time to pay a visit to the mines, for which Selmecz-bánya has been celebrated ever since the days of the Romans.

Beszterczebánya.

On arrival at Beszterczebánya, we were at once conducted to the river Garam, to see the permanent boom, constructed for the purpose of catching the loose firewood floated down to the depot. The boom, which is about a mile and a quarter long, consists of masonry pillars, with a wooden grating between them. This is formed by two fixed horizontal beams, one above water, and the other near the bottom of the stream, with stout movable stakes between them. The latter are placed at intervals of about 9 inches, and are passed through holes in the upper beam, merely resting against the lower one, and being kept in position by the weight of the water and wood pressing against them; they are given a slight slope up stream by the projection in that direction of the lower of the two horizontal beams. A similar arrangement, which is sometimes adopted in other places; especially where the occurrence of dangerous floods at certain seasons of the year renders it difficult to maintain permanent works, is to erect, instead of the masonry pillars, heavy timber tripods, against one side of which the grating is fixed. The entire structure can then be removed at pleasure. In the present case, advantage has been taken of a convenient reach of the river, at the lower end of which are two canals leading to two depots; while at the upper end is the sluice gate, used for the passage of rafts. The boom crosses the stream between the canals and the sluice gate; but owing to its comparatively great length, its direction is not far from being parellel to the line of the current. Great quantities of fuel come down, sometimes as much as 500,000 cubic feet being collected at one time. This accounts for the great length of the boom which is necessary both to enable the rafting channel above it to be kept open, and also to provide sufficient escape for the water, and thus prevent its being dammed back by the wood, which lies in a dense mass extending down to the very bottom of the river. The log-rafts, each of which consists of about 650 cubic feet of timber; are here secured with cross pieces both fore and aft. The bed of the river is no longer rocky, and there is no necessity to give the heavy ends "play." The rafts, which are floated two or three together, are attached with ropes, one behind the other, and thus taken down to the Danube, and thence to Buda-Pesth and Orsova. Before the heavy customs duties were instituted on the frontiers of Germany, most of the large timber from the district used to be despatched by rail for sale in that country.

While we were at the boom, very little firewood was there; and some men upon a raft were engaged in fishing up sunken pieces from the bottom of the stream. Their method of anchoring themselves, by means of a pole pushed through a hole in their raft and jammed by the force of the current, is very simple and ingenious. We visited the depot, in which there was an amazingly large quantity of firewood, most of which is there converted into charcoal for use in the smelting furnaces.

On the morning of the 13th we left by train for Brezova, and thence drove to Roincz, to the house of the officer in charge of the Forest Division, M. Papp. After a short halt we went on, a distance of 14 miles, to see the reservoir named Kemeny Gábor. We stopped on the way to look at a small wet slide used for the floating of firewood; it was composed, in cross-section, of three pieces, the bottom one being slightly hollowed out. The spikes used for fastening the timbers together, so as to form the trough, were cut from the dead lower branches of spruce trees, sawn off close to the trunk. They answer the purpose perfectly, being almost as hard as iron. Here there is a very fine forest of spruce, silver fir, and Scots pine, the growth being rapid, and the damage resulting from storms very slight.

Some open ground, which has become denuded through excessive grazing (a very rare occurrence in these hills), has been closed with the most satisfactory result; and the contrast between the protected and unprotected portions of the valley was very striking. The torrents which had begun to form have been treated on the system adopted for such works in France. Further on we visited a nursery of spruce, larch, Scots pine, and black Austrian pine (*P. Austriaca*), and saw a number of dry fuel-slides roughly put together, their characteristic feature being that they are of an inexpensive nature and easy to construct, so that they can be readily made wherever they are required for temporary use. The dam of the reservoir at the head of the valley, which contains 10½ million cubic feet of water, was formerly built of wood and stones, on a masonry foundation, at a cost of £3600; but such works do not last more than about fifteen years, and recently, when the dam had to be renewed, it was made entirely of masonry, on the old foundation, at an expenditure of about £5600. It may be said, then, that the cost of the new work was about double that of the old one; but in view of its far more lasting nature, there can be no doubt that the more costly system is the cheaper in the end. Passing beyond the reservoir, we examined the mouth of a wet slide, which is about 13 miles long, 2 feet 6 inches to 3 feet wide at top, 20 inches wide at bottom, and 2 feet deep. It is used for floating logs, and is formed of nine stems held together by wooden stakes and pegs. Three of these form the bottom, and there are three at each side, their inner surfaces, as well as those in contact, being smoothed and fitted so as to render the trough fairly water-tight; but a fresh supply of water is let in at various points along its course. When it is in use there are from 10 to

15 inches of water in the trough, along the bottom of which the logs slide, aided by the current. In the afternoon we returned to Ronicz.

Next morning, the 14th, we inspected the boom or grating used for the collection of firewood at the entrance to the depôt. The water above it was full of billets of wood, a few of which were let through at a time, and passed down the small depôt canal. On their way they were cleverly fished out by workmen armed with iron hooks, mounted on long handles, with which they jerked them on to the bank. Any which escaped were caught by a second grating further on.

We subsequently visited the large iron-works, the principal manufactures turned out of which are rod-iron and gas-pipes. Many of the furnaces are heated with gas made from coal or wood. We were shown a magnificent engine of 1000 horse-power, which was put in motion, stopped, and reversed in an incredibly short space of time; and a steam-hammer of 300 tons, the workman in charge of which exhibited his complete control over it in a variety of interesting ways.

Conclusion.

Our pleasant tour in the Carpathian forests being now at an end, we returned to Buda-Pesth on the evening of the 14th July. That we were enabled to see so many interesting things in such a short time was due entirely to the excellent arrangements made for us by the forest officers, by whom we were everywhere received and entertained, and who spared no pains to show us as much as possible, and to afford us information regarding their work. Had it been otherwise, and without the aid of our friend M. de Lavotta, from whom we parted with sincere regret on our return to Buda-Pesth, it is certain that we could not have accomplished half of what we did; and our grateful thanks are due to the acting Director-General, M. Rouai, M. de Lavotta, and the many forest officers whom it was our privilege to meet. But we should imperfectly express our acknowledgments of the hospitality shown to us, if we failed to record the graceful part borne in it by the ladies, who are perfect hostesses and most accomplished housewives. To them we owe it that, in spite of the fatigues which our rapid journey necessarily entailed, our brief stay in this interesting country was rendered as enjoyable as it was instructive from the professional point of view.

It would be out of place here to enter on a description of domestic life among the Hungarian upper classes, into which we were so fortunate as to gain an insight. But it is difficult to avoid some allusion to the peasantry of the various races, Magyars, Russians, Slavs, Wallachians, Galicians, Jews, and gipsies (Czigân), we met with. A practised eye readily detects the differences between them, but even the ordinary traveller soon learns to recognise the Russian in his red cloth trowsers and embroidered jacket, his unmarried sister or daughter wearing a wreath of artificial flowers. Also the Galician, with his dark woollen Polish jacket, much embroidered and adorned with orange-coloured tassels. But the people with whom we came most in contact were the Wallachians, who, in the districts we visited, do the greater part of the work in the forests, especially that connected with the rafting and floating of timber. They are a wild looking people, dressed, as a rule, in dirty white clothes, with wide trowsers and coat sleeves, over which they wear a woollen jacket, so rough that it has the appearance of sheep skin; also a very broad and stiff leathern girdle, reaching from the hips more than halfway to the arms, and drawn together in front with four stout buckles. Their faces and the other exposed parts of their bodies, are much sunburnt, their feet being bare or encased in cloth or leather sandals; and their long hair hangs unkempt about their shoulders. They present, at first sight, a striking resemblance to the wild tribesmen of the North-Western Indian frontier, and might easily be mistaken for them, if it were not for the straw hats worn by the men, and the skirts of the women. During the last few years, there has been a formidable immigration of Jews into Hungary, principally from Poland and the north; and their treatment forms, at the present time, a serious political question. They are by no means popular in the country of their adoption, where we saw quite enough of their forbidding countenances.

The Magyar peasants adopt different dresses in various parts of the country. But, as a rule, the men wear loose white trowsers, such as are worn by Afghans; and in the districts about Beszterczebánya, the women wear a bright-coloured bodice, with short skirt, and long leather boots reaching to the knee, their hair hanging in a long thick plait down the back.

The gipsies, when seen camping in their wretched wigwams by the roadside, are not attractive objects, but they are born musicians; and the bands of them who frequent the hotels and promenades of Buda-Pesth, playing the wild and beautiful Hungarian airs, are among the many attractions, which make it one of the most delightful cities in Europe.

A visit to the Hungarian State forests is particularly instructive to the Indian forester, because the conditions in them resemble, in so many respects, those under which he has to work. There is probably no country in Europe where the export of timber by rough-and-ready means can be so well studied as it can now be in Hungary; and if time could be found for it, a tour in the Carpathians, during the months of April and May, might be most advantageously added to the course of instruction, now given to candidates for the Indian Forest service.

CHAPTER III.

A TOUR IN THE BÁNÁT.

General Description.

The Domain of the Bánát is situated in the south-eastern corner of Hungary, between latitudes 44° 41′ and 45° 31′. The eastern limit follows the crest of a chain of mountains, rising to a maximum height of 4775 feet, and forming part of the eastern Carpathian range. Spurs, alternating with valleys, run westward from the high ridge, and fall with a gentle slope to the level of the great Hungarian plain, which lies at an elevation of from 300 to 500 feet above the level of the sea; the altitude of Báziás, on the Danube, being not more than 180 feet. Within this territory, an area of 834 square miles (of which 357 square miles, or nearly 43 per cent., are forests, and the remainder fields, meadows, vineyards, and pastures) was conceded to a Company in 1855, together with its coal, iron, copper, and other mines, and the factories for working them which had already been established by the State. The Company also obtained the line of railway from Vienna to Buda-Pesth, and thence to Báziás, with the branch line to Resicza and Anina, making a total length of 723 miles; and also the coal mines at Kladno in Bohemia. It at the same time purchased, from the Vienna-Raab Company, 28 miles of railway running from Vienna to Raab, and the locomotive shops at Vienna, belonging to that Company.

The Domain in the Bánát obtained by the "Austrian State Railway Company" has a population of 124,748, or 150 per square mile, consisting principally of Roumanians, but partly also of Bulgarians, who occupy Krassova and several villages in the neighbourhood of Oravicza, and are excellent farmers; as well as of Servians, Slavs, who are principally miners, Hungarians, Germans, Bohemians, Jews, and Czigân or Gipsies.

A portion of the cultivated land of the Domain belongs to the peasants; but the forests are the exclusive property of the Company, which also owns the pastures in all communes in which there are mines or factories, the inhabitants having the right to use them on payment of a fixed rate per head of cattle. But in the other communes the pastures belong to the landed proprietors collectively, and the Company merely takes its share with the others. It possesses, however, seignorial rights over the whole Domain, which entitle it to the fishing and shooting and to levy dues on the sale of alcoholic beverages, as well as on mills and markets. The three latter rights are let for about £7600 a year. The right to shoot and fish within the forests is retained by the Company in the hands of its forest staff; but elsewhere it is farmed out on leases. In return for these rights, the Company maintains 21 churches, and nominates and pays 38 priests and 43 schoolmasters, at a cost of about £5440 a year. The dominant religion is that of the Eastern Greek Church; but there are a considerable number of Roman Catholics, and a few Protestants, chiefly members of the United Greek Church, and Jews.

The central offices of the Company are at Vienna. At Oravicza in the Bánát, there is an Inspector of Works who is charged with the construction and maintenance of communications within the Domain, including 44 miles of broad guage, 57 miles of narrow guage, and 38 miles of subterranean railway, used for working the mines; also 62 miles of main roads, the property of the Company, 93 miles of communal roads maintained out of funds supplied by the communes, and numerous export roads in the forests. There is also at Oravicza an office, in which topographical and geological maps, and plans of the mines, are prepared, and rights and concessions are recorded; and an Inspector who controls the forests, cultivation and pasture, over the whole of the Company's property. For this purpose, the Domain is divided into six districts, viz.:—those of Resicza, Steirdorf, Oravicza, Dognaczka, Bogsán, and Maldova, over each of which is placed a superintendent with a forest officer under his orders.

Since the Company obtained the concession in 1855, it has constructed 500 miles of new railway lines, and organised a navigation service on the lower Danube, to connect Servia, Roumania, and Bulgaria with its railway at Báziás. By this means, and by the enlargement and improvement of its factories, it has quadrupled its out-turn of produce; and can now dispose of it, not only in Austria and Hungary, but also in the neighbouring countries of Eastern Europe.

The Bánát is situated on a geological basin formed principally by thick beds of the secondary groups, presenting all important ages except the trias, and lying on gneiss and mica schist. Where the secondary strata are traversed by syenite, the Jurassic and cretaceous limestone has been crystallised, and here are found the metals which constitute the principal riches of the country; they comprise magnetic iron, red and brown hematite, copper, lead, iron pyrites (from which sulphuric acid is made at Maldova), zinc, bismuth, silver, and gold. A large quantity of coal is found in the Carboniferous and Jurassic groups. Considerable deposits of Tertiary formation are also met with in the basin, principally in the neighbourhood of Krassova, Tirnova, and Maldova.

The plains are covered by a deep layer of black vegetable mould, which is well suited to the cultivation of cereals, and produces excellent crops of wheat, oats, and maize. On the lower hills, where the soil is chiefly clay, lie the pastures, with forests here and there and large quantities of plum trees, cultivated, especially near Krassova, for the "raky" which is distilled from the fruit. The higher hills are as a rule covered with forest.

The plains of the Bánát are the hottest part of Hungary, the spring and summer being very hot, and marked by protracted periods of dry weather. Snow does not lie here during the winter. Great cold is experienced in the mountains, where frosts occur late into the spring, but there is much less drought. In the exceptionally dry season of 1863, the rainfall at Oravicza (680 ft.) was 15·7 inches, while at Fránzdorf (1770 ft.) it was 21·25 inches. The dry and cold winds from the south-east do much damage in all parts of the Domain, carrying the fine soil from the fields, overturning fruit trees, and making havoc in the forests.

Factories at Resicza.

We left Buda-Pesth on the 16th July 1886, and traversed the well-cultivated Hungarian plain, down to Temesvár and Vojtek; whence we took the branch line to Bogsán, and then the narrow-gauge local railway, following the valley of the Berzáva, to Resicza, where the largest iron works in Hungary have been established.

The town, which stands at an altitude of 817 feet, has now 10,000 inhabitants, most of whom are in the service of the Company, which has erected 1200 houses for their accommodation; it has gradually grown up around the high furnaces which were first lighted in 1771, and have been working without intermission down to the present time. But since the factories were originally established, they have been very much increased by the addition of reverbatory and other furnaces; and since the Company came into possession, they have undertaken the manufacture of Bessemer steel, rolled steel rails, wheels for railway carriages, steel sleepers, boiler plates, girder bridges, and numerous other things. In consequence of this, the high furnace at Bogsán, the iron mines at Moravicza, and the coal mines at Doman and Székul, all of which are worked in connection with Resicza, and are connected with it by means of 38 miles of narrow-gauge railway, have been largely developed. The building timber, mine-props, and charcoal required for the Resicza factories are furnished from 66,700 acres of forest, which cover the hills to the east and south.

Arriving at mid-day on the 17th, we were conducted by M. Fery and M. de Bene, two of the Company's engineers, to a point about three or four miles up the river, whence the logs of building timber, brought down from the forest on trucks drawn by horses or bullocks, are carried by rail into the town. The wood for charcoal is floated down a distance of 28 miles, in the form of loose billets, and caught above the town at a weir, the river behind which was at the time of our visit crammed with them. About a million and a quarter bushels of charcoal are annually made at Resicza, nearly a million and a half bushels being turned out of the kilns in the forests above Fránzdorf.

The light railway, by which we made our excursion, was constructed in 1872; before that year all transport between the factories and the mines at Moravicza, Doman, and Székul, as well as with the furnaces at Bogsán, had to be effected over hilly roads by means of bullock-carts; as many as twenty pairs of bullocks being sometimes required to move the heavier loads. The gauge of the line is 3 ft. 3 in., and the rails weigh $11\frac{3}{4}$ lbs. per running foot. They are laid on wooden sleepers 2 ft. 3 in. apart, and measuring 5 ft. 5 in. by 5·9 in. by 3·9 in. About one-third of the total length of the line consists of numerous sharp curves of from 160 to 320 feet radius, by which it winds along the bottom of the valley up an incline of about 2 in 100. There is one tunnel, which is 260 feet long.

We returned from our excursion through the park, which was laid out by the Company for the benefit of its workmen, on the occasion of the hundredth anniversary of the opening of the works; and we then paid a visit to the Bessemer Steel Factory. The molten iron, brought from the high furnaces, is poured into a huge vessel, previously brought to a very high temperature, and through which a powerful blast of compressed air is then passed. This carries off the carbon in the form of carbon dioxyde, and at the same time drives off other impurities. The metal is then poured, by means of hydraulic machinery, into moulds, lined with a paste of crushed quartz; and the blocks of steel thus formed are afterwards heated and rolled into rails. The heat in the factory was terrific; but we were told that the health of the workmen does not suffer from it.

The only fuel used in the high furnaces is wood charcoal; and the ore is almost entirely magnetic iron of excellent quality. From 140 to 175 cubic feet of charcoal are required for the manufacture of a ton of iron, of which about 15,000 tons are turned out annually. Iron is also brought from Bogsán; but the total quantity available for the Bessemer and Martin factories is insufficient to enable them to be worked at full power. They do not make more than from 20,000 to 25,000 tons of steel per annum, but are capable of turning out double that quantity.

In the evening we attended a *Soirée,* given in a building provided for such entertainments by the Company. The bandsmen were all workmen from the factories.

The Forests of the Domain.

The total area of the forests in the Domain, is 213,905 acres, covering two extensive tracts, the most important of which lies on the mountain crests and slopes to the east and south, while the other is situated in the plains and hills around Bogsán.

On the plains and low hills oak predominates, the species being *Quercus cerris*, *Q. conferta*, *Q. pedunculata*, and *Q. robur*; but it is mixed with a varying proportion of wild cherry, wild plum, maple, and hornbeam (*Carpinus orientalis?*) and other kinds. The oak grows higher up the southern and western slopes than it does on those having a northerly aspect, where it is replaced by beech, which is the principal tree of the Bánát mountains. At intermediate levels, this tree is found mixed with hornbeam, ash, elm, lime, and other broad-leaved species; but at higher elevations, it is associated with conifers, the most important among them being the silver fir, which occupies considerable areas, in localities where the greatest cold is experienced, notably about Fránzdorf. Here also well-grown spruce is found, and larch has recently been introduced. On the southern slopes of the mountain, where the soil is dry, Scots and Austrian pines have been planted. There are 176 species of ligneous plants in the Bánát.

The forests have all been surveyed, and maps have been prepared and reproduced by photo-zincography in the Company's offices; each forest officer and subordinate being in possession of a good map of the portion of forest under his charge. A valuation survey has also been effected, and the estimate of age-classes gives the following result, viz.:

Crop.	Acres.
From 80 to 100 years old, and over,	75,625
,, 60 ,, 80 years old,	27,407
,, 40 ,, 60 ,,	26,428
,, 20 ,, 40 ,,	30,059
,, 0 ,, 20 ,,	54,386
Total,	213,905

Working plans have been made for the forests of each of the six districts, into which the whole forest area has been divided. Near Oravicza where the soil is good, the revolution for silver fir is 100 years, for beech 80 years, for the forests of the plains it is 60 years. But, speaking generally, for the great beech forests between Resicza and Maldova, where the growth is slow, the revolution for high forest is from 80 to 100 years. In the forests around Bogsán, where the soil is rich in vegetable mould, but dry and shallow, the revolution for oak coppice is 60 years. In this southern latitude, oak trees a hundred years old give healthy and vigorous coppice shoots; and regeneration by the coppice system is consequently very easy, if the operation is properly carried out.

Two systems of felling high forest are practised, viz.—*clean felling*, which is adopted in forests of pure, or nearly pure, beech; and *selection felling*, employed in mixed forests worked for large timber. The first-mentioned system is here preferred to that of natural regeneration by seed, on account of the violent storms which sweep over this part of Hungary, and overturn the standards left under the latter system; thus not only interfering with its success, but also endangering the lives of the men employed in working out wood, and making charcoal in the forest. The regular system is also less economical of labour, which is here very scarce; and it can therefore rarely be adopted. The selection method is supplemented by planting, when the crop of self-sown seedlings on the ground is insufficient. In addition to the re-stocking of the forest after *clean felling*, a good deal is done in the way of planting up blanks and bare hill sides.

Between 1855 and 1876, over 240 million cubic feet of wood were cut in the forests of the Domain; and of this quantity nearly 144 million cubic feet were converted into more than 73 million bushels of charcoal for use in the furnaces. In 1881 the forests produced over 23½ million cubic feet of wood, of which more than 10½ million cubic feet were converted into charcoal.

Forests of the Berzáva.

On the morning of the 18th July, we started with M. Fery at an early hour, and drove a distance of 18 miles, to visit the forests in which the wood used at Resicza is grown. Our route lay through the Domain, and led us past several villages surrounded by fields and orchards. The company gives advances for building, and allows the people, on the payment of a nominal land rent, to plant orchards of plum and apple trees, from the fruit of which they distil a spirit. The control of all such concessions is vested in the forest officers. We passed through some forests of beech mixed, at the lower levels, with hornbeam, birch, and other trees, and higher up, with spruce, silver fir, and a small proportion of larch. We noticed a considerable number of plantations, the plants standing in vertical lines. We halted at the village of

Frànzdorf (1770 feet); and then turning southward, followed the main valley of the Berzáva, until we reached the reservoir (2180 feet), above which a portion of the birch forest is being clean felled.

The cuttings are commenced at the end of September, continued throughout the winter, and completed in May or June, when the logs are converted into billets 40 inches long. Between July and September, a system of temporary dry slides is constructed of beech poles, about 6 inches in diameter; and by this means the billets are conveyed—during the period from October to March—a part of the way down the valley. The temporary slides cost about 7d. to 8d. per running yard. In winter, when the frost is on the gronnd, a fall of 7 in 100 is sufficient for them; but, for work during the dry season, a slope of from 10 to I5 in 100 is required; and if the billets do not run freely, the slides must be wetted, so as to reduce the friction. Over the last two miles above the reservoir, a system of wet slides has been constructed in connection with the dry ones; and down them the wood is sent—between April and July—to a point immediately below the dam. The main channel of the wet slide is formed of planks from 2½ in. to 4 in. thick; it is 24 in. wide at bottom, 40 in. wide at top, and has a fall of 1 in 100. If such works are required to last for a single year only, the timber used is fir; if for five or six years, it is beech; oak will last for ten years. The main portion of the existing slide cost 3s. per running yard, the feeders, which are of smaller section, costing 2s. 6d. The slide, when in use, is full to the brim with water and billets, and men are stationed at sharp bends, or other points where obstructions are likely to occur; in order to prevent a stoppage, by pushing the wood along. Where an exceptionally steep fall occurs, there is an ingenious arrangement for passing the water into a sub-channel, by means of a grating in the floor of the slide, and thus reducing the speed of the descending wood; the water re-appears lower down, where the fall is less. The slide passes the end of the dam, the portion below which is furnished with a number of outlets, each leading into a shoot, so arranged as to throw the billets into the bed of the stream. Each outlet has a door, which, when it is opened and thrown back across the main channel, bars the further passage of the wood, and permits it to escape down one of the shoots. When the first door has been open for some time, so that a large heap of billets has been deposited, it is closed, and the next one is opened, and so on, until the stream bed, opposite the outlets, is sufficiently filled with billets,—that is to say, when some 350,000 to 500,000 cubic feet have been accumulated.

The dam, which has been built at a distance of about $5\frac{1}{4}$ miles from the head of the Berzáva, where the forest is situated, is made of wood and stones, faced with clay; it is 37 feet high, and the reservoir, when full, contains $4\frac{1}{3}$ million cubic feet of water. When the sluice gates are opened, the reservoir empties itself in five hours; and the billets are carried down the Berzáva, which has a fall of 1 in 100 for the first mile, and of from 3 to 5 in 100 for the rest of the way. The first weir, which is near Resicza, at a distance of 23 miles from the dam, is reached in about six hours. The wood caught at it is led by a canal 600 yards long, running beside the river to the first charcoal yard, where 26 kilns are at work. A part of the wood which passes the first weir is caught by a second, 500 yards further down; whence it is taken by a canal to a second charcoal yard provided with 34 kilns. The remainder is arrested at a third yard containing 40 kilns, by two strong weirs, beyond which none of it can pass. The narrow-gauge railway traverses the yards, and by it the charcoal is conveyed to the furnaces. The three yards hold $4\frac{1}{4}$ million cubic feet of wood, and are capable of turning out a million and a quarter bushels of charcoal in a year.

The time occupied, from the commencement of the fellings to the delivery of the last batch of wood at Resicza, is about one year and ten months; and the total cost, including that of felling and converting, is $\frac{3}{5}$ of a penny per cubic foot (stacked). It is said that if the wood had to be conveyed by the carts to Resicza, the cost would be at least doubled.

In the month of October, two years after the fellings were commenced, charcoal-making is begun in the forest. All the wood unsuitable for floating is then put into kilns, which are circular in form, and of various dimensions, according to their situation, the largest containing 5000 cubic feet (stacked) of wood. The split billets are laid at the bottom, and round pieces cut from branches are placed above them.

It is said that 100 cubic feet of stacked wood, equivalent to 72 cubic feet of solid wood, yield $38\frac{1}{2}$ bushels of charcoal at Resicza, and $35\frac{1}{2}$ bushels in the forest, where the arrangements for making it are not so perfect. The wood is almost exclusively beech, the kinds next in order of importance being oak, lime, and silver fir. The forest now being cut is aged from 120 to 140 years; and it yields 2450 cubic feet (solid) of wood per acre. There is a good deal of advance growth on the ground, especially at the lower levels; but, where this is wanting in sufficient quantity, the crop is completed by planting.

Before leaving the reservoir, we were shown the arrangements for breeding trout, which are conducted by the forest officer, and we then drove back to Resicza, stopping for a short time at Fránzdorf, to see a dance given after a Roumanian peasant's wedding. The women's dress consists of a white embroidered garment, reaching to the ankles, a long and narrow woollen band, wound round the waist, and used for carrying loads, and a pair of bright-coloured and richly ornamented woollen aprons, one worn in front and the other behind, the latter ending in a long red fringe, which falls to the bottom of the white skirt. A red-flowered handkerchief, bound over the hair, completes a very picturesque and semi-oriental costume. Most of the girls wore bright-coloured natural flowers in their hair; and the bride was distinguished by a white wreath.

The men are clad in white, with a coloured jacket; they wear sandals, and wind strips of cloth loosely round the lower part of the leg. The dance appeared to us a rather monotonous one; but those engaged in it, among whom was a large proportion of remarkably handsome women, seemed to be enjoying themselves thoroughly.

On the morning of the next day, accompanied by M. Fery and M. de Bene, we paid a second visit to the Bessemer works, where we saw the making of railway-carriage wheels, and other things; and in the afternoon we mounted to the high ground above the town, and inspected the wire-rope tramway, 270 yards long, used for carrying down ore to the furnaces. There are two trucks, one at each end of the rope; the full truck in descending draws up the empty one, so that no engine is required. We were told that a wire-rope tramway, 17 miles long, and worked by steam-power, is in use in Transylvania.

Anina and the Danube.

On the 20th of July we left Resicza, and drove 37 miles across the hills to Anina, stopping on the way to examine the Bulgarian village of Krassova, through which our road lay. The country is very much denuded of trees, apparently owing to excessive grazing, but some planting work is going on in places. At Anina we were received by M. Schmidt, the Company's chief engineer, who treated us with great courtesy and kindness. He took us over the iron-works, where we saw the manufacture of cast-iron columns, rolled iron bars, wire, and nails. Some very pretty ornamental ware of the same metal was also being made, and a specimen of it was presented to us.

The locality is rich in both coal and iron, and also in a bituminous schist, yielding, on distillation, an oil from which petroleum and paraffin, to the amount of 1800 tons per annum, are manufactured at Oravicza.

We quitted Anina next day by train, passing through a beautiful beech forest, succeeded by an open country, which has evidently suffered very much from over-grazing, the red soil on the hillsides being completely exposed in the neighbourhood of the villages. The scenery up to Oravicza is very beautiful; but beyond this we crossed a cultivated plain, producing, in addition to grain crops, which were being harvested by the peasants in their white dresses, a great quantity of maize, and some potatoes and vines. We then travelled by way of Jám and Jassenova to Baziás, where we passed the night.

On the morning of the 22d we went on board one of the Danube boats, and steamed down to Orsova. On our left were the spurs of the Eastern Carpathians, and on our right the Servian hills. The wide river is here very rapid and muddy, and there is a great deal of traffic on it, many steamers and boats of all kinds, including "dugouts," being seen. There were also some floating mills. The low Servian hills are, as a rule, well wooded; but on the Hungarian side, where the general aspect is southerly, the forests are confined to the higher levels, the lower slopes being occupied by villages and fields. After passing down several rapids, we entered the beautiful defile of Kasan, where we saw, on the right bank, the remains of Trajan's road, cut out of the base of the cliffs. His inscription on the rock is still legible. This is the finest part of the lower Danube, the scenery being equal to, or even surpassing, the best parts of the Rhine between Coblenz and Bingen.

On leaving Orsova, we drove a distance of 16 miles, up the valley of the Czerna, in which there are some magnificent poplars, to the Baths of Hercules, where, after dining at the Kursaal, we passed the night; and, rising the following morning at 3 A.M., drove to the railway station, and took the train for Buda-Pesth. At first the country was very hilly and well clothed with woods, but as we advanced further the valley opened out, and was cultivated. We struck our old route at Temesvar, and, crossing the Hungarian plain with its vast fields of maize, its yokes of oxen in the plough, and bands of horses treading out the corn, reached our destination the same evening.

That we were able to see so much of the Bánát in such a short time, was due, in the first instance, to our kind friend, M. Ronna, principal director of the company, whom we had met at Nancy, and who gave us the needful introductions. We are also much indebted to M. Willigens, Inspector-General, in administrative charge of the Domain, and M. Drexler, secretary to the Council of Administration, as well as to the local officers previously mentioned in our narrative; and our most sincere thanks are due to all these gentlemen for their kindness, and for the valuable assistance they afforded us.

We returned to Nancy by way of Vienna, Frankfort, Mayence, and Metz, after having made a most interesting tour.

II. *The Proposed School of Forestry.* By Sir Dietrich Brandis, K.C.S.I., Bonn, Germany.

(Read at the Annual General Meeting of the Society, on the 26th of July 1887.)

My friend, Dr Hugh Cleghorn, your late President, has done me the great honour of suggesting that I should deliver an address to the members of the Royal Scottish Arboricultural Society at this year's annual meeting. Unfortunately, I am unable to be present, and I therefore thankfully avail myself of my friend's offer, to read at the meeting a few words which I desire to address to the Society. First of all, I wish to express the great satisfaction which my position as an honorary member of the Royal Scottish Arboricultural Society affords me. This great honour was conferred upon me fifteen years ago, while I was holding the position of Inspector-General of Forests to the Government of India. At that time it was very gratifying, and I may truly say, it was a source of great comfort, under circumstances which were unusually difficult and by no means always pleasant, to find that my labours in the cause of Forestry were appreciated and recognised by the foresters of Scotland.

I have said that the circumstances under which I worked in India were difficult. You are all aware that India has a civilisation much older than the greater part of Europe; that, while our ancestors, two thousand years ago, were leading a roaming life in the woods, living upon the game they caught, without fields and fixed habitations, a large portion of India was and had long been an open, highly cultivated country, governed by powerful kings, with large cities, temples, and palaces, the inhabitants of which had an elaborate system of laws, a system of religion, and a literature rich in poetry. You are also aware that the civilisation of the West, although it commenced at a much later period, has in most respects overtaken and far outrun the ancient civilisation of the East.

When, about thirty years ago, we commenced to take action, in a methodical manner, to place the management of forests in India upon a satisfactory footing, we were confronted with difficulties of a peculiar kind. You have all been accustomed in Scotland, from your early youth, to regard the proprietary rights in waste and forest to be as clear and settled as the proprietary rights in fields and gardens. The boundaries of estates over heath and moorland are as well defined as where they run between farms and houses. In India, on the other hand, the proprietary rights in forest and waste-land had not developed to the same extent as the rights in the cultivated area. In most parts of the country, whether the rulers were Hindus, Buddhists, or Mahommedans, the prevailing idea was that the forest and waste belonged to the ruling power. This idea, however, was by no means general. In some provinces, noblemen and other large proprietors had, in course of time, appropriated all the waste-land and forest; and in other districts, where the system of village communities had become fully developed, the waste and forest, and sometimes a part of the cultivated lands also, were regarded as the joint property of the village community. Hence there was in many cases great uncertainty regarding the first and fundamental question, who is the proprietor of the forests? And the difficulty was increased by the existence of what are called "rights of user" in the forests—viz., the rights which the inhabitants of the neighbouring villages had exercised from time immemorial to cut firewood and timber, to collect grass and other forest produce, and to graze their cattle in the forests. Similar rights of user, as you are all aware, are found, not only in India, but in many forest lands of Europe. In the New Forest, for instance, the largest of the British Crown forests, the Crown has unrestricted proprietary rights in a small part of the area, while of the remainder a portion only may at one time be enclosed and planted, the same being thrown open to pasture and the exercise of other rights by the commoners when another area is enclosed.

The British Government in India, as the guardian of public interests, could not any longer delay action in the matter. It had become apparent to all thoughtful observers that the long period of peace and quiet, brought about by the consolidation of the British power in India, had stimulated the process of clearing the forests for cultivation, so that everywhere forest was disappearing to make room for fields. This steady increase of cultivation was the necessary consequence of the just and good government which India had enjoyed under British rule. At the same time, the consumption of timber was augmented, and the destruction of the forests was intensified by the construction of railways, the building of roads, bridges, and canals; by the erection of public buildings throughout the country, the growth of the export trade and of manufacturing industries, and by the steadily increasing well-being of all classes. Where the forests had not been cleared to make way for the plough, most, and in many places all, accessible timber fit to be used was cut and brought away, to be consumed as fuel and charcoal, to be used for shipbuilding, for railway sleepers, or for house-building. The gradual disappearance of the forests, and the deterioration of those which remained, became alarming, and it began gradually to be acknowledged that action must be taken in the matter. The Indian forest question had been brought before the British Association for the advancement of Science, at the Edinburgh meeting of 1850, and a committee had been appointed by that meeting to study the question, and to submit a report. Of the members of that committee, two are still alive—your late President, Dr Hugh Cleghorn, and General (then Captain) Richard Strachey, the distinguished President of the Royal Geographical Society, who, while Secretary to the Government of India, has done more than any one to pave the way for a good organisation of the forest business. Upon Dr Cleghorn devolved the duty of writing the Report, which was submitted to the meeting of the British Association in 1851.

Previous to this, action had commenced in India in different places. In 1842, Mr Conolly, the Collector of the district, commenced the magnificent Teak plantations of Nilambur in Malabar, which for many years were in charge of a valued member of your Society, John Ferguson, of whose death last year I was grieved to hear. In 1847, General (then Captain) Frederick Cotton drew the attention of the Government of Madras to the Anamalai Teak forests, and on his recommendation Lieutenant (now General) James Michael, Companion of the Star of India and an honorary member of your Society, was appointed, in 1848, to conduct the timber operations in those forests. About the same time Dr Cleghorn, then Civil Surgeon of Shimoga in Mysore, had represented to the civil authorities of that State the evils resulting from the wholesale destruction of the forests through the shifting *kumri* cultivation, by cutting and burning the forest, and it was mainly owing to his persistent representations that this wasteful system of cultivation was put a stop to in Mysore. In the Bombay Presidency, the late Dr Gibson was appointed Conservator of Forests in 1847, and in the Tenasserim province of Burma, which had become British territory in 1826, repeated, but at that time mostly ineffectual, attempts had been made to secure the protection of the Teak forests. All these are well-known facts, and they have on several occasions been brought before your Society. What is not so well known is, that when it became necessary to reduce these detached efforts to a regular system, so as to secure lasting benefits to the country, the main difficulty was the uncertainty that existed regarding the proprietary rights over the forest ranges of India. The solution of this difficulty, you will readily understand, lies at the root of all good forest management.

After Dr Cleghorn had for a series of years worked hard as Conservator of Forests of the Madras Presidency, he was called to report upon the forests in the Punjab, which province, as you know, occupies the extreme north-west corner of India. While he was engaged in finishing this duty, we were together at Simla during the summer months of 1863, and he then clearly and fully explained to me the state of the forest business in the Madras Presidency. After discussing the question in all its aspects, we came to the conclusion, that what was wanted there, as well as in other provinces, was to demarcate the State and village forests; that is, after careful local inquiry, to define the boundaries of the forest areas over which the State, the village communities, and private landowners held proprietary rights. Our views we embodied in a joint-memorandum, and this document was submitted to the Government of Madras. Active measures had at that time been taken in this direction in several provinces—foremost in the Central Provinces, under Sir Richard Temple, then the Chief Commissioner of that territory, who, most of you will remember, in October 1881, gave to your Society a most interesting account of forest conservancy in India. In the Presidency of Madras, however, unfortunately the necessity of action in this direction was not at that time recognised; and it was not until 1882, when, at the close of my Indian career, I was deputed to Madras by the Government of India, that a Forest law was passed, and that action in the right direction, on the lines of the joint-memorandum submitted by Dr Cleghorn and myself in 1863, was commenced on a sufficiently large scale. This happy result—the importance of which for the welfare of the people of Southern India cannot be overrated—was accomplished by your distinguished countryman, Sir Mountstuart Elphinstone Grant Duff, who at that time was the Governor of the Southern Presidency.

What I have said regarding the peculiar difficulties in this respect of forest administration in India, I intend should serve as an introduction to the main subject of my present address. My wish is, on the present occasion, to submit to your Society the views which I have formed regarding the proposal to establish a Forest School in Scotland, a proposal which I desire at the outset to state has my warmest sympathy. What had to be done in India, before the Government could undertake measures for the permanent good management of the forests, was first to determine which areas were the property of the State; and secondly, to free these areas of the customary rights of user with which they were burdened, or where this was not feasible, to define the extent of such rights, and to regulate the exercise of them. This work, which you will admit was indispensable, is in progress in most districts of the vast British Empire, and though it is and must be carried out to a great extent by the civil and judicial officers of government, yet it cannot be accomplished without the co-operation of the forest officers. Hence you will understand that these gentlemen have to deal with questions altogether different from those with which wood-managers and foresters have to deal in Scotland. And in other respects also the work of a forest officer in India is very different from that of foresters in Europe.

In the excellent lecture on the forests of India to which I have already adverted, Sir Richard Temple gave you a true and lively account of the forest fires, which in most districts of India are, and have from time immemorial been, an annual occurrence. The season of spring, when the awakening of the vegetation in Europe gladdens the hearts of men, in most parts of India is the hottest time of the year. No rain, no dew,—the trees in most forests leafless,—grass, herbage, and everything else dried up by parching winds, and by the uninterrupted and relentless power of a fierce and burning sun. The smallest spark suffices to light a fire, which spreads over the grass lands and forests of entire districts. The great injury which these fires do to forests in India, has on several occasions been explained to your Society, and I shall not dwell upon this subject on the present occasion. It was mainly through the exertions of one of my old colleagues, Colonel Pearson, whose name in connection with the Indian Forest Service is familiar to you, that the first effective action on a large scale for the suppression of these fires was taken in the Central Provinces in 1864, where at that time he was Conservator of Forests. The measures to protect the forests against these annual fires form an important and often very difficult part of a forest officer's duty in most provinces of India. This work, which during the hot season is extremely laborious and trying to health, is happily not needed in Scotland. Again, in the drier districts of India one of the chief aims of forest management is to increase the supply of fodder for cattle, particularly during seasons of drought. But time presses: I must be satisfied with a bare mention of this most important feature of Indian Forestry, and must give up the idea of entering further into this branch of the subject.

The main point of difference between the work of a forester in Scotland and that of a forest officer in India, consists in the vast area of the Indian forests, and in the magnitude of the operations involved in the management of these estates. You are aware that those forests in the British Indian Empire, which are the property of the State, and which have been either freed of customary rights of user, or in which these rights have been defined and settled, are called "reserved State forests." There are other forests, over which the Government exercises a certain control, more or less effective according to circumstances, but on the present occasion I shall limit myself to the reserved forests. Well, their area, according to official documents, on the 1st April 1885, amounted to nearly 50,000 square miles, or 32 millions of acres, all the property of Government, and managed by Government officers. You will at once understand that for the protection and management of so large an area, a very large staff of officers, numbering many thousands, are employed, and that nearly the whole of these are and must as a matter of course be natives of India. Among these again there are, as you can readily imagine, superior and suborbinate officers, and in order to give candidates for the superior native forest service the needful professional education, a Forest School was established in 1878 at Dehra Dún in Northern India. Of this Forest School I am glad to see you have in the last volume of your *Transactions* an excellent account by Colonel F. Bailey of the Royal Engineers, who, after having organised the Indian Forest Survey, became the first Director of the School, and Conservator of the extensive forests attached to it for the practical instruction of the students. At this school, my former colleagues tell me, there are now about sixty young men from all parts of British India, Hindus, Mahomedans, Buddhists from Burma, and native Christians. Only a comparatively small number of the highest appointments are filled by men sent out annually by Her Majesty's Secretary of State for India. The number of these appointments is, I am informed, now about 170, and it is not intended considerably to increase it. Although these officers sent out from home are, on arrival in India, in the first instance employed in subordinate positions, yet when they have become familiar with the language and the peculiar work in India, they are destined to fill the highest appointments. Hence a most important part of their work consists in directing a large staff of subordinate officers. From among them are selected the chief forest officers in the different provinces, the officers charged with the preparation of working plans, and the professors of the forest school. With them rests, and must generally rest, the initiative in professional matters, and any mistakes made by them may have a far reaching and very mischievous effect. You will readily understand that they ought to be picked men, thoroughly familiar with the science and practice of forest management in Europe, and with the experience gained in forest administration in those countries, where it is best understood, and where it exists on a large scale analogous to what we find in India.

Now I will direct your attention to the manner in which forest business is managed on the Continent of Europe. In the kingdom of Prussia, for instance, the area of the State forests alone amounts to 6,600,000 acres. More than twice this area is in the hands of towns, villages, public corporations, and private individuals. The whole of the large forest area of Prussia,—upwards of 22,000,000 acres,—is managed on a regular system, with the object of maintaining a uniform annual yield in wood, timber, and other forest produce, the amount of which over a large portion of the area is slowly increasing every year, as the result of the steady improvement which takes place in the condition, and, consequently, in the productive powers of the forests. The number of the superior officers entrusted with the management of the Prussian State Forests is 807. As regards their duties, they correspond in India to the superior Native staff, who receive their professional education at Dehra Dún, and the staff recruited by the officers whom the Secretary of State for India sends out. The professional education of the superior Prussian forest officers is organized thus: After passing the closing examination at one of the large German public schools, the candidates go through a practical apprenticeship of one year in one of the State forest districts, and after studying for two years at a forest school, and one year at a university, they may present themselves for their first examination, which, like all others for State service in Prussia, is a pass, and not a competitive examination. A high standard is fixed, which must be attained. The next step is to spend two years in practical work in several forest districts, after completing which the candidate presents himself for his second or final examination, which, like the first, includes all branches of forestry, the questions asked having, however, more special reference to the actual requirements of the service, than was the case at the first examination. The closing examination at the public school is generally passed at the age of 19, so that, allowing one year for military service, and six months for the two examinations and the unavoidable delay connected therewith, the candidate will have attained the age of 26 or 27 by the time he has passed the final examination. He then receives the designation of *Forst Assessor*, and is eligible for employment in the State forest service. Government, however, is in no way obliged to find employment for passed candidates, and as a matter of fact, few obtain a permanent appointment in the lowest grade of the superior Staff, which is that of Oberförster, before they are considerably past the age of 30, while those who do not find such employment seek appointments in forests belonging to towns and villages, to public corporations, or to private proprietors. In other German States the arrangements are similar to those just described. There are local peculiarities, but the principle is the same; everywhere a thorough and prolonged professional training, partly practical, partly theoretical, is required of candidates for the superior State forest service.

I do not apologise for claiming your attention so long for the organisation of the Forest Service in Germany. You will presently see that it has a direct bearing upon subjects in which you are specially interested. My experience has taught me, that young Englishmen, Scotsmen, or Irishmen are, by constitution and habits, admirably fitted to make first-rate forest officers. Nevertheless, on the first occasion, when I had an opportunity of carrying the point, which I long had in view, I requested the Government to permit me to select two German forest officers for service in India, who had passed all examinations for the superior State forest service. This was in 1866. I took the greatest possible pains in this business, was favoured by circumstances, and was most fortunate in my selection. What I wanted were men as young as possible, who had successfully passed the prescribed course of professional training similar to that which I have just described to you. It thus happened that they were not Prussians. Dr Schlich, who succeeded me as Inspector-General of Forests when I left India in 1883, was a native of Hesse Darmstadt; and Mr Ribbentrop, who is now acting in the same appointment while Dr Schlich is employed at Cooper's Hill in starting the Forest School, at which, as you are aware, candidates for the Indian Forest Department are now educated, was a native of the former kingdom of Hanover, which in 1866 had just been annexed to Prussia. The fact that the Government of India have selected these two men for the important appointments which they now hold, and that for these appointments they have been preferred to many forest officers in India of great ability and experience, shows, that the thorough professional training which Dr Schlich and Mr Ribbentrop had received in their own country, had been most useful to them in India, and that its value has been fully recognised by Government. It is, as you may readily imagine, a source of great satisfaction to state these facts to you, and I venture to hope, that some day it will be carefully considered, whether those Indian forest officers, who are destined for the highest appointments in that country, ought not to receive a professional education as thorough as the candidates destined for the superior staff of the Prussian forest service. The time allotted to their studies at Cooper's Hill is two years, while the time allotted to their professional studies under former arrangements on the Continent of Europe was two years and eight months only. The time was not fixed so short because that was considered as sufficient, but because it was and is not, I believe, at present deemed possible to assign a longer period or to organise the whole business in a different manner. The professional education of forest officers in Germany has not always been as elaborate and as prolonged as it is at present. In every country these are matters of gradual growth.

But good and really effective forest management is of vital importance for the welfare of the people of India. We, all of us, who had anything to do with the growth of forestry in that country, started with the provision of a lasting and, if possible, steadily-increasing supply of timber, wood, bark, and other forest produce as the aim and object of forest management, and, in addition, we hoped that by improving the forests on the hills the water supply for irrigation would be better regulated, that inundations and the silting up of rivers would be diminished, and the like. At a later period experience taught us that in certain parts of India, the sufferings caused by drought and famine might be somewhat mitigated by increasing the production of cattle fodder in the forests. And within the last few months it has been established beyond doubt, that in the Central Provinces the protection of the forests has already had an appreciable influence upon the rainfall. This had long been hoped for by enthusiastic foresters in India, but there was no proof for it. This proof has now been obtained, and I may add that I owe this most important information to the highest living authority on the subject,—to my friend, H. F. Blanford, the Meteorological Reporter to the Government of India. Deficient rainfall means famine in India, and we may therefore hope that the improvement of forests on a sufficiently large scale in certain parts of the country will to some extent tend to diminish the risk of drought and famine.

You will readily understand that with these important interests at stake, every effort ought to be made to steadily improve the professional training of the forest officers sent out to India from Great Britain. I shall not enter further into this subject, which, though of paramount importance to India, is not of such special interest for the members of your Society. But what I desire to say is this, that the requirements of wood-managers and foresters in Scotland are entirely different from the requirements of Indian forest officers. It does not follow that in special cases foresters, who in Scotland have learnt their profession in the empirical manner hitherto customary, could not work their way up to the higher ranks of the Indian forest service. There have been many instances in India which show that under the guidance of good officers, and otherwise under favourable circumstances, men can make up, by means of industrious study, and of steady hard work, for their deficient professional education at the outset. Indeed, as explained to you in Colonel Bailey's excellent paper on the Indian Forest School, to which I have already adverted, the bulk of the work in the first organisation of Indian forest business was successfully accomplished by men who had not received any special professional training. This, however, was in the beginning, when forest work in India had more of an administrative than of a professional character.

As further progress is made, this will change, and new problems of a professional character will present themselves, which will tax to the utmost the special knowledge and the skill of the forester in India.

My advice in this matter is, to keep the two undertakings entirely distinct, the elaborate professional and scientific training of those who aspire to appointments in the superior forest staff of India, and the establishment of forest schools for wood-managers and foresters in Scotland, England, and Ireland. In Prussia and other countries of the Continent of Europe, the State is the largest forest proprietor; moreover, it is justly held to be the duty of the State to watch over the good management of the forests which belong to towns, villages, and public corporations. In these countries, therefore, it clearly is the business of the State to organise the system of forest instruction. It is different in Great Britain, where, out of a total area under timber of about 2,800,000 acres, the Crown has only about 100,000 acres, while the rest belongs to private proprietors. In the United Kingdom the condition of things is similar to that which exists in some parts of Austria, notably in Bohemia and Moravia, where the large forest proprietors have formed two Associations for the purpose of providing professional education for young men, who desire to enter their service as wood-managers or foresters. The professional education for the State forest service in Austria was considered too high and too expensive for the requirements of these private estates; the proprietors therefore determined to help themselves. The Bohemian school at Weisswasser was established in 1855; students are required to pass through a middle class school, and to serve a practical apprenticeship of twelve months, after which the course of studies at the school occupies two years. A forest district of 2900 acres, the property of Count Waldstein Wartenberg, is attached to the school, and placed under the control of the Director for purposes of practical instruction. The Director, Chevalier Fiscali, is a distinguished forester, and under him is a staff of five professors, one for those branches of forestry not taught by the Director himself, one for mathematics and surveying, two for natural sciences, and one for drawing and bookkeeping. Eulenberg, the school maintained by the Association of Forest Proprietors of Moravia and (Austrian) Silesia, was founded in 1851, and has a similar organisation. No fees are paid by sons of foresters.

Ever since I heard of the plan to establish a forest school in Scotland, I have been of opinion, and have given expression to this opinion whenever I have had an opportunity, that as soon as the desire gains ground among proprietors in Scotland to obtain for their estates the services of wood-managers and foresters who have received a more systematic professional training than is attainable at present, they will find the needful means and take the needful steps for the establishment of a forest school. It clearly is their interest to increase the annual yield, and to improve the productive powers, which means the capital value, of their estates. These ends may to some extent be accomplished by a more systematic management of their woodlands, and this again will doubtless be promoted by giving to foresters a more systematic training in their profession than they receive at present. I am, however, fully aware, that there are two circumstances which, to some extent, may impede the speedy accomplishment of this idea—the low price of timber, and the very high rent at present obtained by the letting of grouse moors and deer forests. Of these two circumstances, however, the members of this Society are much better able to judge than I am, and I do not therefore attempt to discuss them.

The natural and proper thing in the present case, is for the proprietors to take action on their own account. Should this, however, not be the case, and should the Royal Scottish Arboricultural Society feel themselves strong enough to take the initiative in such an undertaking, this would be an excellent and most important step in the great and good work which your Society has steadily pursued since its formation in 1854. Your aim from the commencement has been, to raise forestry in Scotland to the dignity of a profession. Your *Transactions*, the prize essays published by your Society, the Excursions to instructive forest districts, the great International Forestry Exhibition at Edinburgh, and the lectures delivered under the auspices of your Society, have all been important steps in the same direction. If the Royal Scottish Arboricultural Society should find itself to be in a position to take the lead in this great movement, the large landed proprietors might perhaps afterwards be disposed to take up the scheme and to work it out on their own account. Something of this kind happened at Weisswasser, which was at first established by the Bohemian Forest Society, and which was thus continued until 1862, when the forest proprietors of the province took over the institution.

In whatever manner the scheme of establishing a forest school for the professional training of wood-managers and foresters may be accomplished, I desire to assure you of my hearty sympathy in the undertaking. In some excellent remarks, headed, "How to make the most of the Excursions arranged by the Society," your honorary member, William M'Corquodale—with whom in 1865 I spent a delightful and most instructive day in the woods of Scone Palace, near Perth—justly drew attention to the advantage of an accurate study of the methods of forestry practised on various estates. Much, very much, of the highest interest to the forester, may be seen and learned in the Scottish woodlands. Different methods of forestry have been practised under widely different circumstances, in some cases with marked success, while in other cases there have been failures. A forest school, if the teaching is of the proper kind, will contribute much to a better understanding of the circumstances which have led to success in the one case and to failure in the other. The students will be taught to observe accurately, to combine their own observations with the theoretical knowledge they have acquired, and this will eventually enable them to draw correct conclusions from the facts which they have observed. The school, if well directed, ought to become a centre of scientific research, the results of which will contribute much towards a more successful management of the woodlands. The foresters trained at the school will not only be more efficient in their work, but—and this is of very great importance—the better they learn to understand the connection, as worked out by science, between cause and effect in the life of trees and shrubs, the greater will be their enthusiastic attachment to their profession. True, healthy, enthusiastic attachment to one's profession is a blessing in the life of a young man, the value of which it is difficult to overrate. When the time for action comes in the matter of the Scottish Forest School, I shall deem it an honour and a pleasure, if it should be desired, and if circumstances should permit, to help with my advice, and some day, perhaps, to explain to the students some of the conclusions which I have formed as the result of many years' study of trees and shrubs in different countries.

III. *Forest Administration in the Canton Vaud, Switzerland.* By GEORGE CADELL, Lausanne.

PRINCIPAL TREES OF THE CANTON.

The canton of Vaud, though not one of the so-called forest cantons of Switzerland which are clustered round the Lake of Lucerne, yet possesses large and important forests, from which it derives a substantial proportion of its revenue. Lying along the northern bank of the Lake of Geneva, or, as the Vaudois prefer to call it, the Lake Léman, it extends from the slopes of the Jura, which form the frontier between France and Switzerland on the west, to the confines of the central Alps on the east. It thus shares in the three sharply-defined zones of forest, into which the different climates and soils met with divide the small country of Switzerland.

The beech, which is the characteristic tree of northern Switzerland, forms a continuous chain on the Jura, at an altitude of from 1500 to 3000 feet. The chestnut, which in Switzerland occupies the place of the oak, borders the lake, and runs along the valley of the Rhone, up to the region where it is replaced by the larch. And this last, which grows to a great size in the central Alps—trees of 80 feet in height and 6 feet in diameter being frequently met with—follows the canton to its eastern limits.

THEIR RESPECTIVE HABITATS.

The three distinguishing trees, then, of the canton Vaud are the beech (*Fagus sylvatica*), the chestnut (*Castanea vesca*), and the larch (*Larix Europæa*), and it may not be amiss to give here a short indication of their respective positions. The beech was formerly the dominant tree of the canton, as indeed it was of the whole of Switzerland above the central Alps. It has, however, gradually receded before the cultivation of the vine; and the trees on the Jura, owing to the poorness of the calcareous soil, are knotty, and branch too close to the ground to form good timber trees. It is therefore chiefly used for firewood, and furnishes the principal supply of that article.

The chestnut attains its most exuberant growth in the mountains, but is found in isolated patches throughout the canton; and the larch, which is highly valued as furnishing lasting materials for châlets, takes the place of the chestnut at a higher altitude. We may mention in passing that one often meets with châlets built of larch in the fifteenth century, the wood being quite black with age, but perfectly sound.

Other trees are the white sapin (*Picea pectinata*), which rises above the beech on the Jura and other mountains, giving way in its turn to the *Cytisus alpinus*. The red sapin (*Abies excelsa*), which is found above the larch in altitudes where the cold is too severe for the full development of the latter. The maple (*Acer opulifolium*) is found in company with the *Cytisus alpinus* above mentioned, while the *Cytisus laburnum* prefers the lower slopes. The *Pinus sylvestris*, or Scots fir, is not found in its full development in Switzerland.

FORMER PRODIGALITY OF FOREST RESOURCES.

It may surprise our readers to be told that, with all this possession of forest wealth, with the absolute necessity for a large supply of wood fuel for the maintenance of the industries of the country, with the pressing duty of preserving barriers of forest for the protection of the villagers from destruction by avalanches, and of the soil from disintegration by floods,—the reckless use of these resources was such that thirty years ago the canton of Vaud was, in common with the rest of Switzerland, dependent upon foreign importation for its supply not only of timber but of firewood.

An official report, which was called for in the year 1858-59, stated that "the actual production of the forests was not sufficient for the consumption of the inhabitants—it forms only 76 per cent., and if one adds all the other combustibles we have still a deficit of 4 per cent." And again, "The Alps, which ought to furnish the wood necessary for the more populous districts of the plain, from which much wood is exported, do not produce even sufficient for the demands of the inhabitants, without counting the needs of the industries and of the means of transport."

And the consequences were more serious still; for it was reported "that many of the inhabitants of the mountains know that avalanches now fall in places which were not formerly exposed to this plague."

RENDERING NECESSARY A NEW FOREST ACT.

This state of matters led to the passing of a new law, on the

31st January 1873, for the administration of the forests, which took the place of the former law passed in 1835, and which forms the basis of the present system of forest regulation in Switzerland.

LAWS PASSED BY THE FEDERAL COUNCIL, AND ADMINISTERED BY THE CANTONS AND COMMUNES.

Here, with the indulgence of our readers, a little digression will be necessary, to form a correct idea of the working of the laws of the Swiss Government, which goes under the general name of "communal." And this will perhaps be considered more pardonable if we reflect that it is this system of communal government which some of our politicians hold out as a model for our imitation, and as the one most likely to satisfy the wishes of those who shortly formulate their demands under the cry for local government.

The Swiss Confederation is divided into 22 Cantons, and these again, severally, into numerous Communes, each of which is entrusted, so far as is possible, with the entire management of its local concerns. Some laws,—and the Forest Law of 1873, which we are considering, is one of them,—are called Federal Laws, and are of general application throughout Switzerland. But this application, within the broad lines laid down by the Federal Council, is left to the discretion of the Cantonal Governments, who again delegate their powers, but still retaining the power of supervision and confirmation to the Communes, or what we call the Municipalities.

OF THE FOREST SYSTEM OF ADMINISTRATION.

For the purposes of Forest Administration, the Cantonal Government of Vaud divided their country into six circles, each of them placed under a Forest Inspector. Within these circles flourished side by side—

a. State forests wholly managed by the State officials.

b. Communal forests managed by the communes, but under the inspection and with the advice of the local State officials.

c. Private forests, the property of private individuals, where State interference was but rarely called into play, except in the extreme case of wasteful management, which caused damage, not only to the property itself, but to those immediately surrounding it.

The ideal aimed at—and successive reports show that the ideal has been in part, at any rate, attained—was the administration of the forests *with the concurrence and by the assistance of the people.*

Conscious of the difficulty of stating the position of matters in a clear and intelligible manner, we would ask the indulgence of our readers, while we have recourse to an actual example to throw some light on our meaning.

EXAMPLE OF ITS WORKING.

The mountains of the Hautes Alpes had, previously to the year 1856, been swept bare of trees, and their unprotected slopes used solely for pasturage. In that year disastrous floods occurred, which at last moved public opinion, and a law was passed in 1860 prescribing the re-afforesting of the mountains. The year following, the work was begun. In addition to the obstacles offered by nature, the unsuitability of the soil for plantations, etc., the scheme met with the greatest opposition, pushed even to fury, sometimes to crime, from the mountaineers. These declared that the mountains were sacrificed to the plain, and that they were thus deprived of their pasturages, and consequently of their flocks, their only means of subsistence.

The remonstrances of the mountaineers were met not by absolute refusal, but by conciliation. The works of re-afforesting and re-grassing, if we may coin the word, went on side by side. And, in brief, their success was rapid and complete. The most violent storms of 1868, which had formerly caused such disasters, were absolutely harmless in the regenerated portions. The mountains became productive. Where a few sheep formerly found it difficult to live, by devouring all the existing vegetation, abundant crops of grass, capable of being mown, now sprung up. The mountaineers, essentially a pastoral people, found not only food for their increasing flocks, but shelter and poles for the cultivation of their vines. Thus the very people who most violently opposed the re-afforestation of the mountains, were the most loyal supporters of the forest administration. Their confidence was gained, not forced. And this, as we have already said, is the ideal aimed at in the Swiss system of Communal Government. How this has succeeded generally in the forest administration of the canton of Vaud, let the report of the Department of Agriculture and Commerce itself show.

CO-OPERATION OF THE COMMUNES.

"Many communes have fulfilled the engagements which they entered into on the occasion of 'coupes extraordinaires'" (that is, fellings above the "possibility" of the forests, admitted in consequence of existing scarcity of wood, and in view of re-planting to make up the deficiency); "others have constructed at great expense ways of outlet for the passage of their wood, and devote to the care of their forest properties a particular and constant attention, on which we cannot but congratulate them, and cite them as examples."

Now, we do not mean to say that this has all been done from pure and simple affection, or from pure and simple intelligence. Human nature is everywhere much the same. And without laws—ay, without strong and stringent laws (and the Swiss government, as we shall presently see, leaves nothing to be desired on this head),—human nature is nowhere uniformly sweet—nowhere uniformly intelligent. But in the application of the law lies the test of wise administration. An ignorant, uneducated people may be ruled by the gauntlet of steel pure and simple. But if a government permit or encourage the education of its people, the gauntlet must at any rate be masked under a silken glove. And that government is most strong, which is least demonstrative. That rule is most useful, which is least often called into use.

PERSONAL LIABILITY OF AUTHORITIES FOR ABUSES.

We do not propose to inflict on our readers the phraseology of the law, to bear out the statement we have above made. We will, however, direct their particular attention to the *personal* liability of every one in the country, for the proper administration of the forests.

Thus the State forest guards are enjoined to hand in, within 48 hours, official complaints of all contraventions of the law which occur within their beats. If they do not do so, they are held liable for all the fines and punishments incurred by the delinquents, without prejudice to other action.

A subsequent article provides for the same proceeding, in the case of guards appointed by the communes.

While, going higher up the social scale, the members of a municipality who knowingly have committed, or authorised, contraventions of the law, are themselves liable to the fines to which such contraventions have given place, with the additional and special fine of 15 francs per acre for all forest on which they allow pasturage otherwise than provided for by law.

OF RIGHTS OF USAGE.

The rights of pasturage, and other claims, made by dwellers in the vicinity of forests, which it is considered necessary to keep as State or Communal forests, are recognised, but only so far as to make their compulsory surrender a matter of pecuniary compensation. The paramount importance of maintaining the forests in a healthy condition for the public good is distinctly made to override all claims of private interest. And with such a report as we have alluded to above, resistance to government authority, in the enforcement of this general principle, is neither reasonable nor possible.

THEIR SUBORDINATION TO THE PUBLIC GOOD.

What we wish to insist upon, and bring into relief, generally, in the system, is, on the one hand, the strictness of the written law, and on the other, the reasonableness of its application. So long, for instance, as the balance of supply and demand was unduly depressed, the provisions of the law were bound to be enforced, if need be with rigour. But when this equilibrium was regained, interference with private rights is not attempted, and would not, if attempted, be tamely accepted. One talks, without the faintest idea of irony, of the "machinery" of such and such a department. Such a word is entirely out of place in describing the system of forest management in the canton Vaud. Granted that the red tape exists,—this is we suppose a necessity of all departmental working. But the colour of the tape is less red, and the strings of the tape are less tightly drawn in this communal arrangement, than in many other more polished systems of government. The people are assumed to have minds of their own, more or less open to reason. And more remarkable still, it is even suspected that the government official may have a glimmering of common sense, and a certain reserve fund of individual discretion.

OF STATE ASSISTANCE AND ENCOURAGEMENT.

(a.) *By rewards;* (b.) *By subsidies.*

But the administration of the forests is not a system of entire confidence in the intelligence of the people on the one hand, or of stringent enforcement of the law on the other. Encouragement is given to those who faithfully carry out, in their respective spheres, the recommendations which are made for the preservation or extension of the forests. Thus the forest guards and other officials, who fulfil their duties conscientiously and with zeal, receive annually prizes fixed by the Council of State; and subsidies are given to the communes which undertake large measures of re-afforestation within their limits, and also to individual proprietors.

In the report of the Department for 1886 we read: "We desire to see a larger number of the communes and of individual proprietors entitle themselves to the benefit of the subsidies which the Confederation accords (viz., from 30 to 50 per cent. of the total cost) in the interest of the augmentation of the forest surface, especially in the high districts, or on lands where the soil remains still unproductive."

(c.) *By the supply of Plants.*

And under the heading of "Nurseries," in the same report, we read: "Re-afforestation being ordained as one of the principal conditions of permission for extraordinary fellings, and recommended especially in the higher regions, it is necessary that the State should furnish to the communes and to private proprietors the facility for procuring plants of forest trees, not only in quantity and in quality, but at a reasonable price."

We may mention that the "reasonable price" above referred to averaged 8 francs 18 cents (say 6s. 9d.) per 1000, the trees principally supplied being of the resinous kinds—the red and white spruce, the larch, and the Austrian and Weymouth pines; and of "foliage" trees, the beech, oak, maple, ash, alder, and poplar, the last two being specially recommended for planting on the sandy shores of the lakes.

OF THE NATURE AND EXTENT OF THE COMMUNAL FORESTS.

Looking to the price charged for the plants, it must be said that the maintenance of the nurseries is, so far as the State is concerned, a duty more onerous than remunerative. But that it is appreciated is evidenced by the fact that the demand, especially for beech plants, augments from year to year. The number of saplings bought by the communes from the State nurseries for the year 1886 is stated at 598,230. And it may further interest those readers who are fond of statistics, to know that in the same year 2,000,760 forest plants were put out in the communal forests, and 1855 pounds of seed sown in the communal nurseries. To compare these figures with the total extent of forest land in the canton under the control of the communes, we may mention that this consists of 3,838,895 hectares of forest trees, and 381,697 hectares of firewood trees—the hectare being equal to about $2\frac{1}{2}$ acres English measurement.

OF THE CONSTRUCTION AND MAINTENANCE OF ROADS, DAMS, ETC.

The construction of all roads giving access and egress to the various forests is a matter of arrangement with those communes that are interested, and which bear their proportion of the expense. In practical working, few real difficulties lie in the way of agreement, the general rule being that all who benefit by the roads—be they State, Communes, or private individuals—share in the expense of making and of maintenance. The same rule applies to dams, embankments, sluices, and all works necessary for the floating of wood down the rivers, which form an important means of communication in the canton.

OF DAMAGES TO THE FORESTS.

Heavy falls of snow are the main cause of the damage annually done to the forests, and it has been found, as the result of experience, that the minimum of distance between trees of the resinous species should be 1·20 m.—say 4 feet. Other enemies are the influence of the frost in the nurseries, and of the lightning on the higher slopes. But the amount of wilful damage done by either man or the animal creation is wonderfully small—an additional fact, which may be taken as evidencing the general acquiescence of the people in the forest administration.

OF SHOOTING AND FISHING.

The two minor departments of shooting ("Chasse") and fishing ("Pêche") have from last year (1886) been entrusted to the care of the forest inspectors, under the general heading of Agriculture and Commerce. This duty has been entered upon in the same spirit as forest conservancy. Sportsmen have been invited to send in the modifications which they desire to see introduced into the existing laws, and, although their opinions are very diverse and frequently contradictory, this is no more than might be expected from the primary labours of any commission, whose duty it is to sift the reasonable from the absurd or forced proposals which are brought under its notice. The guards or gamekeepers are specially enjoined to make examinations of the contents of the stomachs of the animals which they kill, in order to demonstrate whether their destructiveness to game is in a greater or less proportion to their usefulness to agriculture.

CONCLUSION.

And now we have brought those of our readers who have been good enough to follow us, to the end of our short sketch of the Forest Administration of the canton Vaud. Our facts are taken either from personal observation or from official sources. Our conclusions are our own, and are, of course, open to adverse criticism; but we confess to a very candid admiration for many of the institutions of Switzerland. Viewed on the surface—and if the letter only of the written law be taken—they are democratively autocratic, by which we mean autocratic in the strongest sense of the word. Viewed in relation to the contentedness and well-being of the people who live under them, and by whose will they exist, they are eminently suited to the country. And with regard to the special department, whose work we have been reviewing, the amelioration of a property, racked to the utmost by waste and ill-usage, has been thoroughly carried out, and this, too, with the support of a people, from whom the temporary and partial sacrifice of what in Switzerland is one of the necessaries of life was demanded and was cheerfully submitted to.

IV. *Dr Cleghorn's Services to Indian Forestry.* By Sir D. Brandis, late Inspector-General of Forests to the Government of India.

Since Forestry is now recognised as an important business in India; since it has become possible, by means of protection, and chiefly by means of protection against the annual ravages of fire, to convert the poor jungles of olden days into dense, well-stocked, and productive forests, which yield a large and steadily increasing revenue,—and mainly since experience has shown that Forest Conservancy, instead of doing harm to the people of India, promotes their well-being, and is a blessing to them and their country, —the question has, naturally, often been asked and discussed, in which part of the British Indian Empire Forest Conservancy was first started?

In the beginning of the century the Government of Bombay established a timber agency on the western coast of the peninsula, in order to secure a permanent supply of Teak timber for the Government dockyards at Bombay. In 1847, Dr Gibson was appointed Conservator of Forests in Bombay, and ever since that time attempts have been made, with more or less success, not only to work the Government forests of that Presidency, but also to secure their maintenance, to protect and to improve them.

Soon after Tenasserim had become British territory in 1826, repeated, but at that time mostly ineffectual, attempts were made to effect the protection of the Teak forests in that province.

In the Presidency of Madras, Mr Conolly, the Collector of Malabar, commenced planting Teak on a large scale at Nilambur, and this was the beginning of those famous plantations, which have since been steadily extended by the Madras Forest Department, and which are now reported to cover 3500 acres.

The object of the present paper is not to decide the question, whether Madras or Bombay may claim the honour of having first started Forest Conservancy in India, but to set forth the share which Dr Cleghorn has had in this business; and hence it will be necessary to review somewhat more fully what was done in this respect in the Madras Presidency, where Dr Cleghorn commenced his labours.

In May 1847, Captain Frederick Conyers Cotton (now Major-General and Companion of the Star of India) reported to the

Government of Madras on the Teak in the Anamalai hills, and asked for the services of an officer to explore the forests. The sanction of the Government of India having been obtained to this proposal, Lieutenant James Michael (now Major-General and Companion of the Star of India) was appointed in June 1848. In August 1849, the Court of Directors called for reports on the results of Lieutenant Michael's work. The terms of the despatch are well worth recording, as evidence of the just views entertained at that time by the Court of Directors. They wrote: "We trust that effectual measures will be taken for its conservation (of the Anamalai Forest), so as to protect it from the serious injury which other forests have sustained."

Captain Cotton then submitted a report on the operations of felling and converting, the making of a road across the hills, and the settlement of the Colengode and Cochin boundaries. He also reported the number of good Teak trees standing.

In the Cochin disputed territory, . .	107,000 trees.
In the Colengode ,, . .	28,000 ,,
In the Government territory, . . .	61,700 ,,
Total, . . .	196,700 ,,

Minutes were written on the subject by Mr D. Elliot, Member of Council, and by the Governor, Sir H. Pottinger, and in February 1850 the Government sanctioned Lieutenant Michael being kept on. In February 1851 he was sent to Moulmein to learn the methods of dealing with heavy timber, in December 1853 to the Kanara Forests, and in 1854 he was formally appointed Superintendent of the Anamalai Forests. The published reports (selections from the Records No. V. of 1855) deal only with timber and roads, and there is no reference to conservancy. Lieutenant Michael, however, did more than this—he brought about the lease of valuable Teak forests from the Nambadi of Colengode, and he started a system of clearing Teak seedlings, and young Teak trees, of dry leaves and other inflammable matter in the forests, so as to protect them against injury by the annual fires of the dry season.

In 1856, Lieutenant Michael went on leave, and Captain (now General) Douglas Hamilton was appointed in his place. He was in charge of the Anamalai Forests for several years, and at a later date—after a regular Forest Department for the whole Presidency had been organised—Captain Hamilton was succeeded by Lieutenant (now Colonel) Beddome.

About the time that Captain Cotton first drew attention to the Anamalai Forests, Dr Cleghorn was stationed as an Assistant-Surgeon at Shimoga, in the Nuggur Division of Mysore. Being interested in botany and a keen observer, he remarked the wholesale destruction of forests in that district, chiefly through "Kumri" cultivation. It was mainly through his representations that the attention of Sir Mark Cabbon, then Commissioner of Mysore, and of Colonel Onslow, the Superintendent of the Nuggur Division of that State, was drawn to the necessity of Forest Conservancy. Dr Cleghorn's name is mentioned in a Report on the Conservation of Forests, which the last-named officer submitted to the Commissioner in May 1847.[1] In consequence of this report and of Dr Cleghorn's representations, Kumri cultivation was stopped in the greater part of Mysore and Coorg; and in 1868, while on a tour of inspection through these districts, the writer of this note had the satisfaction of seeing large tracts of country clothed with well-stocked young forests, which had grown up on the old Kumri clearings.

In 1850, the British Association for the Advancement of Science, at their Edinburgh meeting, appointed a Committee to consider the probable effects, in an economical and physical point of view, of the destruction of tropical forests. The report was drawn up by Dr Cleghorn, and was submitted to the Association, which assembled at Ipswich in 1851. The other members of the Committee were: Professor Forbes Royle, Captain R. Baird Smith, and Captain (now Lieutenant-General) R. Strachey. This report gave an exhaustive review of the question as it then stood, and as far as it related to India, and it contributed much to induce influential members of Government in India and at home, seriously to consider the necessity of organising systematic measures of Forest Conservancy in India.

In the Bengal Presidency it was Lord Dalhousie himself who, as Governor-General of India, carried through effective measures for the conservation of forests, chiefly in the newly-acquired province of Pegu; while in Madras Lord Harris took steps in the same direction. In August 1856, Dr Cleghorn submitted a report to the Government of Madras, containing proposals for establishing Forest Conservancy. These proposals were sent up to the Government of India for sanction, which was accorded in

[1] Report of the Twenty-First Meeting of the British Association held at Ipswich in July 1851, p. 83.

November; and on the 19th December 1856, Dr Cleghorn was appointed Conservator of Forests in the Presidency of Madras. An account of Dr Cleghorn's work during the first five years of his tenure of this appointment is contained in three general reports and other official documents, which, with other important unofficial papers, were published in the little book, entitled, "Forests and Gardens of South India," which Dr Cleghorn published in 1861, when compelled to come home on sick leave. This book has done much to promote Forest Conservancy in India. The reader must not expect to find in it the record of a complete and scientific system of forest administration, the introduction of which, under the circumstances, at that time would not have been feasible. But the record of the work accomplished by Dr Cleghorn during this period shows that he directed his attention to such matters as called for immediate action, and that his recommendations in regard thereto were in the right direction. He justly laid great stress upon the necessity of acquiring a good knowledge of the principal trees and shrubs, as well as of the climate, soil, and forest growth in the different forest tracts; he arranged for the supply of timber, charcoal, and firewood; and in regard to the protection of the forests, he studied the chief sources of injury, indiscriminate cutting, fires, and Kumri cultivation. The result of his persistent representations was, that by an order of May 1860, the Government of Madras prohibited Kumri cultivation in Government forests without previous permission, and directed that this permission should be given sparingly, and never for spots in the timber forests. Dr Cleghorn had thus accomplished for the Madras Presidency the same result which, thirteen years previously, he had helped to bring about in Mysore, and in both cases the result accomplished through his persistent representations has been most beneficial for the country and its inhabitants. Dr Cleghorn was able to carry his point in this matter, because he was known to be a true friend of the natives; he entertained feelings of warm sympathy towards them, and had made himself familiar with their mode of life and system of husbandry. As a medical man his name was widely known, and he had acquired much influence among the native population. When urging the discontinuance of Kumri cultivation in Madras, as he had previously urged in Mysore, he knew that he was proposing measures which in the end would be highly beneficial for the people themselves. Dr Cleghorn's single-minded desire to promote the welfare of the people was known to those who at that time were in influential positions in Madras, and the confidence which they placed in him was the secret of his success in this important matter.

At a later period Kumri has unfortunately been again permitted in Mysore, and in Madras the beneficial effect of the order of 1860 has subsequently to a great extent been rendered nugatory by the tendency which for some time prevailed in that Presidency, to regard as private property a large portion of the forest lands, particularly in South Kanara, which had formerly been considered to be the property of Government. These subsequent mistakes, though they have done great injury to the country and its inhabitants, do not in any way diminish Dr Cleghorn's paramount merit in this matter. Dr Cleghorn paid great attention to a proper arrangement of cuttings, so as to secure the maintenance and promote the natural reproduction of the forests. Under his direction numerous new plantations were established, while existing plantations were maintained and extended. Establishments for the protection and proper management of the forests were organised in all districts. The time had not yet come for comprehensive forest legislation, but local rules were issued, on his recommendation, by Government, which for the time being were sufficient.

On Dr Cleghorn's return to India in November 1861, he was directed by the Governor-General in Council to proceed from Madras to the Punjab, in order to examine the forests in the Western Himalaya, with a view to obtain reliable information regarding the timber resources of that province, and to institute a systematic plan of conservancy and management. The exploration of the forests in the hills occupied the summer months of 1862 and 1863, while the winter months were devoted to the inspection of timber depôts, brushwood tracts of the plains, and the preliminary arrangements necessary for the formation of the Department. His Report on the Forests of the Punjab and the Western Himalaya, which was published in 1864, sets forth the results of his work, and has been of great value in facilitating the organisation of forest administration in that province and in those native states of the Western Himalaya where it was possible, by means of leases, to obtain the control of the forests. His work received from the Lieutenant-Governor of the Punjab great praise, and the Governor-General in Council expressed his concurrence in the high estimation entertained by the Punjab Government of his services.

Meanwhile (in October 1862) the writer of the present paper had been summoned from Burmah, where he had been in charge of the forests since January 1856, to advise the Government of India in the general organisation of Forest business. On his recommendation, Dr Cleghorn was associated with him on the 1st January 1864, and remained in that capacity attached to the Government of India until 1st March 1865. Previously, in August 1863, these two officers had drawn up a joint memorandum, which was sent to the Government of Madras, and which urged the necessity of early demarcation of the Government and village forests in the Madras Presidency. These proposals were not, however, at that time approved by the Madras Government, and it may here be added that, in spite of the persistent representations subsequently made on the same subject by the Government of India, no adequate action was taken in Madras towards effecting a separation of the various rights and interests in the public forests and waste lands until the Madras Forest Act was passed in 1882.

In April 1866, while the writer of the present paper was on leave in Europe, Dr Cleghorn was appointed to officiate as Inspector-General of Forests until April 1867, when the thanks of the Government of India were conveyed to Dr Cleghorn for his long and successful labours in the cause of Forest Conservancy in India. On his return to Madras, he resumed his work in that Presidency with his former zeal and industry. That, nevertheless, during that period much less progress was made in the forests of Madras than in those of other provinces of the Empire, was due to the views of the Government of Madras, which at that time began to manifest themselves. Dr Cleghorn retired from the service in 1870, but has since been employed every year at the India Office as a confidential adviser to assist Her Majesty's Secretary of State in the selection of candidates for the Indian Forest Service.

When Dr Cleghorn laid the foundation of an effective system of Forest Conservancy in Mysore and Madras, Forestry was very little known in India. A commencement had been made in several places, but Dr Cleghorn was the first to carry out conservancy measures on an extensive scale. His aims were large and comprehensive, but the single-minded devotion to the task which he had set himself gained the confidence of many who might otherwise have been hostile to the new measures advocated by him. A public resolution by the Government of India, of 10th January 1865,[1] justly designated him as the founder of Forest Conservancy in India, and added—"His long services from the first organisation of forest management in Madras have without question greatly conduced to the public good in this branch of the administration; and in the Punjab also Dr Cleghorn's labours have prepared the way for the establishment of an efficient system of conservancy and working the forests of that province."

Since Dr Cleghorn's retirement from the Indian Service, he has done much for the promotion of Forestry in Great Britain, particularly through the Royal Scottish Arboricultural Society, of which he became a member in 1865, and of which he has been President on two occasions—from 1872 to 1874, and from 1883 to 1886. It was in a great measure due to his exertions that the International Forestry Exhibition of 1884 was held with such marked success at Edinburgh.

[1] Parliamentary Return on Forest Conservancy, Part I. India, 1871, p. 95.

V. *Deciduous Trees, with Ornamental and Coloured Foliage, useful in Landscape Forestry.* By JOHN METHVEN, Leith Walk Nurseries, Edinburgh.

(Read at the Annual General Meeting, 1887.)

There cannot be two opinions as to the importance of practical foresters cultivating a taste for planting with a view to produce a pleasing effect on the landscape, while at the same time acquiring a knowledge of the various trees popularly known as "fine foliaged." We live in a time when the æsthetic is studied in everything connected with dress, architecture, house furnishings, garden decoration, and other affairs of everyday life; and the grand opportunities presented in forestry should be fully taken advantage of to improve the public taste. In view of the now almost innumerable species and varieties of trees with attractive forms of foliage and gorgeous variegations, our plantations should show, more than they have hitherto done, that planters have an eye to the beautiful in the arrangement of colour and variation of form, which after all is the great charm in woodland scenery. Opinion is divided as to whether the fresh green of spring-time, or the rich colouring of autumn is the most beautiful, but that both are beautiful and charming cannot be denied. If we can produce the russet brown, the golden, and the crimson tints of autumn throughout the summer, surely an advantage is gained. There can be no doubt that many of our Lowland plantations could be brightened by a free admixture of such beautiful-foliaged trees; and as park, avenue, or roadside trees, some of them are unequalled. Indeed, all of those of which specimens are shown (a list of which is given at the end of this paper) are perfectly hardy in our climate; and of their ornamental character there is no question. Most of them are distinct species, while some are natural deviations from the original form. As an example of what I consider a "fine-foliaged" tree, I will only instance the golden sycamore, or "Corstorphine Plane" as it is commonly called, the original tree of which grows within three miles of where we stand, near the village of Corstorphine, and which during the month of June is worth a pilgrimage to see. It produces leaves of the most brilliant golden colour, and is a conspicuous object in the landscape for miles around. So far, I have only spoken of the æsthetic effects of these ornamental trees.

Nearly all of them, however, are excellent timber-producing trees. As such, many of them are of great value, and bring a high price in the market.

I will now mention, in more detail, some of the most useful genera of this interesting class of trees; giving a few hints and remarks which may lead others to make further inquiry into this attractive subject.

The Maple (*Acer*).

The Acers—which are represented by the Maples and Sycamore—are, it need scarcely be remarked, not only uniformly handsome as ornamental trees, but, without exception, exceedingly valuable for their timber. They are natives of Britain, various parts of the Continent of Europe; Asia, on the Himalayas, Japan, and North America.

The Asiatic types, while bearing foliage of exquisite beauty of form and colour, are not at all likely, from their rather tender nature and weak growth, to take the position of forest trees in this country; and it is to Europe and America that we are indebted for the glorious species and varieties which so richly adorn our woodland scenery. There are a great many very distinct and beautiful varieties, all of which are worthy of consideration in the arrangement of trees for effect.

The Horse Chestnut (*Æsculus*).

The Horse Chestnuts are a small but very interesting group of deciduous trees, remarkable for their symmetrical habits of growth, handsome foliage, and showy flowers, which in large specimens are produced in great abundance. They are indigenous to many parts of Asia and North America, and are perfectly hardy in this country. Than the common horse chestnut, there is no more beautiful tree in our parks and ornamental plantations. It forms a noble characteristic object in the landscape, and superlatively so in early summer. Speaking of this tree, Mr Shirley Hibberd, in an interesting article in the *Gardener's Magazine* for June 1871, remarks: "During the last few weeks it has been like a new revelation to man of the power and goodness that inhabit the heavenly places. Its vast breadth of cheerful grass-green foliage; its wonderful array of pink-tinted white flowers, render it, at least for the present time, the grandest tree in all the land." Of the tree in its normal state, we need add nothing more; but sports and seminal varieties are of much value for ornamental planting.

The Alder (*Alnus*).

Of this genus there are only two or three species, but they are very generally found indigenous in moist situations throughout Europe, several parts of Asia, northern Africa, and North America. Though not commonly classed among ornamental trees, and comparatively little planted for their timber, the species are, under favourable circumstances, very handsome, and are not without their claims as decorative trees. As an old writer very truthfully remarks: "The Alder suffers as an ornamental tree from an association of ideas—we not only see it very common, but we see it in low, dreary, dirty situations. Nevertheless, if the Alder be suffered to form its own head in an open advantageous situation, it is by no means an unsightly tree."

Beside the species, there are now a goodly number of handsome varieties in cultivation, all of which are found to succeed well under similar circumstances with the normal type.

The Aralia (*Aralia*).

Of this genus only one or two species are sufficiently hardy for the climate of Scotland. Probably the most interesting of these is *A. spinosa.* It is an American species, particularly in Virginia, where it attains a height of from 18 ft. to 20 ft. It is hardy in Scotland, and examples may be found equal in height to that attained in its natural *habitat*. It forms a singularly handsome tree; its magnificent foliage and fine outlines rendering it very conspicuous, and never failing to attract admiring attention.

The Birch (*Betula*).

The fine deciduous trees which compose this genus are widely distributed over the temperate and colder regions of the world. They are perfectly hardy, and well suited for cultivation in this country. Though some of the species are chiefly regarded as forest trees, they are, without exception, very ornamental, and, we need scarcely say, frequently met with in our parks and pleasure grounds. The common Birch has formed the theme of many a poet's song. Burns frequently alludes to it as the "scented birch;" Coleridge calls it "the Lady of the Woods;"

and Townley, with still greater enthusiasm, thus celebrates its praises:

> "The pine is king of Scottish woods;
> And the queen—ah, who is she?
> The fairest form the forest kens,
> The bonnie birken tree.
>
> . . . . .
>
> "What magic hues the sunset pours
> All through a birken glade!
> Sooth you might think that every leaf
> Of living gold was made.
>
> "And every stem is silver bright,
> Wrought featly o'er with brown,
> More daintily than jewel work,
> Upon our fair Queen's crown."

The Siberian Pea-Tree (*Caragana*).

Of the Caraganas there is not more than one species that can be called a tree, and that is *C. arborescens*, a beautiful free flowering form, with pinnate leaves, a native of Siberia, and very hardy in this country. The young leaves have a striking effect as they develop in spring, being of a rich golden colour, which is retained till they are full-grown, when they gradually assume a light-green tint. Of the varieties of this species the golden one is very notable, the rich colour of the foliage being retained till the end of summer.

The Hornbeam (*Carpinus*).

There is only one species, *C. betulus*, of any use or ornament, and it bears a general resemblance to the beech, but has a stiffer habit of growth. It makes very fine hedges, as it retains its leaves for the greater part of the winter. It produces a valuable wood where hardness is a desideratum. There are several varieties, and one with variegated foliage makes a beautiful tree.

The Hickory (*Carya*).

The Hickory family is composed of only a few species, but these are all very beautiful. They are indigenous to North America—where the wood is in much request for cabinet-making purposes, while it forms a valuable article of export to Europe. The foliage of all the kinds is pinnate—the leaflets differing in number from five to nine. They have been long cultivated in this country, and have proved perfectly hardy, growing freely in most soils, and forming splendid park trees.

There are few or no really distinct varieties, but all of the species are worthy of a place in any arrangement of decorative trees.

The Chestnut (*Castanea*).

The only one of this family which we would select as an ornamental tree is *C. vesca*, the Spanish Chestnut, a well-known and much appreciated hardy tree. It is a native of Asia Minor, where it attains to a height of from 50 to 60 feet. It is of rapid growth, perfectly hardy, and, when allowed plenty of room, forms a handsome spreading umbrageous tree, densely furnished with its oblong shining leaves.

Of this fine tree there are numerous very striking varieties, most of which are probably of European origin, and all of them very desirable as ornamental trees.

The Catalpa (*Catalpa*).

Indigenous to Carolina, Georgia, and Florida, this fine tree, *Catalpa syringæfolia*, is only equal to the climate of Scotland in favoured situations. It stands well, however, in many parts of England, where it is seen as a broad spreading tree of some 30 feet in height. The leaves are cordate—from 5 to 6 inches across—and of a bright green tint. Where this tree thrives—and we have seen it in perfection in the southern and midland counties of England—it produces its large terminal panicles of white flowers, spotted with purple and yellow, in great profusion.

The variety "*aurea*" is one of the finest of golden-leaved trees.

The Laburnum (*Cytisus*).

So far as trees are concerned among this family, the well-known plants called "Laburnums" are the type. Two species are cultivated in this country, the one, *Cytisus alpinus*—a native of the Apennines—and popularly known as the "Scotch Laburnum;" and the other, *Cytisus Laburnum*, a native of Germany, but popularly called the "English Laburnum." They are very showy in the early months of summer, when clothed with their beautiful golden blossoms, and both have claims of a special kind upon the attention of planters of ornamental trees.

We introduce them, however, for the varieties with golden or variegated foliage, which are well worth the special attention of planters, from the bright colouring they give to groups of small trees, and along the margins of plantations.

The Beech (*Fagus*).

The species of this genus form a limited but important group of evergreen and deciduous trees, with a wide geographical distribution over the temperate and colder regions of both the old and new world. They are famous alike for their highly ornamental character, and we need not say for the excellence of their timber, which is employed for a great variety of purposes.

The evergreen species are not found to do much good as trees in this country. They are natives of both sides of the Straits of Magellan, and occur in vast forests in Tierra del Fuego, where they extend from the sea-side up to the snow-line of the mountains, and vary in height from about 40 feet in the more sheltered situations, to mere scrubby bushes, 2 or 3 feet in height, in the high and exposed sites. It is therefore to the common Beech, *Fagus sylvatica*, with its numerous varieties, that the planter has to look for his supply of ornamental trees.

The Ash (*Fraxinus*).

The large array of species and varieties which compose this group are widely scattered over Europe, some of the temperate regions of Asia, and many parts of America. They are, for the most part, of large growth, and more or less valued for their timber. With few exceptions, they form remarkably handsome trees, and have long been favourites in our parks and other ornamental grounds; even the common form *F. excelsior*, commends itself to the attention of lovers of fine trees, by the warm green colour and elegant form of its leaves, its soft symmetrical outlines while young, and its picturesque grandeur in old age, all of which qualities render it a favourite in any arrangement of trees for landscape effect.

The varieties are many and very varied, and are all worthy of a place in any collection of choice deciduous trees.

The Tulip Tree (*Liriodendron*).

Of this genus the only species with which we are acquainted is *L. tulipifera*, one of the handsomest, whether as regards habit of growth or foliage, of our hardy trees. It is indigenous to North America, from whence it was sent to this country more than 200 years ago, and is now very widely distributed over the three kingdoms. In some districts, particularly in the southern counties of England, and in Ireland, it grows to an enormous size, and there produces its beautiful flowers, resembling those of a tulip, from year to year in great profusion. It is perfectly hardy, and will grow in any loamy soil, if well drained.

The varieties are by no means many, and the finest of all is that with golden variegated foliage.

The Poplar (*Populus*).

The generic name, *Populus*, is said to have been conferred upon this family from one of the species being used in ancient times to decorate the public places in Rome, where it was commonly called "*arbor populi*," or "Tree of the People." The various species and varieties are found in a wild state in almost every country in Europe, in the colder regions of Asia, and very abundantly over a wide area in North America. They are all deciduous, and, in many cases, lofty trees, closely allied to the willows, with which they are associated in the natural order *Salicaceæ*.

Nearly all the species are sufficiently hardy for cultivation in Britain, and have long been employed by landscape gardeners in the formation of ornamental plantations. Of trees so well known, it is unnecessary to do more than call attention to the varieties with coloured foliage, all of which are specially adapted for producing a beautiful effect.

The Plum (*Prunus*).

Although best known as fruit trees, and as such, widely cultivated, the Plums have a representative of recent introduction, which well deserves a place among the choicest selections of ornamental trees. This is known as *Prunus Pissardi*, a perfectly hardy species, with neatly-formed purple foliage, and of a free graceful habit of growth. It seems to thrive best in open sunny exposures, and in rich, but dry, soils.

The Apple and Pear (*Pyrus*).

Apart altogether from the various uses of the fruit-bearers which are included in this group of trees, comprising, as it does, the familiar Apple and Pear, the Rowan, and the Service tree, there are a number of beautiful-foliaged species, well adapted for the purposes of the planter for landscape effect. These are all perfectly hardy, and, under ordinary circumstances, produce striking specimens, as contrasted with the more sombre tints of the ordinary deciduous trees. Several of the finest, with their varieties, are indigenous to this country, while America, and the northern parts of Europe, contribute a number of very interesting forms, all of which are of much service to the ornamental planter.

The Oak (*Quercus*).

Remarkable for the great range of their distribution over the world—almost every country producing its representatives—the wondrous diversity of foliage in the various species and varieties, the facility with which they can be cultivated in this country, and the great value of their timber, give to this group an interest of a very peculiar kind. Few trees are more ornamental, whether in youth or age, even in their normal state, and none are more beautiful in form and colour of foliage than the numerous varieties which now exist, and which, from time to time, are being added to our collections.

The Sumach (*Rhus*).

This is an extensive genus of evergreen and deciduous trees, inhabiting a wide area in the temperate and warmer regions of both hemispheres; very varied in their habits and general aspects, and for the most part are exceedingly handsome. Comparatively few of the species, however, are hardy enough to withstand our climate, but those which can endure it are frequently met with in our parks and ornamental plantations, where they are much and deservedly appreciated. It may be added, that all the species are more or less poisonous, and two, viz., *R. radicans* and *R. vernicifera*, are so much so, that it is best to avoid coming in contact with them.

The Willow (*Salix*).

Of this very extensive genus, composed of shrubs from 2 inches in height to trees upwards of 90 feet, it is unnecessary to give a description. There are, however, a number of comparatively little known and very ornamental species and varieties, especially those of a "weeping" habit, which are worthy of attention, and all the sorts are particularly well suited for planting in moist soils, where they delight to grow, and generally form very graceful and attractive objects.

The Elder (*Sambucus*).

Considering that this genus has such a wide distribution over Europe, Asia, and America, it is somewhat remarkable that there are only three or four species known. The common species, *S. nigra*, is so familiar that it is unnecessary to say more than that it is an effective tree, and that, take it for all in all, it is one of the finest of our strong-growing deciduous shrubs or low trees, and, along with *S. racemosa* and the many beautiful varieties of both species, is well deserving of more extensive introduction into ornamental plantations. We need not add that all the varieties are quite hardy, and all require for their proper development, whether as regards foliage, flowers, or fruit, to be planted in open sunny aspects, and in well-drained ground.

The Lime (*Tilia*).

Widely distributed over both Europe and America, the noble trees which compose this comparatively small group are, without exception, hardy in this country, and, with their varieties, are ornamental in the highest sense. From the European type, the glory of our parks and avenues, to the grand species from America, with their now numerous varieties, we have an array of fine trees, to which the early planters in Britain were strangers.

The Elm (*Ulmus*).

No collection of ornamental trees would be complete without some representatives of the Elms, which, for stateliness of habit, fine variegations, and thorough hardiness in almost every situation, commend themselves to all who can appreciate the picturesque in the grouping of trees. The two species, *U. campestris* and *U. montana*, which form the type of the genus, are indigenous to England and Scotland; and from these have sprung a progeny of varieties, all of which are exceedingly interesting.

List of the Leaves of Ornamental-Foliaged Trees, Exhibited at the Meeting by John Methven to Illustrate his Paper.

Acer campestre variegatum.
,, eriocarpum Wieri laciniatum.
,, insigne.
,, lævigatum.
,, platanoides dissectum.
,, ,, laciniatum.
,, ,, Lorbergi.
,, ,, Schwedleri.
,, pseudo-platanus Worlei.
,, ,, Leopoldi.
,, ,, variegatum.
Æsculus rubicunda variegata.
Betula crenata.
,, populifolia purpurea.
,, pubescens asplenifolia.
,, purpurea.
Carpinus betulus variegata.
Castanea vesca variegata.
Cornus mascula elegantissima aurea.
,, ,, variegata.
Cytisus Austriacum.
,, laburnum aureum.
, ,, quinquifolium.
Fagus sylvatica asplenifolia.
,, ,, castanæfolia.
,, ,, cristata.
,, ,, purpurea.
,, ,, tricolor.
,, ,, variegata.
Fraxinus excelsior simplicifolia.
Juglans sulcata.
Liriodendron tulipifera variegata.
Platanus orientalis.
Populus Ægyptica.
,, canadensis aurea Van Geerti.
Prunus Pissardii.
Pyrus aucuparia pendula variegata.
Pyrus longifolia.
,, vestita.
Quercus Americana Albertsi.
,, ,, macrophylla.
,, cerris Lucombeana.
,, ,, variegata.
,, comptonifolia.
,, concordia.
,, Daimio.
,, dentata.
,, falcata.
,, glandulifera.
,, imbricata.
,, laurifolia.
,, lusitanica variegata.
,, macranthera.
.. nigricans.
,, pannonica.
,, pectinata.
,, pyramidalis punctata.
,, robur argentea variegata.
,, ,, asplenifolia.
,, ,, filicifolia.
,, ,, heterophylla.
,, ,, Louetti.
,, ,, maculata.
,, ,, nigra.
,, sempervirens pyramidalis.
Sambucus canadensis aurea.
,, nigra argentea.
Tilia alba variegata.
,, Americana.
,, Europæ argentea.
,, ,, asplenifolia speciosa.
,, ,, bicolor.
Ulmus montana argentea.
Viburnum Opulus variegata.

REPORT OF THE SELECT COMMITTEE OF THE HOUSE OF COMMONS, 1887, ON FORESTRY.

The Select Committee on Forestry—extracts from the Reports of which have appeared in the *Transactions* for the last two years—was ordered by the House of Commons to be re-appointed on the 16th of May 1887, "*to consider whether, by the establishment of a Forest School, or otherwise, our Woodlands could be rendered more remunerative.*"

The Committee was nominated on the 20th of May, and consisted of the following members:—Viscount Ebrington, Sir Edmund Lechmere, Sir John Lubbock, Sir Richard Temple, Colonel King-Harman, Colonel Nolan, Dr Farquharson, and Messrs C. Acland, Biddulph, Craig Sellar, Evelyn, Farquharson, Munro Ferguson, Gilhooly, Egerton Hubbard, Fuller Maitland, Rankin, and Mark Stewart; five members to be a *quorum*. Sir Edmund Lechmere was elected Chairman of the Committee.

At six meetings held by the Committee on the 8th, 15th, and 28th June; 6th, 12th, and 20th July, for the examination of witnesses, the following gave evidence:—William Barron, landscape gardener, Borrowash, Derby; John Wrightson, Professor of Agriculture, Downton College, Hants; Rev. John B. M'Clellan, Principal of the Royal Agricultural College, Cirencester; Earl of Ducie, Tortworth Court; Thomas J. Elliot, Professor of Estate Management, Royal Agricultural College, Cirencester; Earl Bathurst, Oakley Park, Cirencester; Sir James Campbell, Bart., Deputy-Surveyor, Dean Forest, Gloucestershire; H. A. Britton, Timber Valuer, Wolverhampton; Hon. G. Lascelles, Deputy Surveyor, New Forest, Hants; John M'Gregor, Forester, Dunkeld, N.B.; William M'Corquodale, Forester, Scone, Perth; John G. Thomson, Forester, Grantown, N.B.; Robert Dundas of Arniston, Midlothian; Rev. T. E. F. Flannery, Parish Priest, Carna, County Galway; Andrew Gilchrist, Forester, Powerscourt, County Wicklow; John Clutton, Ex-President of the Surveyors' Institution, London; Evan Powell, Land Agent, Llanidloes, Wales; Sir Joseph D. Hooker, Ex-Director of the Royal Gardens, Kew; Rev. John C. Brown, Haddington, N.B.; Viscount Powerscourt, Powerscourt, County Wicklow; Sir Alexander Taylor, President of the Royal Engineering College, Cooper's Hill, Staines, Surrey; and Sir Richard Temple, Bart., M.P., The Nash, Worcestershire.

The evidence given by these twenty-two witnesses is generally of an interesting nature, and, along with the proceedings of the Committee, fills a bulky Blue Book of about 160 pages. The details are far too voluminous to be given here, but those interested in the subject can purchase the Blue Book—"Report from the Select Committee on Forestry, with Minutes of Evidence, 1887,"—for 1s. 9d., through any bookseller.

The interests of various educational institutions in England were warmly advocated by their representatives, as suitable centres for teaching Forestry; the Scottish representatives, and all the other witnesses who touched upon the subject, were unanimous that Edinburgh was the best centre in Scotland; and the Irish representatives, and others examined thereon, agreed generally that Dublin was the proper centre for Ireland. Among a mass of irrelevant matter, it is often difficult to sift the facts bearing directly on the subject before the Committee, but the general opinion is clear enough in favour of a better system of education and training for Foresters, and that existing institutions should be utilised for the purpose. The weight of the evidence in favour of the best centre for a School of Forestry is about equally divided between Edinburgh and Cooper's Hill. The first has the most complete educational equipment and greater economy to recommend it; the second, the important fact that it has already a small School of Forestry attached to it, for the training of students for the Forest Service in India, but necessarily conducted on a rather costly scale for home forestry requirements. Several other schemes were propounded, but no approach to unanimity was expressed regarding them.

The following extracts bear more directly on Scottish Forestry, and the general question of a School of Forestry, and therefore may be deemed of greatest interest to the members of the Royal Scottish Arboricultural Society.

In the course of his examination, on the 28th June, Mr John M'Gregor, Ladywell, Dunkeld, Forester to the Duke of Athole, gave the following evidence:—

"Since 1860 I believe you have had the entire charge of the Duke of Athole's woods?" "Yes."—"Where are the woods situated?" "All in Perthshire."—"What is the acreage of woodland which you have under your charge?" "About 20,000 acres."—"What description of trees do the woods principally consist of?" "The bulk is larch; five or six thousand acres of larch mixed with spruce, and about a thousand acres of oak coppice. The remainder principally Scots fir. The largest larch plantations are those of Loch Ordie and Loch Hoishen."—"Have you any other description of pine?" "None, except specimen trees in policy grounds."—"Have you not the *Abies Douglasii* in your woods?" "A few thousand trees; more experimental than anything else."

"Have you given your attention to the general subject of the condition of woods and forests in Scotland?" "In Perthshire; I confined it to Perthshire, because I have never been much out of it."—"What is your opinion as to the management in Perthshire?" "It might be better."—"Do you consider that the land agents, or the factors, as they are called in Scotland, are fairly well informed as to the management of woods and timber?" "Very few of them."—"What are the subjects on which factors and woodmen are deficient?" "They are deficient in the knowledge of what trees ought to be planted on suitable soils, and when thinning out ought to commence; and, in fact, the general management of the woods altogether."—"What are the special subjects which those who have charge of woods ought to understand?" "They ought to understand the soils and situations suited for the different varieties of forest trees to be cultivated for profit, and they ought to know the proportions in which those trees should be planted, and whether they ought to be planted mixed or pure."—"They should know something about the diseases of trees?" "Certainly."—"And of the insects affecting trees?" "Yes; that is a subject which requires to be very much studied."

"Will you give us some idea of the system pursued upon the Duke of Athole's estates as regards falling and thinning timber. Do you cut down a certain quantity every year?" "That depends very much on the demand. We commence to thin as soon as ever a plantation requires thinning, and we thin out the least vigorous trees, the least valuable, leaving the best, generally, until the wood is ripe, and then it is all cut down."—"Have you a steady and ready demand for the fallings and thinnings?" "We had before the gales of 1879; but since then the demand has fallen off, and the price has also fallen off very much."—"That is in consequence of the large amount of timber that was blown down by the gale; the market has been over-stocked?" "Yes, and the depression of the coal and iron trades as well."—"Do you consider that in Scotland tracts of waste land can be planted with profit?" "I think so."

"Will you give some particulars in your own experience of the Duke of Athole's estates as regards profit?" "The present Duke has planted recently about 3000 acres, which are doing very well, principally Scots fir. We found that the old plantations afforded much shelter to the arable land, and since the plantations have grown up they are very valuable as wintering for sheep. Some of our sheep farmers have to send their hoggs 100 miles away to winter; whereas if there were more woods in the valleys they would not require to send them away so far."

"Can you give us any details of the average value per acre of yearly falls and thinnings?" "Not of yearly falls; but I could give you pretty accurately the value of a plantation of 366 Imperial acres of larch planted in 1817, which I had occasion to value a few years ago. The mode I adopted was to measure an acre here and there, through the wood. In all there were 17 acres measured. The number of trees per acre was 180 to 190, and the value would be about £40, 5s. per acre. That was the average over the whole. The acres on the lower part of the plantation were worth perhaps nearly £100; and at the top of the hill, with 1000 feet of altitude, the acre would not be worth more than £20; but over the whole the value would be about £40 per acre."—"What would be the lowest elevation?" "About 300 feet to 400 feet."—"Do you mean it is worth now, to cut down, £40 per acre?" "Yes."—"That is standing?" "Yes; for the wood merchant to cut it himself, and do everything; the proprietor would have that."—"Clean cut?" "Yes; it is not yet at maturity. It will be more valuable."—"That is the present value, assuming a clean cut?" "Yes."—"But that is not the value at which you would put it if you were going to take part of it away and leave part standing?" "No."—"You could make more if you tried?" "Yes."—"Supposing the property were going to be sold, would the timber then be valued at £40 per acre?" "I should think so."—"You still assume that it would be cut down this year; do you consider that there is an increase of value still in the timber, that it may be more valuable at a future day?" "Yes. If the property were to be sold I do not think the present purchaser ought to pay any more than it was worth at the present time."—"Do you think you can get anything more than the present value, without making a clean cut, so that the remaining trees shall grow into greater value, so that you can get more than £40 an acre?" "Yes; I think if it were managed until the best trees were at maturity it would bring more money."—"Has this plantation paid anything at all since the year 1817; have there been any thinnings taken away?" "Thousands of pounds' worth have been taken away."—"What is about the average annual value for the last fifty years?" "I could not say that, because I had not the management of it all the time."—"Has there been any return from pasture?" "Yes. Before this was planted the pasturage was let for £5. It is now let for £15."—"The annual value of the 366 acres was only £5 a year before it was planted?" "For pasture."—"Then you consider the larch has really improved the pasture?" "There is no doubt; because it has killed the heather, and grass has come up instead."

"Have you given your attention to the question of schools for instruction in forestry?" "Yes."—"What is your general view of the question?" "At the present time there are no means by which a young man can learn anything about forestry except going about and working under foresters as a day labourer. The Highland and Agricultural Society have of recent years introduced examinations; and they also offer premiums for essays on subjects connected with forestry."—"You are one of the board of examiners of that society?" "Yes."—"Are Mr Thomson and Mr M'Corquodale, who are here, also members of that board?" "Yes."—"And Dr Cleghorn is the other member?" "Yes, those are the examiners in practical forestry; there is also an examiner in botany."—"Perhaps you will give us the qualifications you require from the candidates?" "They are supposed to have a thorough acquaintance with the details of practical forestry; with a general knowledge of the following branches of study so far as these apply to forestry—the outlines of botany; the nature and properties of soils, drainage, and effects of climate; land and timber measuring and surveying; mechanics and construction as applied to fencing, draining, bridging, and road-making; implements of forestry; book-keeping and accounts. The examinations are open to candidates of any age. Then the syllabus of examination in the science of forestry and practical management of woods consists of: (1.) Formation and ripening of wood; predisposing causes of decay; (2.) Restoration of woodlands, consisting of, (1) Natural reproduction; (2) Artificial planting; (3.) General management of plantations, cropping by rotation, trees recommended for different situations; (4.) Season, and methods of pruning, thinning, and felling; (5.) Circumstances unfavourable to the growth of trees; (6.) Mechanical appliances for conveying and converting timber, construction of saw-mills; (7.)

Qualities and uses of chief indigenous timbers; processes of preserving timber; (8.) Management of nurseries; seed sowing; (9.) Collection of forest produce; (10.) Manufacture of tar and charcoal; (11.) Insects injurious to trees; preservation of birds which prey upon them, drawing a distinction between birds which are beneficial and those which are destructive to trees. That is practical forestry."—"What is the mode of conducting the examination in forestry?" "In the first place, written questions are settled by members of the Committee a few days before the candidates are asked to come up to Edinburgh. Those questions are submitted to the candidates when they come to the Society's Chambers, and they are allowed three hours to answer them. Then the oral examination takes place the day after. That occupies two or three hours, the candidates being examined first in practical forestry, and if they fail in that, they are not examined further."

"The Society also gives premiums for approved reports?" "Yes."—"Is that competition confined to foresters, or is it open?" "It is open."—"It is open to land agents or to anybody?" "Yes, we have had land agents and land agents' clerks who come up."—"Do you think that forestry ought to be connected with the science of agriculture, as a part of agriculture, rather than of any other science?" "Yes, it would be more natural to combine them."—"What is the class of men who come up to these Forestry examinations of the Highland and Agricultural Society?" "They are assistant foresters generally, and land agents and their clerks."—"Do any actual working foresters, men who absolutely are working in the woods, come up for examination?" "No."—"You have no labourers?" "They are young men who have it in view to become foresters who come up, thinking that the certificate of forestry from the Highland and Agricultural Society would enable them to obtain a situation."—"Most of them have learned what they know by practical work more than by study?" "By practical work entirely. They are working men, and know very little about scientific matters."—"They have not learned much by reading?" "No, they are doing so now, but then it is very difficult for them to learn by reading, because there is no text-book worth reading."—"How long have these examinations been instituted?" "I am not very sure. They have been in existence for about ten years, but I could not say exactly."—"Are they attended tolerably well every year?" "Not very well. We have never had more than four candidates at one examination."

"You have read through the evidence given before the Committee of last year, and of the year before?" "Partially, so far as I had time."—"You read Dr Schlich's evidence?" "Partly."—"Do you concur with the views he expressed as to the locality of the school of forestry and the mode of establishing a school of forestry?" "Generally; I do not remember what he says about the locality. Some of the witnesses approve of having a school concentrated at Cirencester or Downton, and others at Cooper's Hill. I do not think that would suit for Scotland at all."—"Looking at the question purely as connected with Scotland, what part of Scotland do you think would be most convenient for such a school?" "I do not think that forestry can be properly taught in a school in class-rooms. They require to have some acres of land. Perhaps if 5000 acres of land could be got containing proper soil for growing trees, that would be sufficient."—"Is there any agricultural school in Scotland with which a branch of forestry instruction can be connected?" "There is nothing that I know of but the Botanic Garden at Edinburgh."—"Have you seen anything of any agricultural schools?" "No, never. I know nothing about them; we have no agricultural schools in Scotland; some large farmers take pupils, but that is entirely private."—"Have you ever had any pupils to farmers come up for examination in forestry?" "Yes, but they were young men who intended to become foresters."—"Or land agents?" "Or land agents."—"You have had them coming up for that examination with a view to their being land agents afterwards?" "Yes, they were at the time factors' clerks."—"Is there a sufficient number of young men anxious to become foresters to justify the establishment of a school of forestry?" "Not at the present time, but then there is no encouragement for them. I think the proprietors must take the first step. If proprietors take any man they can get hold of for a forester, there is no use in a young man spending time or money learning forestry, if some retired gamekeeper is to be put in charge of the woods."—"Proprietors must show that they value the certificate?" "Certainly."—"Do you mean that they must pay their head forester better than they do now?" "Well, I do not say that, but I would say that a forester, to be authorised to go and deal with woods, ought to be somewhat in the position of a doctor or veterinary surgeon. He ought to be certificated by somebody, who is qualified to give a certificate as to his competency."—"At the present time you do not think that that is so?" "I do not think so. I think the proprietors, as a rule, have stood aloof from the movement. We have an Arboricultural Society in Scotland, but the proprietors have not patronised it so much as they might have done."—"How is that Arboricultural Society maintained?" "By subscriptions from members."—"Who are the members chiefly?" "There are a good many proprietors members, but they do not attend the meetings."—"Are many foresters members of it?" They are mostly foresters."—"Is it important for a forester to have the exclusive management of the sale and the purchase of all matters connected with the woods he manages?" "It depends entirely on the size of the woods. If he has a very large charge, I think he ought to be entrusted with the whole; if it is a very small estate, perhaps that is not necessary."—"A very small estate would hardly find work for a forester?" "No."—"But where there is the work for a forester you think he ought to be entrusted with the sale entirely?" "I think so."

"You said something just now about the profitable cultivation of woods; of course that entails the knowledge of markets and of the demand that is likely to take place. Have foresters in Scotland very little opportunity of gathering much knowledge of that kind?" "The system observed on the Duke of Athole's property is when a lot is to be cut down, to advertise it, and take offers from wood merchants, and that brings out the real value of the timber."—"But in order to carry on forestry profitably and with foresight, it is necessary even to plant with some idea of what is likely to be the future demand?" "Yes; and to plant what is likely to grow. At the present time I think it would be very injudicious to plant larch extensively."—"Because you think larch has not become a success?" "I am sure of it. There is hardly a larch plantation in Scotland free from disease, but then what that disease is, is a disputed question. I hold that it is caused by an aphis."—"That of course is a matter for scientific investigation?" "Entirely, and for that reason foresters should know a good deal about entomology."—"That of course requires special instruction?" "Certainly."—"That can only be given at a school or college?" "Quite so."—"Have you any practical suggestion to make as to how that difficulty can be met?" "No. If a school was to be organised and established, a person ought to be appointed who could give instruction in that branch."—"You said there was a Botanic Garden at Edinburgh; do you think anything could be usefully attached to that institution for this purpose?" "There is not a district near Edinburgh sufficiently large where a forest could be established, but there is no doubt the Botanic Garden would be a very useful place."

"In your examination for the Highland and Agricultural Society you deal with entomology?" "Only with insects which are injurious to trees."—"Cannot something be done by maintaining those examinations, and making them more widely known?" "Yes, I think so."—"Were those examinations advertised much?" "Not very much. They were advertised in the newspapers."—"What fees have to be paid for these examinations?" "Nothing."—"No fee at all?" "No."—"The certificate then is practically a free gift?" "It is a free gift."—"There is no expense to the candidate?" "None whatever. The only expense is his coming to Edinburgh to be examined. The certificate is signed by the president of the Society, the secretary, and the examiners."—"Are the questions ever published afterwards?" "They are published in the journal of the Society."—"Are the proprietors, who you say do not appear to appreciate these certificates as they ought to, aware of the amount of information that is necessary to acquire a certificate?" "I hardly think so."—"You think a little improvement might be made in that way?" "Yes, very much."—"Is it your opinion that more can be done in that general way than by the establishment of a definite school specially for the purpose of forestry?" "Yes, but there is no doubt that a definite school would be a very great step towards the better management of woods, and the publication of a text-book, such as they have with regard to Continental forests. We have no text-book; the only book worth reading at the present time, is 'Arboriculture,' by the late Mr Grigor, a nurseryman at Forres."

"With regard to what you say about the appointment of foresters, I suppose you mean that the proprietors, in fact, are ignorant about trees, and not particular with regard to whom they appoint?" "A good many of them."—"What is your opinion as to what is necessary in the way of a school, or in the way of improving the knowledge of timber in Scotland?" "I do not see any better way than the establishing of a school. For instance, no gentleman would take a gardener unless he were a thorough gardener, accustomed and well able to grow vegetables and fruits; he grows only annual crops; and when the proprietor sees it necessary to have a proper gardener whose mistakes can be seen at the end of one year, I think it is far more necessary that he should have a thoroughly qualified forester whose mistakes may not be found out for thirty years."—"What kind of school would you suggest?" "Something like what a number of the witnesses have been speaking about; I would suggest a school in Scotland with an extent of 4000 or 5000 acres."—"What sort of fees would you charge?" "If it were such a school that gentlemen's sons might go there, I think they ought to pay a fee, and perhaps agents, but working foresters would be hardly able to afford it."—"In anything that was established, there would require to be a free class which working foresters could attend?" "I think so, for poor young men who could not afford to pay a fee."

"Is there much waste land in Perthshire which could be profitably planted?" "Very much."—"How much do you think?" "I have no idea."—"Is there much difficulty in getting your timber to the market?" "No. The Highland Railway has been of great benefit to the district."—"Are the rates high?" "The wood merchants complain about them. We sell to the wood merchants; we are not so immediately connected with the rates as they are, but we hear the wood merchants complain very much about them."—"Do you sell your timber direct to the wood merchants?" "We sell it direct to the wood merchants. When it is not a clean cut, we cut out such trees as require to be cut and measure them; they are sold by the foot at three different prices."—"Is all your timber managed on commercial principles?" "Except what is used for estate purposes."—"Is all the timber that is used for improvements in the estate home-grown timber?" "Generally."—"Is there any foreign timber used in houses?" "Yes. If there is a great hurry to get a shooting lodge put in order, or a farmhouse, they sometimes take dry foreign timber, but where there is time it is generally home timber that is used."—"Do you think home timber might be used for building purposes?" "Yes, there is no doubt of it."—"You do not think enough trouble is taken to find markets for home-grown timber?" "The only trouble taken is to advertise it to the wood merchants; we leave them to find the markets."—"What reasons do the wood merchants give for not taking home timber?" "None. They would take it if they had a market for it; one reason is the depression of trade. The principal market we used to have for home timber was the coal and iron pits."

"Is the growth of timber much hampered by game in Perthshire?" "A good deal."—"By what kind of game chiefly?" "I would begin at capercailzie, they destroy the tops of the Scots firs;

and hares and rabbits are the principal animals. I find that grouse are very apt to destroy young buds."—"You think the growth of timber is seriously hampered by game in Perthshire?" "If it is planted in large areas, not very much, but small belts are very much damaged by game."—"Do you raise any natural wood?" "Nothing but birch. There is a natural pine wood in Perthshire, the old wood of Rannoch. It is a wood of considerable extent entirely of Scots fir."—"Could more timber be grown on the system of its being allowed to grow naturally than by plantations?" "You require to introduce the seed somehow; then you require to break up the surface."—"You do not grow any timber by the natural system?" "No."

"Could you give the Committee a table of the original cost of the Duke of Athole's plantations, and what they paid during the last fifty or sixty years?" "I could not tell you what they paid, but I can give you an idea what the cost was."—"Have you no record of the annual value of the timber sales?" "I have the sales books since 1860."—"Could you tell us how much per acre, roughly, over a certain area it has been the last twenty years?" "No, I could not. Because the wind-blown trees in 1879 have interfered with all our calculations in that respect."—"Up to 1879 you might?" "We might manage the general average income, but I could hardly give the income from the different plantations."—"You could not show us the increased value per acre?" "A great many sheep runs are let from 6d. per acre up to 2s. or 3s., and at the end of fifty or sixty years when we have a crop we might have larch worth £40 or £50 an acre, so that it would be far more profitable to be planted than to be kept for sheep. Some people say it would interfere with the grouse shooting, but I do not think so."

"Is there any one kind of foreign timber more than another which rivals the home-grown timber. Does foreign pitch pine or spruce run you close?" "We have a better quality of home spruce than the spruce we get from the Baltic; it is harder; and the old Scots fir wood of Glen Fishie, Rannoch, and Braemar, is equal to any Baltic timber."—"That is natural timber?" "Yes."

"You said you would not plant larch as a tree for profit?" "I would not advise any proprietor to invest much money in planting larch on account of the disease."—"Have you reason to believe that the disease will be permanent?" "No, because I have seen some years that were not so bad as others."—"Is it in Scotland a disease of such amount as to seriously damage the trees?"

"It destroys them altogether, and in England also, I saw an instance the other day, where they were just as bad, in Hampshire." —"What tree would you plant?" "Scots fir is the surest to plant in Scotland on our hills. Scots fir and birch."—"How long is it before Scots fir comes to maturity?" "Scots fir will continue to grow until it is 120 years old, but it is fit for the market before that time."—"How soon would you make a final cutting of a Scots fir plantation at the greatest profit?" "Not sooner than eighty years."—"About two generations?" "Yes."—"Do you think then that planting Scots fir upon ground that can be rented at almost any money is a paying operation commercially?" "I would not advise planting moorland if it were worth from 7s. 6d. to 10s. for pasture purposes. There is plenty not worth 1s. which ought to be planted first; the least valuable ought to be the first planted, and not beyond a certain altitude. Scots fir might be advantageously planted up to an altitude of 1500 feet, but not higher. I think it would be prudent to limit the planting of larch to between 1000 feet and 1200 feet."—"Your opinion is that there is a considerable quantity of land in Scotland which might be commercially profitably planted with some kind of tree?" "Certainly."

"Have you tried the Douglas fir at all in Scotland?" "Yes." —"Do you think that a good tree?" "In certain situations it is. It is a fast-growing tree, but it ought only to be planted on land suitable to spruce firs."—"Is there any deciduous tree which you would recommend to be planted?" "Yes; ash, sycamore, and oak. Oak used to be planted extensively for the purpose of forming coppices, but now oak coppices do not pay. The only place where it would be of advantage is in steep ravines."—"Do you think that any amount of learning or foresight could possibly lead a man to know what would be the proper timber to plant to come into the market in fifty or sixty years?" "I have not the slightest doubt of it."—"You think it is possible?" "Quite possible, unless it were to be attacked by an insect such as the larch is; of course no human foresight could prevail against that."—"What do you think would be the timber to be profitable fifty or sixty years hence?" "I think at present Scots fir on moorland is most likely to be profitable."

"With regard to the diseases of the larch and of trees generally, you said that you thought foresters ought to have a knowledge of the diseases of trees, and a knowledge of entomology, as insects create a great many of these diseases. Would it not be possible for foresters to send portions of a diseased tree for examination to scientific men?" "Quite possible."—"Would it not be a sufficient way of finding out the nature of the disease?" "It might be. I have sent specimens, and I have found scientific men to differ very much about the causes."—"Do not you think if scientific men differ so much about them, that partially scientific or wholly unscientific men would differ a great deal more?" "No doubt."—"And you think it possible for working foresters with anything like a moderate education to acquire such a knowledge of the diseases of trees as to make it really worth while their going into that?" "I think they would; I do not see anything to prevent it."

"You just now mentioned the education of gardeners, and you said that no gentleman would take a gardener who was not a properly qualified man; but there is no school for gardeners as far as I am aware either in Scotland or in England?" "No, but then they go to good gardens to learn."—"They are apprenticed, in fact?" "Yes."—"Do not you think a more practicable way of getting hold of working foresters is to have them apprenticed to good foresters who are at present working foresters, rather than to send them to some centralised school?" "At present there are very few large establishments like gardens where a number of apprentices would be taken in."—"Are there not sufficient of those to be able to train up a sufficient supply of new foresters?" "I do not think so. I know Mr M'Corquodale, of Scone, takes pupils, or he did; and I have had one or two myself, but they came as labourers. I took no fee, and I had not them put under apprenticeship. They simply saw the operations as they went on. There was no agreement whatever. They just came and went when they saw proper."—"Do you think it would be possible to get any knowledge of forestry, sufficient to give some kind of inkling, as you say in Scotland, to young men, by having some tuition at the elementary schools on that subject?" "That is well worthy of consideration."—"Do you think the Government would be justified in giving a grant, making it what they call a special subject?" "Yes."—"Giving a grant to such a subject as forestry?" "Yes, they do so now for agriculture."—"Not in elementary schools?" "It is a special subject under the Science and Art Department."

"Do you think moorland at sixpence an acre might be very profitably planted with trees?" "No doubt."—"What would be the cost per acre of planting the cheapest place on a large scale?" "About £2 an acre."—"Fencing and all?" "Yes, if the plantation were of a large area, because large areas can be inclosed cheaper than small ones."—"Do you know Ireland at all?" "No, I do not."—"If you have a large mountainous district of say half a million acres, and there is very little planting in it, do you think it would improve the country generally to plant a portion of that with trees?" "Certainly."—"If the proprietors will not or cannot do it, do you think it might be of national advantage if the Government took it up?" "Yes."—"Are not there some districts in Scotland where the enterprising proprietors plant a good deal, and other districts with equal advantages where other proprietors do not plant at all?" "That is the case."—"In those districts where the proprietors do not plant, do you think some advantage would be gained if the Government were to take up their work and plant, of course keeping the increase of the trees to themselves. Do you think that might be done with advantage?" "I daresay it might."—"You have not thought on that subject?" "It introduces rather a complicated question; how would the proprietor be compensated?" "Suppose they were paid for the land they give up, and were willing to give it up?" "It would be far better to have the land planted than left as it is at all events."—"And it would shelter the other land?" "Yes."—"And would generally improve and beautify the country?" "Yes."—"Would it not introduce new industries into the country?" "Very possibly."—"In those districts where the proprietors do not plant, do you think it would be advantageous for the Government to step in and plant trees?" "Certainly."

"You began life as a woodman?" "Yes."—"You picked up all the knowledge you got for yourself?" "Certainly; I was at no school."—"Do you think you would have done better if you had had a course of scientific instruction?" "I have not the slightest doubt of it; I have felt the want of it all along. I had to read up, and there are very few books to read."—"That is your own experience, and you are prepared to recommend that men beginning life as foresters, should have some definite instruction?" "Certainly."—"Have you formed any opinion as to what the length of such a course ought to be; what is the shortest time. Of course these men are poor and cannot afford to pay very large fees or go on long?" "The very shortest time to see all the operations would be a year. He ought to be two years at the very least."—"Would that include the lectures and instructions at the school?" "If the school and the forest were to be within a reasonable distance of each other, it might."—"Do you think it is advisable and necessary to teach young fellows of the rank of foresters on small properties, botany and elaborate things of that kind. Do you think they would be much better for it?" "They require to know as much of botany as would enable them to distinguish one plant from another." "That is a very simple matter. You would not be prepared to recommend a long course of botany?" "No, I do not mean that."

"I believe you said the management of the Scottish forests might be much better than it is now?" "Yes."—"In what respect? Where does the deficiency now lie in the management of the Scottish forests?" "The deficiency lies in this, that if it is left to the forester, he often does not know when to begin to thin, or when to plant, and what to do in other matters. Some men in charge of woods prune live branches off resinous trees."—"That bad management is in consequence of the ignorance of those who manage it?" "To a certain extent."—"You said something about factors. Is it not the fact that most of the factorships on small properties are held by lawyers of the neighbouring towns?" "On very small properties, but now I think resident factors are becoming more the rule in Perthshire."—"You cannot expect town lawyers to know much about planting?" "No, I do not think they pretend to."—"You think the better plan would be to have resident men who would superintend these matters?" "Yes."

"Do you think the low price of trees just now is more due to the gale of 1879 or to foreign competition?" "I think it is more due to the depression of trade. If the coal and iron trades were as prosperous as we have seen them, our thinnings and our home wood would sell much better."—"The market, you say, was thoroughly glutted in 1879?" "Yes."—"Is it beginning to recover from that?" "Not very much yet."—"Was not the market glutted by the great gale of 1881?" "There was a succession of gales from 1879 to 1883 or 1884."—"There was a gale in 1881?" "I am not certain, but I believe that altogether in four or five gales, there were 200,000 trees blown down on the Duke's estate. 1879 was the worst gale we had."

"Could you say whether the great plantations on the Duke of Athole's property and elsewhere have had any effect on the climate?" "I think they have; they shelter the low ground very much."—"Have they affected the rainfall at all?" "I do not think there was any record kept of the rainfall before."—"A former witness before the Committee said he thought the effect of planting forests was to make the climate more equable and temperate?" "That is the general opinion, but I could not say so from experience."—"You cannot say that it affects the rainfall either?" "I could not say."—"Have you a great deal of rain?" "No, it is not a very wet district in Perthshire. We have an average rainfall of 30 to 40 inches." "Have these plantations been successful as a commercial speculation?" "I think so."—"But at present prices they are not?" "Even at present prices they are better than if left as moorland in their original state. Before 1879 we were getting 14d. and 15d. a foot for larch, and now it is down to 9d. and 10d. Scots fir freely brought 8d. a cubic foot; now it is only 4d., and there is very little demand at that."—"I suppose anything over 1s. a foot for larch pays well?" "Less than 1s. pays well."

"From whatever cause the cultivation of woodlands is much less profitable than it used to be when you began your career in connection with forests; it does not pay so well?" "Oak coppice does not pay nearly so well. The reason is that other foreign substances are used for tanning leather."—"Does larch pay as well?" "No."—"With regard to the 366 acres of larch, you said that they were planted on land from 300 to 1000 feet above the level of the sea?" "Yes, I am speaking from recollection of the figures on the Ordnance Survey."—"What is the highest elevation at which larch can be profitably grown?" "From 1000 to 1200 feet, provided the soil and situation are suitable."—"You said also that there is a good deal of waste land in Perthshire that might be planted?" "Yes."—"Is much of that waste land at a high elevation?" "There is a good deal of it higher than 1200 feet; but it would not be advisable to plant higher than that."—"But much of it below that is fit for planting?" "A great extent."

"With regard to this disease in the larch that has caused so much ravage; has it increased of late years?" "Yes, I think it has."—"Can you tell us when the disease first appeared?" "A cotton-like substance was noticed first about 1800, and since then it has increased very much."—"Has any way of combating the disease or any remedy yet been discovered or made known?" "I do not think there has."—"Have you found the Scots fir also subject to the ravages of an aphis or any other disease?" "I have found a white substance caused by a coccus on the Scots fir, but it does not kill it."—"In the county of Surrey I find the Scots fir is subject to some disease?" "There are beetles that affect it, and there is also the caterpillar of the sawfly that devours the foliage of the Scots fir."—"But not to the same extent as the larch?" "No, the larch dies entirely."

"Is it your experience that planting larch upon a sandy soil in Scotland makes pasture grow underneath the larch; have you ever seen young larches turn a sandy soil into pasture?" "No, never. The larch destroys the heather, and grass comes up instead of the heather almost always."—"It does turn the heather into grass?" "It does not turn the heather into grass, but it makes grass come in place of the heather."

"What would be the average rental of the land which is under 20,000 acres of timber?" "Two shillings an acre overhead."—"Have you any idea of what the value of the woods would be as they stand?" "No."—"You are substituting the planting of Scots fir for the planting of larch now?" "Yes; and of course we are planting Scots fir where I would not plant larch under any circumstances."—"You are not planting so much larch now as formerly?" "No."—"There is a great advantage in planting timber in large blocks?" Yes; it is so for various reasons; it can be done cheaper, and it affords greater shelter."—"Is it your opinion that there is a great deal of land which has little chance of being turned to the best advantage, because some small annual shooting or grazing rental is valued by the proprietor more than the distant prospect of a large return from timber?" "That is so."—"Are any of your plantations deer fenced?" "Yes."—"What increase of cost do you suppose that would be?" "About 4d. a yard more for the fencing."—"What would the planting and deer fencing amount to per acre?" "I could not tell that exactly."—"Could you do it for £4 an acre?" "Yes; on a large extent."—"Five hundred acres?" "Yes."

"In Dr Schlich's evidence he rather seems to recommend the connection of a forest school with Cooper's Hill, where already students receive a certain amount of forestry instruction, with a view of managing Indian forests; do you think a central school of that sort would be a good thing, and if it were established, do you think it would be better connected with Cooper's Hill, or with some more strictly agricultural college?" "Certainly it would be better to be associated with an agricultural college than with an institution like Cooper's Hill."—"Do you think that until any central school, or any school, can be established for the purpose of instruction in forestry, it would be a good thing to carry out generally the same system which has been carried out, according to your evidence, by the Highland and Agricultural Society?" "Yes."—"The system of having boards of examiners in different parts of the country to examine candidates, not only candidates who are going to become professional foresters, but all candidates who desire to be examined in forestry; do you think that system would be a good one?" "I think it would, because no candidate would come up for examination without preparing himself to a certain extent."—"And you believe that if some such system as that were adopted, it would call attention to the defects which you and other witnesses have given us evidence upon, as to the mismanagement, and the want of scientific knowledge of forestry generally?" "Yes, I think it would do so."

"Besides the points which you have mentioned in your evidence, is there any other point upon which you would like to make any statement to the Committee?" "There is one thing, that if the woods were more extensive in Scotland, there would be more employment for workpeople; the country would maintain a larger population."—"Then you think the forest area in Scotland might be largely increased?" "Very largely; it can be very much extended."—"With profit?" "With profit."—"Why is that not done now?" "I cannot tell. It is expensive for some proprietors to do so, and perhaps they are not very able to bear the cost; that may be one reason."—"I suppose the largeness of the capital required is a consideration?" "Yes, very much so; and it does not make immediate returns; that is another consideration."—"Have you ever known a proprietor borrow money from Government, or a society, pay interest upon it, and make it pay?" "I think it may be done; I believe it can be done just now. The Lands Improvement Company lend money to proprietors to form plantations; or, at all events, a certain proportion of the expense is found by the Lands Improvement Company."—"Would the return upon capital laid out in forestry be long deferred?" "I do not think it would." —"How many years?" "Twenty-five years, perhaps."—"Is that the shortest time?" "I could not tell."—"Would there be no return at all before twenty-five years?" "Yes; the thinnings would be of some value after fifteen years."—"Would there be no return for fifteen years?" "No."—"Is not that rather a long time to wait?" "I do not know."—"You are speaking of larch plantations, I suppose?" "Scots fir."—"Scots fir and larch?" "I have just stated that the larch at present is in such an unsatisfactory state that I would not advise a proprietor to invest largely in planting larch. It is so diseased."

"Are not proprietors prevented by the danger of losing many of their trees by gales of wind in Scotland from planting; you mentioned a very great number that were destroyed in 1879?" "We have had a series of gales since 1879."—"Is not it the fact that proprietors may lose a number of trees in that way, and does not that deter them from investing money in planting?" "I do not think so."—"It seems a reasonable thing that it should do so?" "They were not entirely lost, although they were blown down. Of course it glutted the market, and it was an extraordinary occurrence."—"The price was very much lowered by the multitude of trees in the market through those gales?" "Yes."—"You think it is the slow return that prevents the planting?" "That is one reason."—"What other reason are there?" "When sheep farms are let, and when shootings are let, sometimes the sheep farmer and sometimes the shooting tenant objects to the proprietor taking off a slice of land and planting it."—"That means that sheep farming and shooting rents are much more lucrative than planting?" "They are more immediate."—"You think sporting rents have discouraged planting in Scotland; they have been an obstacle to making new plantations?" "I do not think they have encouraged it at all events."—"Do you suffer much from squirrels?" "Yes, a dood deal."

"If there is any evidence which you would like to give on any special point, which will assist the Committee in the consideration of this subject, we shall be glad to hear it?" "I think there is nothing else."

In giving evidence on the same date, Mr JOHN GRANT THOMSON, Forester to the Dowager Countess of Seafield, at Grantown, Strathspey, replied as follows:—

"In what counties are the woods belonging to Lady Seafield?" "They are scattered over the counties of Inverness, Banff, and Moray."—"What is the extent of the Strathspey district in which you have special charge?" "Between 60,000 and 70,000 acres of woodlands alone."—"A considerable sum of money has been expended on the estate since you took charge of it?" "A large amount of money; somewhere about £90,000 or £100,000."—"What do you consider the cost of planting in Scotland, including the carting, the plants, the draining, the wire, and the whole thing?" "It depends very much on the size of the inclosure. If it is a large inclosure it can be done much more cheaply than a small one. In one plantation out of a number that we made, I have the details here. It was nearly 900 acres in extent. It was fenced with six wires and wooden straining and intermediate posts. The straining posts were put in wherever they were required, at distances 60 to 100 yards, and sometimes 120 yards apart, and the intermediate posts were six feet apart. The cost of that was £259, 10s. 2d. Then we planted 2,826,000 Scots fir. They were one year seedlings, two years transplanted, or two years seedlings, one year transplanted; that is, the same age (three years old), but differently treated. Then there were 111,000 of larch, and 50,000 of others, principally spruce. We have our own nursery, but the trees were charged the same as if they had been bought, some 6s. or 7s. a thousand for the Scots fir. That came to £651, 6s. The expense of carting the plants from the nursery and planting them was £328, 19s. 11d., and for drains, £64, 8s. 4d., making a total of £1304, 4s. 5d., or somewhere about 30s. an acre."

"Have you read the evidence given before this Committee of the last year and the year before?" "Partly."—"What are your views with regard to the question of a school of forestry?" "It would be all the better if there could be a school of forestry. If they had the theoretical as well as the practical part, it would be all the better for foresters."—"You have had some experience of training young men on the estate as foresters?" "I have trained a large number."—"Do they come to you as apprentices or merely as labourers on the estate?" "They are labourers and apprentices at the same time. They stay with us two or three years, and then we generally get some other employment for them as foremen or as foresters."—"Do you think if that system were generally adopted, it would, to a great extent, supply the information which is required?" "Yes; at the same time it would be all the better if there were a higher school where they could get more instruction than could be given on private properties."—"They would get the practice on the private properties, and they would get more of the theory at the schools?" "Yes."

"Have you a theory of your own as regards the question of reproduction of trees. Have you noticed that where trees are frequently planted in the same soil there is a tendency to decay?" "Yes. There is the decayed vegetable matter of former crops of trees, which forms a skin on the ground. The seed does not get down to the natural soil, and until it does get to the soil it will not make any perceptible growth. It may keep alive for a time, but it very seldom takes root at all. As soon as it gets to the soil it grows quite freely."—"Do you think the want of reproduction in some of our woodlands is in any way attributable to that?" "Not unless the ground has been under a crop of wood for a great length of time. In the natural forests they have been under a crop of wood for many generations."—"In that case it would be better to grub up the old wood and plant fresh woodland in another place?" "It would be much better."

"You say that replanting on the same ground does not appear to answer. Do you apply that to planting the same kind of trees?" "Yes."—"Would it be different if you were planting chestnuts or oaks after fir?" "Quite different. I have seen natural woods that have been under Scots fir, when they were cut away, the birch grew the next year, or a year or two afterwards, where Scots fir would not have grown."—"Do you think that with regard to a fact of that kind there is much to be learned by systematic experiment?" "There is, no doubt."—"There is nothing of that kind now established, is there?" "Nothing that I am aware of."—"What is learnt has been learnt hap-hazard from the experience of different men?" "Yes; and when one is going through the country taking notes of any matter of that kind."

"Do you think that more would be done for forestry by the establishment of a school for teaching young foresters either theory or practice, or by establishing a system of examination by competent men, and giving the men who are employed to examine some kind of position, such as professors; an endowment, I mean, so that they might go about the country and study the question in a scientific way, and then by means of their examination direct the education of young foresters?" "I think the best way would be to have the school; and have them examined there in the schools."—"Do you think there is a sufficient number of foresters employed to maintain a school?" "There is a sufficient number employed if they would be able to pay the fees. As a rule, foresters are not over well paid, and if they had to pay heavy fees for a school, I am afraid they would not be able to do it."—"At the same time a school must be a paying concern if it is to go on. It is a question of demand whether the supply can be maintained, is it not?" "I should be afraid that the number of pupils would not support a school."—"That is my fear; that is why I suggested the alternative; if we cannot maintain a school, whether we can do anything in another way to promote intelligent forestry?" "Something might be done as you suggest by going through the country, and having centres where foresters might be examined."—"You have heard of the University local examinations?" "Yes."—"You have heard of the examinations spoken of by the last witness, conducted, I think, at Edinburgh only?" "That is by the Highland and Agricultural Society; yes."—"That system might be extended with profit?" "It would be with profit if it were extended."—"Do you think these examinations are sufficiently appreciated by Scottish foresters and Scottish landlords?" "There are only three candidates on an average, come forward each year for examination."—"Are you one of the examiners?" "I am."—"How are the examiners appointed?" "By the society."—"Are they all members of the society, or are they taken from outside?" "I think they are all members of the society."

"Do you think anything can be done in connection with the Botanic Garden at Edinburgh?" "Certainly, you could get information there; but, if I may be allowed to say so, I think if there is a school of forestry they would require a tract of land, so that it could be managed by the school itself. I do not suppose that private proprietors would be inclined to give their ground for experimental purposes."—"Experimenting on forestry would take a long series of years?" "Yes."—"And all that time the rent of the land would have to be paid?" "Of course."—"Therefore, you see that the undertaking is a costly one?" "It would be a costly one. My idea is that they would require 3000 to 10,000 acres."—"What do you suppose the rental of such a tract would be: 2s. 6d. or 5s. an acre?" "You require to pay a great deal more than that. You require to have it where there is good soil, low ground as well as high ground."—"You would not be able to earn the rate out of the forest, would you?" "It should pay itself."—"You think that it is not an impracticable idea that a school might be established with a sufficient area of forestry to form an important centre of education for foresters?"—"It might be established."—"I suppose the school need not necessarily be a very expensive affair?" "No, it would not require to be very expensive."—"How much do you think a school need cost; what would the staff require to be?" "You would require a lecturer or a professor at, say £400 or £500 a year, and you would require a practical teacher of forestry, say at £200 a year, and that would be about all that you would require."—"I suppose men who are going to the Colonies or to India would come and be educated?" "I expect a great number would."

"Have you much natural Scots fir?" "A great deal of natural fir."—"Do you allow much of it to come up; do you inclose for the purpose of allowing natural fir to grow?" "Great quantities; to a great extent."—"What proportion of your timber is natural fir and what is planted. Is half of it natural fir?" "I should think about half is natural fir and birch."—"Do you get a higher price for it in the market?" "No, although it is better quality."—"You ought to?" "We ought to, but we do not."—"Do you cut on a regular system, or so many acres a year?" "Not so many acres a year, but so much thinning, and clearing at the same time."—"Do you have a clean cut every year?" "Not every year."—"How many men do you employ?" "It varies very much; we do a great deal of our work by contract, nearly all the cutting of trees is by contract, so much per hundred; fencing is by contract, so much a yard or 100 yards."—"Since so much land has been put under timber in your district there has been a larger field for labour; it gives more employment?" "It gives more employment for work-people."—"Have you much difficulty in getting your timber to the markets?" "None now. We have the benefit of the Highland Railway and the Great North of Scotland Railway; both run through the property."—"How much has timber gone down in price during the last ten or fifteen years?" "Fully a third."—"Have you been much troubled by squirrels?" "Very much."—"And by game?" "Very little."

"How many wood-cutters do you employ?" "In Strathspey there are three foresters, and under each forester there is a regular staff of men."—"We have it in evidence that a school of forestry would be most useful to the head men; men like yourself or your sub-foresters, and that technical education is not necessary for the men who are only employed to cut down trees, or do the regular planting?" "If those men had the education they might rise from being wood-cutters to being head men, and very likely would rise."—"A forest could be well managed by a skilled head forester and by men under his command who were not skilled?" "Perfectly."—"You told us in evidence that probably young men could not afford the cost of the education?" "Where there is a will there is nearly always a way."—"In speaking of forestry, must we not distinguish between forestry that is necessary for England, Scotland, Wales, and Ireland; I mean, would a forester taught in Devonshire be a good forester for Strathspey?" "I think not; the two are distinct."—"It was argued that there were certain general principles that were equally applicable to all parts of the United Kingdom, but that the practice must be learned in the individual place?" "Almost in the locality."—"Have you any experience of training young men as foresters to go out to India?" "Several of them have been with me for some time before going out, after coming home from France."—"They went abroad first?" "They went abroad to France first and came to me afterwards."

"Have you ever made a calculation of the cost of planting, from the beginning to the end, of any special plantation?" "The one that I have just quoted is from the time the ground was inclosed, which included inclosing, planting, plants, and draining. It cost somewhere about 30s. per acre."—"Have you followed that up by also keeping an account of the cost of cutting and the thinning and any other processes, and on the other side, the money that you received for the sales of the particular plantation?" "None of the plantations that I have made have, I may say, yielded any return yet."—"Then you are unable to give the Committee any information as to any profit which may arise or has arisen on any of your woods?" "From calculations that I made on other plantations I think they should yield about 10s. a year; from 7s. 6d. to 10s. a year per acre."—"You think it would be worth planting any land which did not bring in a rental of 10s. a year?" "Yes, if you have a sufficient extent of it, but if it is only a little bit, the cost of inclosing a little bit is very much extra. It comes to be very expensive if you fence a small bit."—"Do you think there would be a sufficient number of foresters who would take advantage of any school that were established so as to make it worth while setting up a school?" "I think a good number would take advantage of it."

"Do you think the system of apprenticing boys and young men is a good one for teaching them practical forestry?" "I think so."—"Is that a system which is largely adopted in Scotland?" "I always have several young men with myself; I cannot speak as to others."—"I presume they go out to be head foresters to smaller places?" "To smaller places, and sometimes to pretty large places."—"Do you know what the present acreage of forests in Scotland is?" "I think there is somewhere about 730,000 acres of woodland in Scotland."—"I forget whether the Scots fir forests are returned annually with the agricultural returns or not?" "I think they are."

"Do you think that growing trees in Scotland is an industry which is likely to be sufficiently useful from a national point of view to make it the duty of the State to subsidise it?" "I should think so."—"Why?" "Because I think timber is sure to rise in value. Foreign competition will very likely fall off as it gets more inland and more expensive to bring it home, and the home timber will rise in value."—"That has not been the process the last twenty-five years?" "No, it has not."

"Are you able to say from your own experience whether these great plantations at Strathspey and elsewhere have had any effect on the climate?" "I think they have. I know of one plantation that was cut down. There was a spring of water in it before the trees were felled; shortly after the trees were felled the spring dried; now it is replanted again, and they are up four or five feet high, the waters have returned to the spring. The trees prevent evaporation."—"Speaking generally, has the effect of the plantations on the surrounding agricultural land been beneficial or otherwise?" "They have been beneficial as far as shelter is concerned. A great number of farmers have applied to get a small portion of their farms inclosed for the sake of the shelter."—"Can you say whether it has affected the rainfall or not?" "I could not say whether it has, further than the instance I have given you about the spring."

"You just now said you calculated the profit upon certain forests to be something like 7s. 6d. per acre; what do you suppose would be the value of that land to let for other purposes; would it be as much as that?" "No; it would be worth about from 8d. to 1s. an acre."—"It is practically bog land or moor land?" "Not bog land, but moor land, dry moor land."—"What do you think it is worth for the shooting rent and the sheep rent?" "Well, taking the two together, from 1s. to 1s. 3d. an acre."—"Have you any knowledge of woodlands in England?" "I have had experience in the Crown Woods both in the Dean Forest, and at Chopwell, in the county of Durham."—"Do you think there are many districts in England where it would be desirable to plant forests on a large scale?" "Well, I have not sufficient knowledge of the country to say."

"Do Scottish proprietors have much difficulty now in finding competent men to manage their forests for them?" "Occasionally they do find difficulty, especially large proprietors."—"Is there a difficulty in finding the skilled labour which is necessary to properly attend to forests?" "Not a great deal."—"You yourself would not find difficulty in finding skilled labour?" "I have always more applicants than I can find employment for."—"Men who do their work well?" "Yes; who are anxious to get into the employment for the sake of what they see, and of the prospect of getting appointments afterwards."—"Where do the Scottish proprietors now go to find foresters or men to manage their forests?" "They frequently apply to myself, and frequently they apply to others, such as Mr M'Corquodale, and to nurserymen."—"Do you think that Scottish proprietors generally would be favourable to the establishment of a school of forestry in Scotland?" "I think so."—"Do you think it is a matter that they would care very much about, or that they would merely accept it?" "I think that they are taking more interest now than what they used to do in the plantations."

"You told us that the late Lord Seafield invested a large sum of money in planting?" "Yes."—"You said £80,000 or £90,000. Does he expect to get a tolerably good return from that from a commercial point of view?" "Yes, commercially; but then there are other reasons to be taken into consideration. As I say, there are parts of it planted for ornamental and other purposes. Of course, as to what is planted for ornament and other purposes, you do not look to that for interest on your money. You look at it from a different point of view; the beauty of the place, or something of that kind. But the large plantations will pay interest on the outlay, and rent for the land as well."—"Do you think there is an obligation on Scottish proprietors, or any proprietors, to plant a certain proportion of waste lands every year?" "I think so."—"Even if it does not pay?" "It will pay ultimately, I have no doubt."—"Do you think that Lord Seafield would have been as well off if he had not planted trees, but left his moors for grouse?" "I think not."

"We have heard from several witnesses that there is a great deal of waste land in Scotland and elsewhere which might be planted with advantage; of course every waste land will not carry trees profitably; it is no use planting in soil if it is not adapted for growing trees?" "No, it is no use planting in soil that will not grow trees, but there is very little soil but what will grow trees."—

"Damp, boggy soil will not?" "No, that will not grow trees; nor rocky soil, bare rock would not do."—"That would exclude a great deal of waste land in Scotland and elsewhere, that has been been spoken of?" "Yes, if you take it all in one tract."—"Do you think it reasonable to believe that some portion of the diseases of trees arises from their being planted in unsuitable soil?" "Partly. I think it is quite wrong to plant the same kind of trees in different kinds of soil. Some soil is more suitable for one tree than for another."—"You say that it would pay to plant any piece of waste land which is bringing in not more than 10s. an acre; but in the one case you are getting your 10s. without expenditure, and in the other case you have got to go to a great expenditure to get your return. You have got to put down an immense sum before you can get a return from trees, and grouse moors will bring you a return without any expenditure at all. Does not that affect the commercial aspect of the thing?" "These forests do not destroy shooting altogether."—"But they destroy the grouse shooting, certainly?" "Not for a number of years after they are planted."—"You may get black game, but not grouse long after they are planted?" "You get grouse from three to five years after. It depends on the state of your heather."

"In your experience is the use of wood in this country shrinking at all, from iron being more used?" "For large beams and such things as that the demand is falling off, but for ordinary purposes I do not think it is."—"With regard to foreign competition; do you think that will probably lessen in future?" "I think foreign competition will probably lessen in future."—"Is it your view that trees are brought over more cheaply on account of freights being cheaper from a less trade?" "Yes; and labour is cheaper abroad just now, but it is sure to rise as English capitalists go there."

"Is it your opinion that the woods in Scotland and elsewhere are as badly managed as some of the witnesses want to make out?" "There are some of them not very well managed."—"You do not admit that as regards your own woods?" "I think our own woods are managed tolerably well."—"Do you think they are as well managed as they might be if they were more scientifically managed according to the theories of some people?" "I am not aware of anything in which they could be managed better than what is, in fact, being done at the present time."—"I wanted to ask you that question on account of a further question. Do you think your woods are sufficiently well managed to make it desirable as a training ground for students and young foresters; whether they could be adapted to that purpose?" "Well, as I have said, I have trained a great many young men who have gone out to be foresters, and they have turned out very good men."—"Then, in fact, you have practically got a small forestry school of your own?" "Yes, on a small scale."—"You train all your own staff, do you not?" "Well, two of our head men were not trained with me, but all the others have been trained with me."—"Do you consider those men you turn out to be quite competent to take charge of woods on a small scale?" "Quite, and some of them to take charge of woods on a large scale."—"In addition to that, are you good enough to take young men for a short time?" "Yes, we take a considerable number of that kind."—"You would be of opinion that a short course of practical instruction carried on in your woods would be enough to fit a young fellow to take charge of a considerable plantation afterwards?" "He would see a great deal in a few weeks or in a few months, but he would require, I should say, to be twelve months before he would be competent to take charge."—"Do you think he would be competent to take charge of woods without a course of lectures in botany, natural history, and geology for instance?" "He would be all the better for that."—"It would be quite a short course?" "Quite a short course."—"Half-a-dozen lectures would be enough to tell him all the botany he would require?" "A dozen."—"Then how many for natural history?" "Half-a-dozen."

"Is it an advantage of scientific instruction that it would stimulate young men to make investigations and work them up. Would it give them the lines on which they could work scientifically and get further information?" "There is no doubt it would, but the drawback is, that unless they are able to get better salaries than they are getting they could not afford to go to a great expense with their education."—"That is exactly the point; the difficulty in getting good cheap and practical instruction for your young men, who will get from £1 to 30s. a week?" "Yes, or from £80 to £100 a year."—"It would be absurd to think of sending them to a large school for two years' training in matters of science?" "The remuneration would not pay the expense."—"Would you consider it possible to establish at your woods or elsewhere a short practical course which would make these young men quite fit to manage woods on a moderately large scale?" "The difficulty of that would be that one proprietor might be willing, but perhaps his successor might object to it, so that you would require to have a school that would be independent of any one individual."—"Do you mean to say that the woods would have to be independent?" "The school would have to be independent."—"There are no woods in the possession of Government which are sufficiently well managed or extensive to allow that instruction?" "Not unless Government would assist in getting a tract of land as I suggested before for experiment." "You think it would not be practicable to work the thing in Scotland in any of the existing woods on account of the difficulty you have suggested?" "I do not think it would be."—"Have you had some experience of English woods as well as of Scottish woods?" "I have been in the Government woods in England."—"Do you consider that the same rules of forestry, looking at the difference of climate and other differences between England and Scotland, would apply to England and Scotland, the same system of management of woods?" "I do not think it would apply to the South of England."—"You mentioned the interesting fact that when you cut down Scots fir that birch came up instead?" "Yes."—"By a sort of natural succession?" "Yes."—"Have not you found the same thing in England, that when you cut down an old wood some other kind of trees grow in its stead?" "I have not had sufficient experience."

"You know all Scotland pretty well, do you?" "Except the south-east."—"Has there been an increase in planting in Scotland, or a decrease, of late years?" "Until within the last two or three years there was a large increase."—"You mean that in the last two or three years there has been a decrease?" "There has been a decrease."—"To what do you attribute it chiefly?" "To bad times, and the difficulty in getting farmers to allow their land to be planted. Farmers are very unwilling to part with the land, the times are so hard upon them."—"I should have thought that farmers would be rather glad to get rid of a good deal of their land? "Unfortunately it is often the best bit of grazing that is taken for planting."

"Have you regular apprentices under you, men regularly apprenticed for so many years?" "Well, not by any regular form of writing, but they come with the understanding that they will remain for two years or three years, and they look forward to getting something better out of it."—"Then if there was a School of Forestry, these men who had been with you for two or three years would go to the School of Forestry?" "They would go to the School of Forestry."—"You say you do not think the number of people would maintain the school?" "I am afraid of it."—Could you utilise any of the Scottish Universities. There is a chair of agriculture, is there not?" "Yes."—"There is no chair of forestry?" "No chair of forestry."—"Would a chair of forestry be of any value, in the place of a school of forestry?" "Well, not unless they had the practical teaching along with it."—"If there was a chair of forestry in the Universities to which these lads who have been three years with you could go and attend the lectures instead of going to the forestry school, they could get the scientific teaching from the professor of forestry, could they not?" "They could get the scientific training, but they could not get the practical training."—"But they could get the practical training from you in the three years they are with you, and then they could go to the University and get their one year, or whatever it may be, of scientific training?" "Yes."—"Has that been mooted at all?" "I have never heard it mooted."—"What wages do these lads get when they have been with you three years?" "They get 12s. to 14s. a week with me."—"On leaving?" "All the time they are with me; then they look forward to getting on as foreman at 18s. or 20s. a week, or they may happen to get a forester's situation at £60 or £70 up to £100 a year."—"And a house?" "And a house; the salary is occasionally higher."

Mr William M'Corquodale, who has been Forester to the Earl of Mansfield at Scone, Perth, for the last fifty years, gave the following interesting details in the course of his examination:—

"You have been employed extensively as a wood surveyor?" "Yes."—"Have you in that capacity visited much of the woods in England as well as in Scotland?" "Yes."—"You have had a general experience of wood management in England?" "I have inspected several estates in England."—"What is your general impression as regards the management of woodland in England. Is it very far behind that of Scotland?" "The estates that I have been employed on were not so far behind. They were pretty well up."—"Do you find that those who have the management of woods are fairly competent to undertake their duties as woodmen?" "Yes, there are many who have been regularly trained as foresters, and they are competent to take the management of woods."—"In England?" "Yes."

"Have you practically trained young men on Lord Mansfield's estate in the same manner that Mr Thomson has done at Lord Seafield's?" "Yes; I always kept a certain number of young men."—"Were they merely labourers, or were they apprenticed to you in any way?" "We have very few labourers. They are all young men, assistant foresters."—"Do they come to you for a certain time?" "They come for a certain time; some of them serve a regular apprenticeship. I have some from England just now."—"Have they had previous experience in wood management before they come to you?" "Many of them come as journeymen; but I train a number of young men from the commencement. Some of them stay three, four, five, and six years."—"Do you consider when they leave you that their practical knowledge is sufficient to enable them to manage woods skilfully without any theoretical instruction?" "I consider that many of those who remain for four or five years are very competent when they leave me."

"Do you think a school of forestry is really required in Scotland?" "Well, I do not think a school of forestry would be very well supported."—"Do you think, independently of the measure of support it might receive, it is really required?" "Young men training for the Indian forests might take advantage of it, I have no doubt; but the truth is that foresters in Great Britain are not very highly paid, and they cannot afford to acquire very expensive education."—"Do you think it would be sufficient for present purposes that young men should receive a practical instruction in such woods as those of Lord Seafield's, Lord Mansfield's, and others?" "I do."—"And then go to Edinburgh and complete their theoretical education in the manner which has been suggested?" "I think they could be sufficiently trained as practical foresters without a forestry school."—"Do you think that through the agency of the University of Edinburgh and the Highland and Agricultural Society's examination, there would be sufficient provision made for the necessary theoretical instruction?" "I do not think there would."—"You think that there would be something more required than the advantages which the University of Edinburgh would afford if there was a Chair of Forestry?" "If there was a Chair of Forestry."—"Without it you think not?" "I think a chair combined with the Agricultural Chair might be quite ample."—"There is a Chair of Agriculture?" "I think there is."—"To that you would attach a Chair of Forestry, that is to say, that the same person, the professor of agriculture, should also instruct in forestry?" "I should think so."

"Do you think, at the present time, with the drawbacks of preferential rates and foreign competition, that timber really can be grown to a profit?" "Foreign competition is the ruination of our own timber, I know."—"But with all these disadvantages, do you think still that there is any hope of growing timber in Great Britain and Ireland at a profit?" "Yes, I think that timber may yield a pretty good return if well managed. There is a great mistake frequently made in not planting the proper tree. It is a crop that cannot be altered for fifty or sixty years; and the right tree should always be put into the right place."—"Then who are the persons who should direct that proper selection; the factors, or the land agents of estates?" "Well, I do not think the factors are very competent."—"But they are the persons who naturally would make the selection?" "There is frequently advantage taken of that by such as Mr M'Gregor, Mr Thomson, and myself. We, and such as we are, frequently go to give advice. I have been employed on the estate of Lord Dalhousie, on which I have laid out 22 sites for new plantations varying from 10 to 200 acres each."—"But by some system of instruction the factors, who are really responsible for this selection of the trees and the supervision of the plantations, could be made quite capable of managing woods without the special advice of such gentlemen as yourself?" "It is very rarely that factors have experience in selecting trees for growing. For instance, taking land going to be planted, if my opinion was to be asked I should say on some lands, 'plant larch and Scots fir intermixed in equal quantities;' on other lands I would recommend silver fir to be planted for a permanent tree, and so on."

"You have had a good deal of experience with the Douglas fir?" "Yes."—"Have your plantations succeeded?" "They are doing remarkably well. Lord Mansfield's are the most extensive plantations of the Douglas fir (*Abies Douglasii*) I know."—"Have you suffered much from trees being blown down with wind?" "No. There is one plantation on which a good many were blown down; but there is one on the side of the railway to Dunkeld that has never had a tree blown down in it. There are eight acres of it. It is a pure Douglas fir plantation. It was thinned in the spring of this year. We have taken 620 trees out of it; and they are the largest of their age I ever saw. They measured about 60 feet in length;

they are twenty-seven years of age; many of them girth 5 feet 9 inches in circumference 3 feet above the ground. I never knew of that amount of growth in any conifer of the age. There are two trees of the Douglas fir growing on the estate of Lynedoch; and when they were fifty years of age they were 73 feet in length. These trees contained 150 cubic feet of timber each. The larch is a very fast-growing tree; and very rarely indeed have I found a larch fifty years of age to contain 50 cubic feet of timber; but the Douglas firs have added 3 cubic feet for every year of their growth."—"Have you put any Douglas fir timber into the market?" "This is the first lot that has been thinned out; I have sold individual trees, perhaps a score at a time, but this is the first lot of any consequence."—"Can you tell what it cost to plant all those eight acres of Douglas fir?" "We reared the plants from seeds, and the planting cost about 10s. per acre."—"What did you get for the 620 trees that you sold?" "They are not sold; they have just been cut."—"What do you expect they will fetch?" "I do not know how they will sell, as the wood is not known, but I should hardly expect that they would sell for as much as larch spars, for which we get 4s. to 6s. per 100 feet run."

"Is it your experience that plantations in Perthshire have suffered much from game?" "They have suffered very much."—"There has been great loss by game?" "Great loss. The rabbits and hares will eat the bark of trees from 80 to 100 years of age, elm, ash, and beech. I have seen them peeling them, raising themselves up as high as they can, and not leaving any of the bark within two feet of the ground."—"You find game is very prejudicial to forestry in Perthshire?" "Yes, very."

"Have you any experience of making a plantation with borrowed money?" "No."—"Can you imagine any man who would borrow money from the Government at three per cent. and make it pay?" "Well, it might pay; but it will take a considerable time before it does. Lord Stormont wished me last year to draw out a note of what 20 acres would cost to plant, and what they might realise in eighty years. I have drawn out this paper for Lord Stormont. Perhaps I may read it."—"Yes; pray do." "It was 20 acres of land to be planted under larch."—"Will you give us the heading?" "First of all, there is the cost of fencing 20 acres, £41; cost of plants, £25; cost of planting, £8; rent of 20 acres at 10s. per acre, £10; that amounts in all to £84. Then there is compound interest on above £84 for twelve years, that is £126, 8s. 7d.

Then, first, thinning at twelve years of age 4000 trees at 1d. per tree, £16, 13s. 4d.; deduct cost of thinning, £8, 6s. 8d.; deduct balance in favour of thinning, from £126, 18s. 7d., and then that leaves £118, 11s. 11d."—"Can you tell us how much an acre you made it at the end of eighty years?" "At the end of twelve years, £16, 13s. 4d., for the 20 acres at 1d. per tree. Then I take the £118, 11s. 11d.; at seventeen years of age, compound interest for five years, £130, 2s. 10½d.; at seventeen years of age, second course of thinning 300 trees per acre, 6000 trees at 2d. per tree, £50; cost of thinning, £25; deduct balance in favour of thinning, £25. Then it reduces it to the amount of £105, 2s. 10½d. Then taking £105, 2s. 10½d. at twenty-two years of age, compound interest at five years, £124, 14s. 1½d.; third course of thinning 8000 trees at 4d. per tree, being at the rate of 400 trees per acre, £133, 6s. 8d.; cost of thinning and repairing fence, £50, 16s. 8d.; deduct balance in favour of thinning, £82, 10s.; then that reduces the amount to £42, 4s. 1d. for you to charge compound interest on. At thirty years of age the interest is wholly paid off, because the planting and everything is paid off in thirty years. It is like thirty years' purchase. Then at thirty years of age balance in favour of plantation, £57, 3s. 10½d.; at thirty-seven years of age, 200 trees per acre, that is 4000 trees at 2s. per tree, £400; deduct cost of thinning, £33, 6s. 8d.; balance in favour at that age, £366, 13s. 4d. At forty-five years of age, 100 trees per acre, 2000 trees at 2s. 6d. per tree is £250; cost of thinning, £31, 5s."—"You need not read all the figures; can you give us the total result?" "The result is, 'Matured crop at eighty years, 130 trees per acre, in all 2600 at 20s. per tree, £2600, and the total amount in favour of plantation is £3217, 12s. 2½d.' That leaves exactly £2 per acre of rent throughout for the land."—"Throughout the period of how many years?" "Eighty years."—"Will you hand in that document?" "Yes."—"Have you allowed anything for rates and taxes in that estimate?" "The rent is calculated from the commencement."—"But there are rates to be paid every year upon it?" "The rates are not included. The rates on plantations in Scotland are very small."—"You make no allowance for that, do you?" "There are no rates mentioned."

"You said you did not think that there would be enough demand for a School of Forestry in Scotland to make it pay?" "I scarcely think it."—"Do you think there would be enough demand to make it desirable for Government to pay for it?" "If there were established a forest school, and if there were a large Government forest in connection with it, I believe it might be taken advantage of, and be of great service in training young men."—"If there were established a school in connection with some of your large woods in Scotland (for instance, your woods), do you agree with Mr Thomson, who said that the difficulty would be that one proprietor might approve of such an arrangement, and that his successor might not?" "I do not know really that it would be taken advantage of as it ought to be."—"Do you not think, that if you had a forest school on a small scale attached to some of your large woods in Scotland, the proprietor would have this advantage, that it would guarantee that the woods would be thoroughly well worked, and that it would be a guarantee for the scientific management of that particular wood?" "I believe it would be advantageous."—"Have you any plan to suggest, short of a Forestry School, as to any smaller school than a Forestry School, at which young forest men, getting from £70 to £80 a year, would receive a better training for their work?" "I do not think that ordinary school teachers can teach much of the science of forestry."—"They have not been trained themselves, in fact?" "I do believe that if young men are very well educated, and properly trained, and serve a regular apprenticeship, they would come out very useful foresters for anything either at home or abroad."

"I believe you have nothing farther to tell us about the commercial value of the Douglas fir?" "No, I cannot say, because it is a new kind of timber; it has never been brought into the market, but I have tried it in fencing and for gates and gate-posts, and it has been found to do very well. We had some fine trees blown down about eleven years ago, which I had cut up into fence posts, and they have been put into wire fences. They are still, that is eleven years, in the wire fence, wearing twice as long as Scots fir posts would do."—"You think it is a good quality of wood from what you know?" "I think it is."—"It is not subject to any disease like the larch?" "It is a tree that is exceptionally free from insects. I do not know a single insect that is peculiar to it."

"Do you find silver firs worth anything as timber?" "Yes; about eleven years ago I could not get reliable information as to how they would last as railway sleepers, from engineers or foremen over the surface men of railways. I got four silver fir sleepers cut, and they were laid on the railway when they were laying sleepers, four miles out from Perth; they were laying at the same time new

Baltic sleepers, and I got the engineer to lay them together to fairly test them. They were laid eleven years last April. They are still in use, and most of the Baltic sleepers were thrown out three or four years ago. I believe that the silver fir sleepers will wear for four or five years yet."—"Do you know whether the value of these foreign fir trees varies a great deal according to the locality and the soil in which they are growing?" "Do you mean foreign?"—"I mean your silver fir. That is not an English tree. The general experience of it is that it is inferior as timber, is it not?" "The quality depends a good deal on the soil and the climate. For instance, Scots fir that is grown in Scotland is a great deal richer, and more full of resin, than a Scots fir grown in England. If you split up a bit of old Scots fir it will blaze like a candle, it is so rich and full of resin. That is not the case if it is grown in England, as far as I have seen."—"What sort of soil were these firs grown in that you cut such good sleepers out of?" "The subsoil is stiff till, with a good rich loam on the surface."—"They were grown in good land?" "They were grown in good land. I believe these silver firs are likely to wear out larch sleepers; larch sleepers stand on an average eight or nine years, and these silver firs have been in eleven years. There was nothing applied to them, no creosote, or anything of that kind."

"You say that the higher the altitude where the Scots fir grows the better the quality of the timber; is it better in Scotland than in England?" "I did not say that the higher the altitude the better the timber; but the quality of Scots fir is generally very good upon high altitudes."—"But Scots fir grown in Scotland is better than that grown in England?" "Yes, it is."—"Because it is a more northern climate and more suitable to it?" "Yes, I believe it is, and there is something in the soil in Scotland that produces a rich timber full of resin."—"You have spoken of the Douglas fir tree. You have a high notion of its value, and you have also spoken of the silver fir. Have you any experience of any other of the foreign pines recently introduced; for instance, the Corsican pine?" "The quality of the timber of the Corsican pine is something the same as the Scots fir; it grows very rapidly, but it is very shy to start after being transplanted. When planted out into the forest a great many die. They are very bare of fibrous roots. It is a very difficult tree to establish, but when they are once established in the forest they grow very rapidly, and I believe it is going to be a very good timber tree."—"Have you any experience of the Sequoia or Wellingtonia?" "Yes, but it will never be a good plantation tree nor very ornamental; it tapers so much. It would not cut up advantageously."—"I mean what they call in America *Sequoia sempervirens*, they find a very useful tree in America; it is half-brother to the Wellingtonia. Do you grow it?" "No."

From a proprietor's point of view, Mr ROBERT DUNDAS of Arniston, Midlothian, gave some useful evidence bearing on a Forestry education in connection with the Scottish Universities, stating as follows:—

"Will you give us your views as to a school of forestry?" "Well, as to that, there has been a great deal of talk about schools of forestry, but I think the want of them has been much exaggerated; I do not think there is the real want that is stated. People go about, and they see woods that are neglected, and it is put down at once to want of scientific knowledge on the part of the foresters, but the fact is that the bulk of the woods we see neglected now-a-days is due to the unremunerative nature of wood growing, and because the owners cannot and will not throw away good money after bad in keeping them in order; that is really the cause. Then with regard to one or two other points. I think there never was a time when in Scotland, at least (the only part I can speak about), the foresters were such a highly-educated intelligent set of men as they are just now; I think they are thoroughly up to their work. You may give them, of course, a little scientific training on the top of their practical knowledge; but I do not think there ever was a time when there was a more highly educated and better set of men than the Scottish foresters are just now. Then there is one objection which strikes me at once to what are called the Schools of Forestry, and that is the large expense it would be to the country in establishing them and keeping them up when once they were established. I do not think that a young man would learn his work so well in what would be a school of forestry, as he would as an apprentice under a thoroughly good forester on a well-managed estate. I saw a good deal of that when I was young, because Mr Brown, my forester, of course became very well known all over both England and Scotland, and numbers of lads came to be trained under him and to learn their work. In fact the demand on him to supply foresters was so great that they were, many of them, not quite long enough there who were sent out; but he turned out a great number of first-rate men, who to this day, many of them (and I think it is forty years ago), are up and down different parts of England and Scotland. In fact the only possible plan of training a set of good foresters is by apprenticeship on a large estate under a thoroughly good man. That would take a man on to say twenty-one or twenty-two years of age. Then if it was thought desirable he might go to any of the institutions. The Scottish Universities are the cheapest places for instruction you can have, and in England there are now arising similar institutions here and there where scientific training is given at a very cheap rate. That might follow the young foresters' five or six years' learning of the work under a thoroughly good practical man, but I certainly should be sorry to see any attempt made at starting a school of forestry without first of all trying the plan of utilising the institutions which are in existence, such as the Scottish Universities and the training institutions in different parts of England. I have had a little experience about that. I am patron of a few poor bursaries in the University of Edinburgh, and small as they are (they are only £20 a year) there is always a number of candidates. It shows that the system of establishing bursaries, if that were tried, need not be very expensive to the nation; there is always a great competition to get these little £20 bursaries. Occasionally I have applications from men who have been in trade, artisans who for some reason of their own wish to get a scientific training, or even occasionally they wish to go out as missionaries and to get training for Church work afterwards. But the main point is that I think £20 or £25 a year would be sufficient to enable a lad, after he had learnt his practical work thoroughly, to go to Aberdeen or Edinburgh and to get what additional scientific training might be thought desirable there. I think that the nation would get far more for their money in that way than they would by establishing a school of forestry. I think schools of forestry would be very expensive, and I do not know that they would turn out good results. Of course one must also keep in mind that the number of foresters for whom places are to be had is very limited; it is only upon a large estate that remuneration can be given for a well-educated forester. I think there would scarcely be openings if schools of forestry were established upon a large scale for the lads that they would turn out. Then as to teaching boys at parish schools or public schools of forestry and agriculture, I have no idea that that would answer. I think a lad, if he intends to take to farming or forestry, must learn the practical part first of all, and then get any scientific addition to it later in life when he is able to take it in better. I think as far as forestry schools go, what I have said explains my view."

"What are bursaries. Are they what we call exhibition scholarships?" "Yes; they are established by money being left for the purpose."—"Are they obtained by competitive entry?" "A great many are by competitive entry. These I speak of are in private patronage."—"You are aware that the Highland and Agricultural Society have taken up the subject of forestry?" "Yes. I have been taking a leading part for many years in it."—"And a certain amount of value is attached to those who have gained their certificates?" "Yes. But if there is anything to be done in the way of forestry education, I think it would have to be by establishing bursaries or some mode of that kind."—"Young men might, after working a certain time upon a large estate, if they obtained any of these bursaries, supplement their instructions?" "Yes, quite so, by a session or two. I am not speaking at random on this question, because I have known several cases of farmers' sons who, before beginning regular work, have gone to the University of Edinburgh for one or two winters, simply to get scientific teaching on the top of what they had acquired with their fathers on the farm, and in one instance I knew the son of a forester who did the same."—"But then there must be somebody capable of giving the scientific instruction, a professor of forestry, attached to the university?" "Yes. There are many of the Chairs in the Edinburgh University which could be utilized for any such purpose."—"The instruction in forestry might be combined with agriculture?" "To begin with, there is a Chair of Agriculture and Rural Economy. Rural economy ought certainly to include forestry. The Professor is a young man newly appointed, and I should say he ought to be perfectly able to take in hand both forestry and agriculture. Then at the same time there is geology, botany, natural history, and chemistry. I think the great advantage to young men of getting a course or two is, that although they may not go very far into the science, it teaches them how to observe. The want of accurate observation is a great drawback to foresters and farmers. They have never been taught to use their eyes in matters of minute detail, especially as to the causes of diseases of wood and the diseases of plants. It is very difficult to get an accurate account of what the man really sees unless he has gone through a certain amount of training to fit him for accurate observation."—"Would not that accurate observation be fostered by a school of forestry?" "Of course it would, but when you have got an institution like the University at Edinburgh and the University at Aberdeen, where you have a staff already at your hand, it would be rather an expensive way of going to work to start another one. My point is, that at all events before starting a school of forestry the teaching of forestry should be attempted in combination with the existing staff at Aberdeen or Edinburgh, both of which are within reach."—"Would not the absence of woods from the neighbourhood of Edinburgh and Aberdeen be a drawback to that?" "No, I do not think so, because I am contemplating that the young men who go there simply go there for a winter course, and that they have been five or six years at the practical part of their business and have learnt that already."—"Then with regard to the expense, you spoke of the very large expense of a school of forestry?" "Yes."—"The evidence that we have had points to some £600 or £700 a year as being necessary for salaries. You would not regard that as very heavy?" "I do not see how anything worth establishing could be done at that sort of price."

"Do you know whether the Agricultural and Rural Economy Lectures at Edinburgh University are well attended?" "That I do not know. Professor Wallace has been a very short time in the Chair, and the class had gone down very much before he was appointed."—"His predecessor had not a large attendance?" "Under his predecessor it had not answered well; I think there is no reason why the Professor of Agriculture in Edinburgh should not also teach forestry."—"Do you know what class of men go there as students?" "Well, the bulk of them are those who are intending to be land agents, and I suppose a certain number of the higher class of farmers' sons."—"Your idea would be that lads who were to become foresters should have their practical training under an existing forester in some of the large estates?" "Yes. With regard to practical knowledge, they should be thoroughly up to their work before they leave the man under whom they are being trained."—"And then get scientific training?" "And then get scientific training for a winter, or perhaps two winters. I would do it in the Scottish fashion, which is taking a half-year at a time. As you know, there are many Scottish lads who cannot afford a whole year, and they work during the summer, and they go to the University and get their class lectures during the winter. That is the only practical way of giving scientific training to a forester."—

"You think they should attend the lectures of the agricultural professor and also lectures in chemistry?" "And botany and natural history."—"What rate of fees would they pay, say for a course of lectures on agriculture?" "That I am not able to say."—"Three guineas a course?" "I do not know how much it is; it is not much. It cannot be much from the very poor class who sometimes attend."—"Probably it would be about three guineas a course?" "Probably."—"You think that would be preferable to starting schools of forestry?" "Much preferable."

On the general question of Forest Schools, Sir Joseph Dalton Hooker, ex-Director of the Royal Gardens, Kew, gave some valuable evidence as follows:—

"Have you formed any opinion which you would communicate to the Committee as to the present condition of woodlands in this country?" "I have observed that they are very much neglected, but then it must be remembered that it is very difficult to judge between what are planted as mere shelter and what are planted for woodland purposes. As a rule, those which are planted chiefly for shelter are entirely neglected, and are not looked upon as a source of profit; whereas woodland and copse woods, if grown for profit, are in quite a different position."

"Do you consider that the establishment of a school of forestry in some form or other would be advantageous to the owners of woodlands in this country?" "I think that an establishment teaching forestry would be exceedingly useful, but I am not prepared to say that I should advocate the establishment at once of a school of forestry proper in addition to that at Cooper's Hill."—"Would you favour the Committee with your views as to what would be the best mode of developing the teaching of forestry?" "I can hardly say that I have considered the matter, except with reference to India and the Colonies, which I have been consulted about; but my impression is that the best plan would be to take advantage of the existing institutions as far as possible. At Cooper's Hill there is an amount of first-class teaching of forestry for certain purposes, and it is a great pity that that first-class teaching should not be utilised as far as it goes more for general purposes. Nor do I see why the agricultural colleges should not be taken advantage of. It is a great pity that the teaching of agriculture and sylviculture should be entirely dissociated."—"You would rather introduce the study of forestry at the existing institutions than found an independent school of forestry?" "Yes; I would do this as a tentative process, and if it succeeded it would then be the time to consider the expediency of forming a school of forestry proper."

"Has your attention been directed to the evidence given by Colonel Pearson before this Committee last year?" "Only to those portions which you pointed out to me to-day."—"You have not, perhaps, had time to form an opinion upon his evidence?" "I was already familiar with what you had pointed out to me as regards Colonel Pearson's recommendations, because I was consulted about the formation of the teaching establishment at Cooper's Hill."—"Will you tell us how far you concur with the evidence of Colonel Pearson?" "Generally, I may say I entirely concur. I think that Cooper's Hill might be taken advantage of with very great benefit."

"Are you acquainted with the system which is pursued at the Agricultural College at Cirencester?" "I am not."—"I gather from your previous answers that, without expressing a distinct opinion upon that subject, you would rather lean to the idea that instruction in forestry might be introduced with advantage at Cirencester also?" "Yes; I think that would be very useful in many ways. Many of the agricultural students would very probably have to act more or less as foresters, and it would be a great pity that they should have to go to another special forestry school to learn much of what they might have learned during their stay at an agricultural college like Cirencester."

"Would you endeavour, at first at all events, to localise the study of forestry so as to bring together all those who desire to take up the study of forestry?" "I think there are certain institutions to which forestry students would naturally like to go. For instance, such places as the Scottish universities, and Cirencester, and Downton, because of the other information which they might obtain there, and which information would bear upon forestry."—"My question was rather, do you think that there would be so many students of forestry, at first at all events, that it would be desirable to introduce special instruction in forestry at several centres; or do you think it would be better to begin by selecting some one institution for that purpose?" "I am not quite prepared to answer that question; but my impression is that there would be difficulty in getting Scottish students to come all the way up to London, or to Cirencester, or to Cooper's Hill; but that is a question of expediency upon which I could hardly give an answer. As regards England, I think there would be no material difficulty in students proceeding to Cirencester."—"Then I may take it that as regards England you think it would be better to try to select some one institution, not necessarily a new one, for the purpose of teaching forestry?" "I think so. But there is a reason why Scottish students might prefer the teaching in Scotland, and that is because the forests of Scotland are in so many respects different from those of England."—"But as regards England you think it would be better to endeavour to keep all the students of forestry at some one institution, in the first instance at any rate?" "I think so."—"Would you recommend the Committee, on the whole, to adopt the suggestion which was thrown out by Colonel Pearson?" "Yes, I think so, having regard to the provisions he makes for land agents, and bailiffs, and so forth."

"What you have said has reference to the training of managers and land agents?" "Yes; but I would even throw all the teaching open to persons of a lower grade, because you often have exceedingly able young men who are not land agents, but who would rise to be land agents if they had the facilities and encouragement which such a training would give."—"You imagine that they would try to get the diplomas?" "Yes."—"But they would not necessarily go in for the wider training which such a college would give?" "Not necessarily; but I think that very likely young men of ability would go in for the wider training after commencing the other, and that is the reason why I think that advantage should be taken of a place which has the best means of teaching, which I assume would be Cooper's Hill for a long time to come."—"Rather than Downton and Cirencester?" "Yes. One reason why I should recommend some teaching of forestry at Downton and Cirencester is because I think agriculture and forestry should not be dissociated."—"Do you think that there is sufficient opportunity of practical instruction in forestry at Cooper's Hill?" "I do not think there is now, but I think there might be. Under any circumstances that is a necessity."—"Do you think that we ought to ask the Government to endow a professor, or to contribute to the establishment of a class of forestry at Cooper's Hill?" "There is one there already."—"That is only for India, is it not?" "Yes, primarily, but the instruction given for India would be very useful for land agents generally; and, as was recommended in Colonel Pearson's Report, and which I approve of, shorter courses might be given at the same place for such land agents and bailiffs as would not go through the whole course of study."—"Do you think that anything could be done at Kew in connection with such classes?" "I think that the elementary training in botany and also instruction on all such matters as diseases of timber and so on, could be arranged for there. Furthermore, I believe that there is forming at Kew a large collection of instructive specimens illustrating injuries to timber produced by fungi, insects, etc.; and a study of such is essential to a sound forestry education."—"Would it be possible to combine that training with the Cooper's Hill classes?" "So far as botany is concerned I believe that it is already arranged that the students at Cooper's Hill will have some instruction in botany in the museums and gardens at Kew, and this would be supplemented by the good timber collection which has been got up at Kew."

"Your view is, that the existing institutions should be profitably utilised for the study of forestry?" "That is the first step. If there was thereafter found to be a great demand for the study of forestry, it would then be a question whether a forestry school other than Cooper's Hill should not be established."—"Is it not rather a cumbrous plan for a land agent first to have to go to the Agricultural College at Cirencester to get his agricultural training, and then to come up to London to get his forestry training in another place?" "Yes."—"Would it not be more convenient to have the two things taught in the same institution?" "Yes."—"Is much theoretical instruction necessary to a student in forestry?" "I think that a sound elementary acquaintance with five or six branches of science would be very useful, but not more than a young man could pick up at such a course of instruction as I should contemplate, and as is, I believe, to be obtained at the Agricultural Colleges."—"What branches of science would you suggest he should be acquainted with?" "I should say meteorology especially; and the organs and tissues of plants, physiological botany, geology, and elementary chemistry."—"You would recommend that only for a man of good emoluments who was going to take a good position?" "It would be necessary for him, but it would be useful for all. I should be inclined to have the instruction so arranged that all classes might have an opportunity of obtaining some acquaintance with the different branches of science concerned in forestry, so that if a gentleman wished to send a young lad of ability, however poor he might be, to study forestry, he might go through the elementary courses first, and then, if he proved competent, he might go up for the higher and fuller curriculum."—"Would it be necessary to have a regular curriculum?" "There is a regular curriculum for India and the Colonies, and I think such a one should answer for land agents."—"Would it not be enough to have merely an Examining Board?" "An Examining Board is one thing, and a curriculum is quite another. The curriculum provides for a regular and continuous course of study. As to the Examining Board, I am not prepared to say what would be the best composition for such a board."

"The difficulty connected with this matter in Scotland is that our foresters are quite small men, who are paid £1 or 30s. a week, and the great desideratum in their case is to get some kind of training which they can get through in some three or four months?" "Yes, I am aware of that difficulty, and that is the reason why I have suggested that there should be elementary courses at Edinburgh, Glasgow, Aberdeen, and St Andrews, or in perhaps two out of the four Scottish universities."—"What is the shortest course from which such a man could really get advantage?" "I should say three months. Of course, six months would be better."—"Would a course of three months' training be long enough to give a man sufficient theoretical instruction to enable him to usefully apply his knowledge in the management of woodland?" "Yes, and to enable him to go on afterwards with books. It would put him in training for future progress on his own part. It would give him scientific methods of study, and then he could go on by himself afterwards."—"That might be quite a cheap course?" "Yes, the great expense would be having to live in Edinburgh or in Glasgow, or wherever it might be; but that is what as poor students of other subjects are doing now in Scotland."—"And Scottish students, as a rule, are very frugal, are they not?" "Certainly."

"Are there any trees which are not usually grown in England now, but which could be grown at a profit in this country?" "I have thought over that matter a great deal, and I cannot say for certain that I know of any that could be. The growth of such trees is so different in this country from what it is in their native country. Taking, for example, the larch disease which has been spoken of here this morning: I remember the larch disease forty years ago as existing then, though not to the same extent. We are growing the larch now in a climate which is totally different from its native climate. It is an eastern tree; it begins in the Tyrol, and extends eastward into Eastern Siberia; it is not really a western tree at all. We are now growing it here in a climate which is not the true climate of the larch."—"Do you think that we could grow the Corsican pine, the *Pinus Laricio*, at a profit in this country?" "I do not see why we should not; it is a very good wood; but it grows much more rapidly here than it does in Corsica. It does not, however, follow that because the wood is good in Corsica it will be so in Britain. If you take a section of the *Pinus Laricio* grown here, and a section of it as grown in Corsica, and compare the two, you will find that there is a considerable difference in the wood."—"Have you any experience of the Douglas pine grown in masses in this country?" "I have seen a great deal of the Douglas pine; it has been in this country for about sixty years. I have taken sections of the Douglas pine grown in this country, and compared it with others grown in America, and the difference is so enormous that I cannot suppose that the wood of the Douglas pine of this country will ever be equal to that grown in Vancouver. If my memory serves me, I have found five annual rings in Vancouver-grown specimens to one of trees grown in this country. The same may be said with regard to the growth of the cedar of Lebanon; in its native country, where it only grows four or five months of the year, its timber is close-grained, hard, and durable; whereas the wood of English-grown trees is valueless."—"May I take it that in your opinion many trees grow too quickly in this country?" "Yes, the northern ones and those from drier climates."

"You spoke just now about the larch growing in this country in quite a different climate to that to which it is accustomed?" "Yes."—"Do you think that has anything to do with the development of larch disease, of which we have heard so much?" "I think that is quite probable. That disease might have a much more rapid development in a moist climate like Great Britain than in Eastern Europe or Siberia."—"That does not hold out a very encouraging prospect for the future of the larch in this country?" "It does not."—"Do you think that the disease has anything to do with the seed?" "No, it is outside it altogether."

"Of course the education of foresters who are intended for the Indian service, or for the Colonies, would be carried much further than that for woodreeves or land agents?" "Certainly."—"But there would be a great deal that is common to the two courses, would there not?" "Yes, all the elementary principles would be common to the two."—"Therefore, the Government having already established a course of instruction for the higher order, that establishment might be utilised for the instruction of men who did not intend to carry the matter so far?" "That is my view."—"Among some of those who have come here to give evidence, particularly those representing land agents, and the landed profession generally, there is an opinion that it would not be so absolutely necessary for woodreeves and bailiffs to go to a school of forestry if there was a school where the land agents could be instructed, because the land agents would then be able to communicate the information they had received to the woodreeves and bailiffs under them; would you agree with that opinion?" "I should doubt whether they could communicate it sufficiently scientifically. It wonld be a great advantage, no doubt, that they should have the knowledge, but still I think it is the training in scientific methods that the men get in a college or a school that would be specially important to them."—"Landowners in these days would hardly be likely to pay the expense of a man going away from the land for three months, or six months, or twelve months, as the case might be?" "No, it is a money question throughout, no doubt."—"Whereas a land agent would willingly go for instruction to a school which would probably enable him to get a higher position?" "Yes, and also for the certificate which he might thus obtain."—"Probably a man who has had a three months' course would have a better chance of getting a place than one who has not had that advantage?" "Yes, it would give an opportunity to a man who had not intended to go into the higher branches of proceeding onward to these. He might show ability at the lectures which he would be obliged to attend, and that might lead to his being encouraged and helped to go on to the higher branches."—"You consider that although a land agent himself might give a certain amount of instruction to the woodreeves under him in scientific subjects, which would be better than nothing, that would not be nearly so good as the instruction which the men would get from three or six months' residence at a college?" "It would not compare with it."

Upon the general question also, Dr John Croumbie Brown, LL.D., Haddington, gave farther evidence, as follows:—

"You have had considerable experience in schools of forestry on the Continent?" "Yes; I have visited most of the schools of forestry, and have had correspondence with the managers of all those which I have not visited personally."—"Which of the foreign forestry schools with which you are acquainted would you consider the best model for one in Great Britain?"—"The question was put to me last year, and on the spur of the moment I answered 'Spain;' and continued consideration of the subject satisfies me that Spain is decidedly the best model for a school."—"Is the school in Spain an independent school of forestry?" "It is an independent school of forestry, supported by the State, at the Escurial."—"Not connected with agriculture?" "Not connected with agriculture."

"What does the staff consist of?" "In round numbers I should say a principal, ten professors, and ten assistants."—"Of what class of men are the students principally?" "They are equal to those who go to the university. They have gone through a preliminary training in the schools, which would have fitted them for a university course if they had chosen to go there."—"And do they go out afterwards as forest managers?" "They can at once have an appointment by the Government, or they may be employed by private proprietors. They prefer the Government appointments."—"Have you any idea of what the expense of the course of instruction there is?" "There is this difficulty in taking the cost of instruction at the schools on the Continent, that in many cases the school-house which may be a palace is given free. In almost all cases the teachers hold Government appointments as foresters, and have a gratuity in addition to their regular pay; in Spain the addition runs from 60 to 100 guineas over and above their pay. It is only the superior officers of the forest engineers who get the higher appointments. It is not in that respect, however, that I recommend Spain as a model; it is more the perfect freedom and liberal course of study that is followed there that I recommend it for."

"Are there forests in the immediate neighbourhood of the school in Spain?" "There are in the Guadarrama; but they do not attach great importance to having forests in the immediate neighbourhood of the school. In common with all the advanced foresters on the Continent, they say that is a matter of very little importance. They take the students to the forests that they may see what is being done, and that there the professors may explain what has been said in the lectures, illustrating this by what the students see going on in the woods."—"Have they any nursery?" "They have a small nursery, but the different students are not required to engage in nursery operations; the nursery is very limited."—"Have they a museum?" "They have a museum."—"Where they have collections of various specimens?" "Yes, collections of everything connected with forestry, forest products, and the produce of forest industry, the implements that are employed in forest management, and mechanical, hydrostatic, hydraulic, and other illustrations of physical science."

"Besides the students of the class you describe, are there any of a subordinate class corresponding to our woodreeves?" "Not there. They attempted an inferior school elsewhere, but it was found not to be successful. It was found better to entrust the training of workmen employed to the highly educated and trained students who had left the school."—"In your opinion, after well considering the subject, do you think that the very best principle to adopt in the event of any school being established, is to endeavour to instruct, as far as possible, scientifically the land agents who have charge of the woods, and leave it to them to instruct, so far as they can, their subordinates, namely, the woodreeves, bailiffs, and working men under their charge?" "I am not prepared to say that. What I admire in Spain is, that instead of just going on in the rut they have adapted the training to the requirements of the country, and we too should adapt our training to the requirements of Britain and our Colonies."

"Your views, as already given in evidence, were rather in favour of having a school in each country?" "I should be in favour of one national school."—"You said that in Scotland it would be better to have one at Edinburgh." "Yes."—"When you speak of having one national school, do you mean for the whole of Great Britain?" "I believe that in Edinburgh we have facilities for the establishment of a school of forestry that would meet the requirements of the whole of the Empire, India, the Colonies, and home." "You would propose to make Edinburgh the nucleus for the whole of Great Britain, would you?" "I have no objection to the national school being situated elsewhere, but I know of no situation in which so many advantages could be combined as in Edinburgh. In Edinburgh, with the existing arrangements, we can at a comparatively small expense establish a school of forestry equal to the most celebrated schools on the continent of Europe."

"Is it the fact that there is a very great difference between the circumstances of forest management and forest growth in Scotland and England?" "Yes."—"Would it not therefore be desirable to have a school in England as well as one in Scotland?" "I believe that no disadvantage would result from having a national school in

England, a national school in Ireland, and a national school in Scotland; but my belief is that it would be the better course in every way, not only pecuniarily, but in other ways, to concentrate the whole of our energy upon the establishment of one central school, wherever the situation may be."—"Where would it be desirable to establish the school in Ireland, if one were established there?" "In Dublin."—"Do you know anything of the Agricultural College at Glasnevin?" "I know little or nothing of it. I know more of the College or School of Science similar to the School of Mines in London. It appears to me that whatever advantages may be derived from the students going to Glasnevin, it would be better that they should go from Dublin to Glasnevin than that they should start at Glasnevin and come into the School of Science, or whatever the designation of it may be, in Dublin."

"You are rather in favour of adapting the existing institutions, than of founding quite a new school of forestry?" "To some extent I am. I believe that the best plan would be to have a school of forestry in Edinburgh under the Department of Education, so that that would be to a certain extent a new institution, and yet it is at the same time combining it with an established institution." —"In addition to that would you have another school in Dublin and one in London?" "I think that it would be preferable to concentrate the whole of our energies upon the development of a school in Edinburgh."—"Your view is, that the principles of forestry are the same everywhere, and that the variations adapted to the different conditions in different districts would be better treated practically afterwards?" "Yes, they could be acquired on the spot. In short I would treat the study of forestry as the study of medicine is treated. The students of medicine are made thoroughly acquainted with the theory of disease, the phenomena of disease, the remedial applications, and remedial treatment, and then they are sent out to apply the information they have obtained to whatever patients come under their notice."—"It would not be safe, would it, to send out a doctor to practice who has only been trained theoretically; he has to go to the hospitals first?" "Yes, he goes to the hospital to see what is done there, which is met by the student in forestry going either alone or with a professor to forests in the immediate neighbourhood or at a greater distance from the school; it is not required to have the students personally treat the patients in the hospital. They hear why this or that is done, and what the effect of the treatment has been, and what the condition of the patient was a fortnight or three weeks before."—"Of course the only reason why a student is not allowed to do the work in an hospital, is that it is not safe for patients to be treated by an unskilled person, but he would learn his profession quicker and better if he did the work himself; would it not be better that a young forester should have the opportunity of doing these things himself instead of merely looking on?" "It might be, but the knowledge might be too dearly purchased. The opinion of all the advanced students of forestry on the Continent is that it is better when studying to study, and when practising to practise, than to attempt to combine study and practice, and so divert the attention of the student."—"Would not the practice be much more likely to sink into the student's mind if it is taken at the same time as the theoretical instruction?" "He might lose much of the scientific instruction. I prefer the word 'scientific' to 'theoretical,' because we maintain that it is a positive science and not mere speculation. It is desirable that the student's whole time should be devoted to his obtaining this knowledge."

The result of the deliberations of the Committee appeared in a Report, dated 4th August 1887, in which they summarise their labours, and arrive at the following conclusion:—

The Committee recommend the establishment of a Forest Board. They are also satisfied by the evidence that the establishment of Forest Schools, or at any rate of a course of instruction and examination in forestry, would be desirable, and they think that the consideration of the best mode of carrying this into effect might be one of the functions entrusted to such a Forest Board.

As regards the Board of Forestry, the Committee submit the following suggestions:—

1. That the Board should be presided over by a responsible official (an expert by preference) appointed by the Government, and reporting annually to some department of the Government.
2. That the Board should be so constituted as to comprise the principal agencies interested in the promotion of a sounder knowledge of forestry, especially the various teaching and examining bodies, as well as the professional societies.

3. That the following Bodies should be invited to send delegates to the Board :—

The Royal Agricultural Society of England ;
The Highland and Agricultural Society of Scotland ;
The Royal Dublin Society ;
The Office of Woods and Forests ;
The Linnean Society ;
The Surveyors' Institution ;
The English Arboricultural Society ;
The Royal Scottish Arboricultural Society ;

and, that the Director of Kew Gardens should be a member *ex officio.*

That the Board should also comprise three Members of each House of Parliament, and a certain number of owners or managers of large woodlands, a preference in the latter case being given to those who are in a position to afford facilities for study in their woods.

4. That the functions of the Board should be—
   (*a.*) To organise Forest Schools, or, at any rate, a course of instruction in forestry.
   (*b.*) To make provision for examinations.
   (*c.*) To prepare an official syllabus and text-book.

5. That the examiners should be required to examine in the following subjects, namely :—
   (*a.*) Practical forestry.
   (*b.*) Botany.
   (*c.*) Vegetable Physiology and Entomology, especially in connection with diseases and insects affecting the growth of trees.
   (*d.*) Geology, with special reference to soils.
   (*e.*) Subjects connected with land agency, such as land drainage, surveying, timber measuring, etc.

The expense of secretarial staff and examiners need not, in the opinion of the Committee, exceed £500 a year, and the cost might be considerably reduced by fees for diplomas.

VI. *The Plantations on the Estate of Wentworth, Yorkshire.* By GEORGE DODDS, Forester, Wentworth, Rotherham, Yorkshire.

In this Report I propose giving some details of the nature, extent, and management of the woodlands upon the estate of the Right Hon. the Earl Fitzwilliam, K.G., at Wentworth, Yorkshire. The estate is situate in the southern part of the West Riding, and extends to close upon 60,000 acres; the woods and plantations occupying about 5640 acres of that area.

The estate lies at a comparatively low altitude in the midst of the South Yorkshire coal and iron districts. The soil as a general rule is not of first-rate quality, and the subsoil is of a cold clayey nature, yet, in some instances, trees have grown in it to a great age and an immense size.

The difficulty now to contend with in growing trees in this district is the amount of smoke in the atmosphere, and any one not accustomed to iron and coal mining districts can scarcely conceive the damage done to vegetation by the smoke and fumes from the mines, and also from the coke ovens which are in constant operation in the locality. In making new plantations or in renovating the old woods upon the estate, much care has to be taken to use the species of trees upon which the smoke seems to have least effect. These are principally trees having a smoothish bark, such as ash, beech, birch, Spanish chestnut, horse chestnut, lime, wych elm, and sycamore.

A considerable quantity of larch has been planted of late years, but after reaching a height of ten to twelve feet the trees are gradually dying off, chiefly on account of the unsuitability of the soil for the growth of larch, but also in some measure from the surrounding atmosphere being impregnated with noxious vapours, which are injurious to plant life. I notice the only trees of the pine tribe that seem to thrive here are the Scots fir, *Pinus sylvestris*, the Austrian pine, *P. Austriaca*, and the Corsican pine, *P. Laricio.*

Many of the newer conifers, especially *Cedrus Deodara* and *Wellingtonia gigantea*, have been planted in the Home woods and Park, but after lingering for a few years they have mostly all died out, and those that are alive present a very sickly appearance.

I purpose to give in detail the system of management of the woods on this estate which has been followed for a number of years, and I think a report upon the woodlands will be better understood from the following tabulated list, giving the names of the various woods and plantations, their extent, crop, age as far as known, soil and situation.

Names of Woods.	Ext. in Acres.	Crop.	Age as far as known.	Soil and Situation.
Wentworth Park and Woods,	1000	Mixed.	3 to 300 years.	Clay. Sheltered.
Rainbro' Park, .	200	Oak.	6 to 150 ,,	,, ,,
Hood Hill, .	220	Mixed.	80 ,,	Various. Exposed.
Low Woods, .	180	Oak and ash.	160 ,,	Clay. Sheltered.
Tankersley Woods,	600	Mixed.	10 to 70 ,,	Various. Exposed.
Swinton Woods,	300	Oak.	60 ,,	Yellow Clay. Sheltered.
Eccleshall, .	450	Oak.	Unknown.	Light Loam. Sheltered.
Tinsley Park, .	380	Oak.	,, ,,	Yellow Clay. Moder. Shelt.
Edlington, .	510	Oak.	,, ,,	Loam. Sheltered.
Bradfield, .	1800	Fir and larch.	40 to 70 years.	Sandy. Exposed.
	5640			

By this table it is seen that there are about 5640 acres under a crop of wood, among which oak predominates, the ages of the trees ranging from a few years to at least three centuries.

1. The Home Park.

Beginning with the Home Park, which extends to about 2000 acres, we estimate the area under wood, including some plantations that lie contiguous to the Park, at 1000 acres, of various ages. The altitude, at the highest point, is about 300 feet above sea-level; the surface of the ground is of an undulating character, so that the district is moderately sheltered. The soil is mostly inclined to clay, with a cold clay subsoil, resting upon freestone. Some of the trees in the Park have attained to large dimensions, chiefly oak, and it is currently reported here that some of the older and larger specimens are the remnants of the ancient natural forest, which I have no doubt once stretched across from Sherwood Forest in Nottinghamshire to this part of the country.

I regret to say that many of the largest of the old trees are dead, and more dying every year, some of them containing from 400 to 500 cubic feet of timber. In fact, we felled some last season which contained 430 feet of timber when measured. It is a pity to see so many hoary-headed monarchs of the forest standing dead or dying side by side. They well exemplify Dryden's beautiful lines:—

> "The Monarch Oak, the Patriarch of trees,
> Shoots rising up, and spreads by low degrees;
> Three centuries he grows, and three he stays
> Supreme in State, and in three more decays."

The earliest planting here of any note was done by the first Marquis of Rockingham, who lived about 180 years ago. It is rather a curious fact that even the trees that appear to be about 100 years' growth, have not the least appearance of attaining to anything like the size and dimensions of the older trees, as they are now showing symptoms of premature decay, by the stunted and sickly appearance of the foliage that they put on every season. This I attribute in a large degree to the prevalence of smoke and noxious fumes, which have arisen in this locality within the last hundred years or so.

There are some very fine rows of lime-tree and elm in the Park, planted in the same form as the Duke of Marlborough drew up his troops at the battle of Blenheim. The lime-trees are all intact, and are admired by every one, but a great many of the elms have been blown down from time to time, and not having been replaced, the gaps spoil the general effect. These trees are now about 170 years old.

There are a great many clumps scattered up and down the Park and the adjoining fields, planted with different varieties of trees, but as stated before, they are not likely to attain to anything like valuable dimensions. Consequently I maintain that the Austrian, Corsican, and Scots firs are the most useful and most likely trees to succeed in a district such as this. For underwood and game cover we find *Rhododendron ponticum* the most useful, although we plant several other sorts, such as blackthorn, privet, and hazel, but none take so freely to the soil as the Rhododendron.

2. Rainbro' Park.

This wood may be said to be one of the Home plantations, as it lies immediately outside of the Park, and extends to 200 acres, varying in age from 6 to 150 years. It slopes to the north, and has a more exposed aspect than some of the neighbouring woods.

It has an altitude of about 250 feet above sea-level. The soil and subsoil are a strong yellow clay.

The original crop has been oak, but as it was showing symptoms of decay, the greater portion of the old trees were cut down a few years ago, leaving only a few of the healthiest and best for the sake of appearance in the landscape. The ground has all been replanted with such kinds as elm, birch, mountain ash, Austrian and Corsican pines. As a general rule the young trees have done well, and promise to make a valuable crop, but in some instances they are overshadowed by the old trees that were left standing. A great many of the old trees are dying off and should be removed, which process will now require extra care, to avoid much damage to the healthy growing young trees.

3. Hood Hill.

This wood consists of beech, Spanish chestnut, elm, Scots fir, and a few larch. It is about 80 years old, extends to about 220 acres, and is situated at an altitude of about 350 feet above the level of the sea. The soil is of a light sandy loam, resting upon open disintegrated freestone. The trees are generally healthy, with the exception of the larch. Some very promising specimens of beech and Spanish chestnut are growing here. The situation is sheltered. A number of very fine drives were formed through this wood about thirty years ago.

4. Low Woods.

This plantation extends to 180 acres, and is about 150 years old. It is in a sheltered situation. The crop is chiefly oak and ash. The soil is a clayey loam. This wood has suffered severely from being in the neighbourhood of iron-works, which, however, are now done away with. I have advised to clear the greater portion of the present crop away and replant the ground with the most suitable kinds of trees.

5 Tankersley Woods.

This district comprises a parish and township lying at a high elevation, and is consequently much exposed. The highest part is about 600 feet above sea-level, and lies very exposed to the west wind. The woodlands extend to about 600 acres, and the trees vary in age from 10 to 70 years. A large portion of the crop is oak, but the younger woods are mixed oak, elm, sycamore, ash, and other trees. The younger woods have been planted in narrow belts, and mostly on land which has been occupied by old pit workings, consequently the soil is of various kinds, but clay is the prevailing one. This is also a smoke infested district, one of the largest iron-works in Yorkshire being upon the land, and also an extensive colliery. We are kept continually felling dead trees, and I am of opinion that, if the smoke continues, very few live trees will be found in the course of a few years.

6. Swinton Woods.

The woodlands in this district extend to about 300 acres. The trees grown are chiefly oak. The situation is rather sheltered, lying close upon the banks of the river Don, and the altitude is about 150 feet above sea-level. The soil is yellow clay.

The woods in the district have all the appearance of having been well attended to, and thinning has been judiciously practised. The great majority of the trees are well grown and healthy, and exhibit all the signs of attaining to valuable dimensions.

7. Eccleshall Wood.

This is a large wood extending to somewhere about 450 acres, and lies to the south-east of the town of Sheffield. Portions of it have already been taken up for building sites, and in a few years hence, I have no doubt it will be extensively used for that purpose, lying as it does within easy reach of such an important and progressive town.

The soil is light loam, in some places inclined to sand, and rests upon the Millstone-Grit formation. The altitude is about 300 feet above sea-level, and rises with a gentle slope to the west, forming the boundary line between Derbyshire and Yorkshire. It is moderately sheltered, and I believe is also an outlying part of the ancient Nottinghamshire Forests. The crop is oak, and must be of great age, as all the trees have the appearance of being grown from old stools.

The oak is not healthy, and shows symptoms of dying off in the course of a few years. Some planting has been done in a few of the openest parts, and consists of larch, Scots fir, sycamore, Spanish chestnut, ash, elm, mountain ash, birch, and beech, and all promise to grow well. The ages of the recent plantings are from 12 to 4 years. The great difficulty to contend against is the brackens and other rank herbage that grow upon this land, which entail a great amount of labour and expense in keeping the young plants clear. It has been found advantageous to cut the brackens in their early growth, as the constant bleeding weakens them very much.

8. Tinsley Park Wood.

This wood lies intermediate between the towns of Rotherham and Sheffield, and receives the full effect of the smoke, sulphur, and other fumes, no matter from which direction the wind may blow.

The district is flat, and about 150 feet above sea-level. The soil is clay. The extent is 380 acres, age unknown, but to all appearance the wood is natural. The crop is oak, with a few birch that have grown up naturally. The greater portion of this wood is, consequently, a matter of some consideration for the owner, as to whether to keep it up as a wood or not? It is completely surrounded by public works, which entail great difficulties in the matter of planting. If replanting is undertaken here, I have recommended to plant sycamore, ash, birch, beech, and wych elm, as the trees most likely to grow to anything approaching timber size in such a locality.

9. Edlington Wood.

This wood extends to 510 acres, at an altitude of about 150 feet above sea-level, and the situation is well sheltered. The soil is clayey loam, resting upon a limestone subsoil. This is one of the most valuable woods upon the estate, and is no doubt a part of the remains of the Nottinghamshire Forests, as it is situate close to the borders of the counties of York and Nottingham. Some yews in the centre of the wood are of immense size and great age. They are still growing, and very healthy, and may have at one time supplied Robin Hood and his merry men with bows and arrows.

The crop is principally natural oak, having a few ash, beech, and larch mixed through it which were planted about 60 years ago. The trees are generally healthy, but in some instances the older oaks show symptoms of decay, chiefly in the top branches, which may be attributed to the repeated cutting over, and springing up again from the old stools. The old oaks contain on an average from 40 to 70 cubic feet. This wood has been worked upon the coppice principle. There are several miles of fine drives through it in various directions.

10. Bradfield Plantation.

An extensive tract of moorland extending to about 1800 acres. This district lies at an altitude of about 900 feet above sea-level, and part of it is exposed to the blast from all directions. The soil is chiefly of a sandy nature, but in an extensive area like this the soil varies greatly. A ravine traverses a great portion of the wood, and upon the slopes, on both of its sides, the trees have done well.

The first planting was begun here in 1817 with 45 acres, and the whole extent was finished in 1830. The crop is principally larch and Scots fir, with a few spruce. The earliest planted parts are fast coming to maturity, hundreds of trees dying off every year. We are now contemplating clearing it off in sections, and replanting.

An experiment was tried here in a part where the soil is deepest and best. About 40 acres were sown with oak acorns; these have grown, but never attained to any size or value. The largest trees after 60 years' growth may contain from three to four cubic feet, whilst many of the larch grown beside them contain 25 feet of wood. This has been a very profitable investment for the owner, as the land is chiefly moor, and of very little value for any other purpose. The larch grown here has the reputation of being very tough and durable. It has been mostly sold at one shilling per foot, at a distance of nine miles from a railway station or the nearest market. The whole of this wood is enclosed with a substantial stone wall.

Management.

I cannot say that the woods upon this estate have been managed upon the most scientific principles, still they will compare favourably with most other extensive woodlands in the district.

The woods No. 7, 8, and 9, mentioned in this report, have been treated as coppice woods, or, as they are termed in the district, "spring woods." The routine of management of these woods is to have a fall every year, so that all the ground may be gone over in twenty-one years.

The timber is sold standing, by public auction, in early spring. The trees are all previously marked, measured, and valued by the woodman. The purchaser pays all the expenses for felling, peeling, cutting, and clearing the underwood, etc. In a book for the purpose, the reserved trees, and trees for sale, are all noted. No tree is measured that does not contain ten cubic feet of timber. Under that size they are classed as poles. The system of measuring is as follows. The men are supplied with six rods, each six feet long, with ferrules to slip the rods into as they are passed up the tree. One man uses the rods, another the tape for the girth, and a third enters the number of tree, the length, and the girth into the book. It is surprising how near, by this simple method, they can go to the contents of each tree.

It is the custom to peel the trees standing, which is certainly an advantage in getting the bark earlier cured, as no time is lost in felling. I am of opinion that it is also better for the timber, as the longer it stands after being barked, it is always becoming more seasoned.

Many would perhaps object to the purchaser cutting down the wood, but in this case it is no objection, as the woodmen are the proprietor's servants; the purchaser agreeing to pay for the working of the wood at prices stated in the Rules of Sale.

The usual contract prices for working the wood are as follows:—for felling, per ton of 40 feet, 3s.; barking, per ton, 30s.; cutting and ranking of cordwood, 4s. per cord; stakes per score, 3d.; and so on, the woodmen providing their own tools.

In the Home plantations and Park much the same system of piece-work is carried out, especially in felling, barking, and similar operations, the same price being paid as in the "spring woods," but in all cases the wood is felled before it is sold, which is mostly done by private bargain.

The younger plantations have been partially thinned, but no system of pruning has been adopted. The consequence is, that most of them are found full of straggling lob-sided trees, which might have been straight and well-grown if proper attention had been paid in due time to the pruning of them.

Planting was formerly done by contract; letting it to some of the working men, at so much per 1000 for making the pits and putting in the plants. This is a system which I do not approve, and consequently it has been put a stop to.

There are two nurseries, of about three acres each, upon different parts of the estate, for keeping up a supply of young trees, and plants for underwood. Seedlings are generally bought and kept a year or two, as the case may be, and in this way the young plants become to a certain extent acclimatised before being planted out permanently. Plants grown in these nurseries lift with abundance of roots, and when planted out they soon lay hold of the ground, and begin to grow with vigour at an early period. In this and other ways, they are an important advantage upon an estate.

VII. *The Plantations on the Penrhyn Estate, North Wales.* By ANGUS D. WEBSTER, Forester, Penrhyn Castle, North Wales.

The estate, containing the plantations which form the subject of this report, occupies the almost entire northern part of the County of Carnarvon.

Lying for the greater part of its length along the shores of the Irish Sea, and being well backed up by a range of mountains which are among the loftiest in Britain, the climate, as might be expected, is on the whole mild and humid, and well suited for the cultivation of timber trees.

The soil is, generally speaking, a sandy loam, of fair quality, but stiff though fertile clays, as well as peat and alluvial deposit, occur in considerable quantities in various places over the estate. Although the low ground from the seashore to the base of the mountains is rich, well sheltered, and the climate extremely mild, thus fitting it for the growth of most of the trees and shrubs that can be grown out of doors in Britain, still amongst the hills the weather is usually wild and stormy, the winds from the south-west telling severely on most trees growing at high altitudes. Useful timber is, however, grown to fully 1000 feet above sea-level; and with care and judgment in planting suitable trees, especially around the margins of the woods, good timber might be produced at even a greater altitude.

As we purpose describing the geological formation in conjunction with each plantation or plantations, as the case may be, it is here unnecessary to offer further remark, than that along the coast there is a narrow strip of carboniferous limestone and within this the Old Red Sandstone; while inwards to the foot of the mountains the flat ground is occupied by argillaceous schists. The rocks which form the mountain range are composed of schistose hornblende, granite, and porphyry.

For convenience sake, and as many of the plantations are of small acreage and lying in close proximity to each other, we have found it better, so as to be as concise as possible, to include several in one, the natural conditions of soil, altitude, and aspect warranting such a course of procedure.

No. 1 is a mixed plantation, 98 acres in extent, situated on the northern flank of an abruptly rising hill, and at elevations ranging from 750 feet to 1020 feet above sea-level. The soil throughout is a free, sandy, rich loam, save in one corner where it is wholly composed of peat, and resting at no great depth on slate rock. In several places throughout the plantation the rock crops above the ground, in some instances to a height of 20 feet, so that timber growth on such places is stunted when compared with that of the wood generally. The main crop consists of larch and Scots fir, with a free sprinkling of *Abies Douglasii* in the lower-lying half of the wood, and a few beech and spruce at the highest elevation.

Generally speaking, the trees have done well, for although only twenty-two years planted, the average height, up to 900 feet altitude, is fully 27 feet. *Abies Douglasii* grows very rapidly; but on overtopping the surrounding trees the leader usually gets broken over, so that at present, although thicker in the stems, they are no taller than the general crop. The plantation has been thinned twice, but the trees are thick on the ground, and the stems of the larch in particular are remarkably clean, straight, and with a gradual taper, rendering them of great value for fencing purposes. At present the average distance between the trees is about 6 feet. Towards the top the crop becomes gradually lighter, but had a belt of the Austrian and Corsican pines taken the place of the larch now existing, the trees would have been, we have no doubt, of little less stature than those at lower levels.

The natural vegetation of the woodland consists of *Empetrum nigrum*, *Erica vulgaris*, *Vaccinium Myrtillus*, *Oxycoccus palustris*, the latter on damp ground, *Pteris aquilina*, *Polypodium vulgare*, *Allosorus crispus*, *Athyrium Filix-fœmina*, *Lastrea Filix-mas*, *Lycopodium Selago*, and various species of grasses, these generally occurring in the more open parts of the wood and amongst the rocks which crop out here and there over its surface.

No. 2 was planted ten years ago, contains 31 acres, and is at altitudes varying from 500 feet to 750 feet. The soil is of excellent quality, being a rich sandy loam, although about 5 acres at the extreme top consist of peat, the whole resting on the *débris* of slate rock.

As an experiment the wood was planted with the Corsican pine and Cornish elm at 16 feet apart, the intervening spaces being filled up with larch, Scots fir, and various kinds of hardwoods. Around the margin on the exposed side a number of the Austrian pine were planted, while spruce and alder were largely used in the damp, peaty ground at the top of the wood. The Corsican pine has, perhaps, done best of any, and will form the standing crop with a few specimens of the Cornish elm for variety and distant effect.

At the highest altitude, and where fully exposed to the strong south-western blasts, the Corsican pine stands boldly out, even where the Scots fir is bending from the blast.

The average height of the trees is about 6 feet, although many of the Corsican pine are from 8 feet to 10 feet, well branched, and with plenty of healthy foliage. A low narrow ridge of soil was thrown up alongside the fence that surrounds this wood, and seeds of gorse were sown rather thickly on the top of it. This is now a capital fence as well as shelter, the latter more particularly on the exposed side.

No. 3 is a plantation of 73 acres, at an altitude of 250 feet to 450 feet, planted thirty-three years ago, and contains a mixture of larch, Scots fir, Douglas fir, oak, elm, and ash. The soil is loam of fair quality, and the trees vary in height from 30 feet at the higher level to fully 50 feet at the lower level.

Abies Douglasii has here done remarkably well, the soil and partially sheltered situation being all that could be desired for the successful cultivation of the tree. Thinning and pruning has been well attended to, and the trees are in consequence equally distributed over the ground and in a healthy thriving condition. In addition to the above trees there are a few specimens growing here of *Araucaria imbricata*, *Cedrus Deodara*, and *Pinus Cembra*, but they are not of large size.

No. 4 is an old oak wood, 35 acres in extent, and growing on a free sandy loam with an alluvial deposit, on the banks of the Ogwen River.

The oak trees, which are fully a century old, and contain on an average 60 cubic feet of wood each, stand thin on the ground, the intervening spaces being occupied by *Pinus strobus* and *Abies Douglasii*, these having been planted twenty-three years ago. At irregular distances alongside a road that runs through the wood, are some fine examples of *Araucaria imbricata*, *Cedrus Libani* and *C. Deodara*, *Pinus Cembra*, *Thuia gigantea*, and *Cryptomeria japonica*. Where they have had plenty of room they have done well, and look the picture of health, the free alluvial soil being particularly suitable for their growth. The ground being well sheltered and with an easy slope down to the river's edge, and the soil of excellent quality, *Abies Douglasii* has done remarkably well, many of the trees being 70 feet in height, and containing fully 50 cubic feet of wood. *Pinus strobus* is also quite at home, the free soil resting on shale rock seeming to suit this valuable tree. Some of it measure about 50 feet in height, and with straight, clean stems girthing 5 feet at a yard from the ground.

Last autumn, the branches of the oaks were pruned hard back, so as to give ample room for the *Abies Douglasii*, which, with *Pinus strobus*, is intended to form the succeeding crop.

Blackthorn, bramble, rough grasses, bracken, lady fern, and *Blechnum boreale* carpet the ground.

No. 5 is 110 acres in extent, and of thirty-five years' growth. It is situated on a gently north-sloping hill, at elevations varying from 200 feet to 400 feet, and about a mile distant from the sea-shore. Over the whole wood the soil may be said to be a fertile sandy loam, except in one or two places where it is stiffish and inclined to clay. With the exception of about 5 acres of scrubby oak, the crop is larch and Scots fir, with a few *Pinus Laricio* and *P. Austriaca.* Having been attended to in the way of thinning and pruning, the trees have thriven well, the average height of the larches being 45 feet, and containing nearly 10 cubic feet of timber each.

The Scots fir is of about the same size, while *Pinus Laricio* is towering 10 feet above any of the others, and with stems proportionately thick. Thinning is at present required, but as prices for timber are unusually low, and the individual trees not actually suffering from overcrowding, this operation has been deferred for a time The oaks, which form what was the original wood, are small and of but little value, and are being gradually removed and their places filled by other and more valuable trees. In addition to the trees already mentioned there are a few specimens of ash, beech, elm, and sycamore which are thriving in a fairly satisfactory manner. Gorse and broom grow in several of the open rocky parts, while of other natural underwood the blackthorn, bramble, raspberry, elder, and bilberry, form a large proportion.

No. 6 is 25 acres in extent, and may best be described as a worthless plantation to the forester, but an invaluable one for the sportsman. It is situated on a rocky hill side, with a north aspect, and within half-a-mile of the sea. The soil, which is thin over the wood generally, is rock *débris* with a small admixture of loam and peat. Dwarf and stunted oaks form the main crop, while hazels, also of diminutive growth, and a few blackthorns, are interspersed in open places, especially around the margin. Save a small sum realised on one or two occasions from the sale of rods for mending the near-lying fishing weirs, no revenue is obtained from this wood, except, perhaps, the sum realised from the great quantities of game which are fostered beneath its shade.

On an average the trees are about 12 feet in height, but remarkably spreading and bushy, and therefore well suited for acting as a game preserve.

No. 7 contains about 53 acres, and in contradistinction to the last, is a profitable wood, although situated at from 600 feet to fully 1000 feet above sea-level, and exposed at times to terrific storms. It clothes the southern slope of a hill, near the entrance to the Pass of Nant Francon, and was planted thirty-five years ago. Except in one place where peat is present, the soil is a kindly loam, not too stiff, resting on slate rock, which crops above the ground in several places.

The crop is principally larch, but a few Scots and spruce firs are likewise present, as are also oak, sycamore, and alder.

As thinning has been carefully attended to, the trees, especially the larches, are well grown, clean, and destitute of branches for half their height. They average 30 feet in height, and, being straight and clean, sell readily either for fencing purposes or telegraph poles. On the outskirts of the wood the trees are not so tall as stated, more particularly those on the southern and south-western sides. Plenty of natural underwood occurs throughout the plantation, especially along the rocky margins of a fast-tumbling mountain stream that traverses its entire length. The bilberry, cranberry, crowberry, heath, and St John's wort occur in plenty, while, as might be expected in a mountain woodland, other smaller growing plants are tolerably abundant.

No. 8.—Three woods are here included, for as they lie adjacent to each other, are of nearly similar soils, and were planted at the same time, they may well be treated as one. The total extent is 35 acres, the soil a stiff but fertile loam, the aspect north, and the underlying rock a valuable slate.

One of these plantations, however, differs considerably from the others in the soil being damp and retentive, and the crop hardwoods instead of conifers. In it alder and birch form the main crop, with a few sycamores and ashes on the drier grounds. They are fully 20 feet in height, and having been allowed plenty of room, are well furnished with branches down to within a yard of the ground. Larch forms the main crop of the other two, and is well grown, clean, and valuable. These woods were planted thirty-two years ago, and from their rapid growth at so high an altitude—750 feet—they show that vast tracts of similar ground in the same valley might profitably be put under timber.

No. 9 contains 62 acres, varies in altitude from sea-level up to 350 feet, and is composed in part of loam, decayed vegetable matter, and stiff clay, the underlying rock being principally argillaceous schist, and in a portion the Old Red Sandstone.

This wood is forty years planted. Larch and Scots fir are the chief trees, with ash, elm, oak, beech, birch, and alder in smaller numbers. Throughout the wood the trees have done well, the hardwoods in particular, and are now fully 50 feet in height; and, from having been allowed plenty of room, are stout and bushy, and with stems girthing 4 feet to 5 feet at a yard from the ground. The situation is, on the whole, well sheltered from the south and west, from which points our most dreaded winds blow. In certain parts the trees have been thinned out excessively, in order to admit light and air for the production of brambles and other game-covert plants. Indeed in some places the trees might, so far as the production of timber is concerned, stand twice as thick as they are at present, and with this desirable result, that the wood produced would be straight and clean, and consequently of much greater value in the market.

No. 10 extends to about 18 acres, and the soil is of fair quality, being of a stiff loamy texture, resting on a retentive gravel subsoil, well drained. *Abies Douglasii*, *A. Smithiana*, *A. canadensis*, *Pinus strobus*, the Norway maple, and oak, together with a few specimens of birch, beech, and the winged elm (*Ulmus alata*), constitute the main crop of this plantation, which is situated on a sheltered and level tract of ground, about a mile inland from the seashore.

Although planted only twenty-nine years ago, *Abies Douglasii* has attained to large dimensions, many of the specimens being almost 70 feet in height, and well branched to near the ground; this latter, the result of careful and timely thinning. Several of the stems of the larger trees girth fully 7 feet at a yard from the ground, and some even exceed that measurement. *Abies Smithiana* has also thriven in a remarkable manner, and formed fine bushy specimens, with beautiful dark-green pendulous branches. The timber is of a firm texture, with a decidedly pretty grain. Growing, as these trees are, principally along the margin of the plantation, and being visible from the adjoining road and railway, they have a very pleasing appearance, their drooping spray and shapely outline imparting a character peculiarly their own. *Pinus strobus*, although of large size, has not done so well as might have been expected, several of those that were cut down when thinning the plantation seven years ago being "pumped" or rotten at the heart, the soil evidently being unsuitable for their growth. The finest trees of this pine that we know of are growing amongst broken slaty rock, with a small admixture of decayed vegetable matter, and where the soil is naturally well drained.

Of *Abies canadensis* there are some healthy and vigorous growing specimens, the mild situation and dampish ground being well suited for producing good examples of this distinct and highly ornamental conifer. The hardwoods have, likewise, thriven in a very satisfactory manner, and having at all times been allowed plenty of room for perfect development, the spread of branches in some instances almost equals the height of the trees. In consequence, the Norway maples show off to perfection their large, five-lobed leaves, and contribute in a very marked degree to the ornamental appearance of the wood.

Underwood, principally privet, laurel, and barberry, has been planted for game-covert in open portions, which, with the natural vegetation—bramble, bracken, stinking hellebore (*Helleborus fœtidus*), broom, gorse, and rough growing grasses—help to impart warmth and verdure that would be otherwise wanting. The covert-plants are formed into irregular-shaped patches of one species, this being decidedly better both for the plants themselves, and for their management in the way of pruning, layering, etc., than had they been indiscriminately planted.

No. 11 is 18 acres in extent, composed principally of larch; but these have not done well, owing to the light gravelly nature of the soil. When thinned six years ago, nearly one-half of the trees were rotten at the core; this extending from the base to about half-way up each stem, and consequently the trees are of little value except for the shelter they afford. The plantation is situated on the crest of a gently sloping, sandy hill, at an altitude of hardly 200 feet, and with a north-western aspect. *Pinus Laricio* thrives exceedingly well here, the sandy soil suiting its wants admirably, at least if rapid growth and healthy appearance are anything to judge by. Seeing how well this tree grows here, we have removed a number of the larch and planted it instead, along with the Austrian pine and several kinds of hardwood trees, so that ultimately a crop of these will take the place of the dying larch.

The plantation was formed thirty-two years ago. The original crop is now fully 35 feet in height, and the stems girth on an average 2 feet at a yard from the ground.

The disease does not show itself until the trees are about 16 feet in height, but after that its progress is rapid, the rot penetrating in a very few years to half the height of the tree. Cutting down the plantation would, of course, be the most practicable way to set matters right; but as it is visible from the mansion-house windows and the grounds, and helps to hide some unsightly buildings, its removal would mar the landscape to such an extent that it has been allowed to remain as it is.

No. 12 is 45 acres in extent, and the greater part of it is oak coppice, with some spruces and silver firs along the side of the public road for shelter and ornament. There are likewise a few specimen conifers, including *Pinus Pinaster* and *P. strobus*, *Abies canadensis* and *A. Douglasii.*

As the ground is poor and rocky, and exposed to the south-west, from which point the worst winds blow, the oaks are not of great size, nor will they ever be of much value, and although planted over thirty years, they have not attained to a greater height than about 16 feet. Five years ago the plantation was thinned, the best oaks being carefully pruned and left as standards. As a game-preserve this wood is of much value; the trees, being deciduous and standing wide apart, allow of the free growth of natural underwood.

No. 13 is 31 acres, facing the north, 200 feet above sea-level, and consists of oak and spruce, planted twenty-seven years ago. The soil is of two kinds—a free rich loam where the oaks are planted, and a damp, boggy loam carrying the spruce.

The oak and spruce have both done well. The plantation has been well attended to, the oaks having been thinned and pruned with care and discrimination; while the spruce portion, by timely draining and the filling up of gaps caused by uprooted trees during storms, is all that could be desired.

A few larch were planted with the oaks as nurses, but these have nearly all been removed in the course of thinning. The average height of the oaks is 22 feet, that of the spruce nearly 30 feet.

No. 14 extends to 33 acres, is at 400 feet altitude, and has a north-western aspect. The soil is a free peaty loam, resting at no great depth on broken slate-rock. This is a mixed wood, consisting chiefly of oak and larch, with a small admixture of elm, beech, birch, alder, Scots fir, lime, and sycamore. About 4 acres at one end of the plantation are planted entirely with alder, the ground being boggy and unfitted for bearing a better crop. The soil, though rocky, is fertile, and produces excellent timber, especially larch, oak, and birch. Thinning has been regularly attended to, and in consequence the trees are clean and valuable, many of the larches, although only thirty-four years planted, containing about 10 cubic feet of timber.

No. 15 contains 29 acres, is situated on rocky ground at 500 feet altitude, the soil being a light, sandy loam. This plantation is composed entirely of oak, but owing to the elevated site, the open exposure to the south and west, and the poverty of the soil, the trees are not of great size, although planted nearly half-a-century ago. They stand thin on the ground, about 18 feet apart, and are short of stem, with flat, bushy heads.

Although the timber is of small size, it is hard and of excellent quality, and sells readily in the immediate neighbourhood for boat building.

No. 16, about 16 acres in extent, is composed principally of Scots fir and larch of nearly one hundred years' growth, and is situated in a sheltered valley at 700 feet altitude. The soil throughout is of excellent quality, being decayed vegetable matter and loam resting on slate-rock. Many of the Scots firs are 75 feet in height, with stems girthing 8 feet at a yard from the ground, and contain about 100 cubic feet of excellent timber. The larches are fewer in number and of less size; but a few specimens are nearly as tall, and contain as much wood as the Scots firs. The trees standing thin on the ground, rhododendrons and laurels have been planted for effect in irregular-shaped clumps throughout the wood. In one corner are a few sycamores and beeches of large size, the former in particular containing some clean and very valuable timber.

No. 17, containing 12 acres, is a young oak plantation of twenty-seven years' growth, and situated on ground gently sloping to the north, at 250 feet altitude. The soil is a stiff loam, bordering on clay, the underlying rock being the Aber *fault*. A stream runs through the entire length of the plantation, and into which the drainage of the ground has been carried; but owing to the stiff, retentive nature of the soil, water lodges for a considerable length of time on the surface. The oaks have done fairly well, considering the unkindly soil, and that they are fully exposed to winds blowing both from the south and west. They are now about 20 feet in height, well branched, and standing at 10 feet apart. A few spruces have, likewise, been planted in the dampest corner of the wood, and these have grown and thriven in a very satisfactory manner, being now fully 30 feet in height.

No. 18 is almost wholly composed of sycamore scattered thinly over an extent of fully 100 acres.

The trees have, in the majority of cases, attained to full maturity, many being about 80 feet in height, and containing 120 feet of wood. In nearly all the trees the timber is of excellent quality, the stems being large, straight, and unusually clean. The ground on which these fine trees are growing is a deep yellow loam, the aspect northern, and the altitude 350 feet. Many of the largest trees have been felled, but generally speaking there is yet a fair crop of averaged size and clean specimens. They have been planted about 150 years.

No. 19 consists of a series of small plantations that lie contiguous to each other, were all planted about the same time, and contain the same class of trees—larch, Scots fir, and a few hardwoods, principally oak and ash. These plantations are on the top and sides of an abruptly rising hill, which runs inland from the sea for several miles. Throughout the whole the soil is of almost uniform quality, being a rich, though shallow, red loam, resting on greenstone and felspathic rock, which in many instances crops above the ground, and renders timber growing quite out of the question. Wherever a little soil is present the trees have, however, done well, and are now, on an average, 30 feet in height, although planted only thirty-one years ago.

It should be stated that there are many trees of less size than the dimensions given, but in all cases this may be attributed to the scanty amount of soil occasioned by the rocks cropping up to within a few inches of the surface.

Thinning has been well attended to, indeed in many of the individual woods this operation has been carried to excess, so as to allow of the free growth of brambles and other natural undercover. The bare rocky peaks of the hill being visible from the mansion and the surrounding grounds, were formerly an eyesore, but the well laid-out plantations have given it quite a picturesque appearance in the landscape.

No. 20 is 12 acres in extent, at an altitude of 250 feet, and was planted eighteen years ago. The crop is larch, Scots fir, and birch, this latter tree being well suited for the dampish loamy soil of which the ground is mainly composed. There are many gaps in the plantation, owing to patches of the larch having died out through excessive damp, but these have been filled up from time to time by more suitable trees, particularly birch and alder. The Scots fir and birches first planted look well, and are from 15 feet to 20 feet in height, bushy, and with stems which are thick in proportion to their length. Those trees which were planted to fill up the gaps are growing rapidly, and will, from the shelter they receive, soon be as tall as the original wood.

No. 21 is about 25 acres in extent, situated on a hill side, and at 100 feet above sea-level. Sycamore, beech, elm, larch, and Scots fir compose the crop, which was planted forty-seven years ago. The soil throughout the wood is of excellent quality, being a free loamy peat, well drained, and resting on greenstone rock principally. Most of the trees have done well, the sycamore in particular. They are nearly 60 feet in height, and with stems averaging 6 feet in circumference at 3 feet from the ground. The trees have plenty of room owing to repeated thinnings, and at present stand about 18 feet apart.

No. 22 is 30 acres in extent, and the soil stiffish loam, resting on rough gravel. It was planted twenty-four years ago. The crop consists of larch, Scots fir, birch, elm, ash, oak, and a few sycamores. The trees are about 40 feet in height, and having been grown thickly are straight and free from branches for nearly one-half their height. For fencing purposes and pit props the produce of this wood sells well, the poles being long, clean, and with a nice gradual taper.

No. 23 is situated at 700 feet altitude, contains 75 acres, and is on tolerably flat ground near the mountain base. The crop consists of larch and Scots fir, with a small number of hardwoods around the border. The soil in most parts is a stiff loam, bordering on clay, but is well suited for timber growing, the crop thriving well and averaging about 40 feet in height. It was planted about half-a-century ago. Most of the hardwoods have died or been cut, leaving the larch and Scots fir. From being grown thickly the timber is clean and free from knots, and finds a ready market in the neighbourhood for crane poles used in the various quarries. The soil being naturally damp and retentive was drained in a very efficient manner when the plantation was formed, and has required nothing further in that way since, except a scouring out of the ditches when thinning takes place.

No. 24 is almost similar to the last in every respect, only it is situated at 500 feet instead of 700 feet altitude. The crop is larch, Scots and spruce firs, oak, elm, ash, beech, birch, and sycamore, as well as a few alders, which latter line the banks of a rapid stream which divides the wood into two nearly equal parts. As regards size and age the trees are similar to those described in

No. 23. They have, however, received a greater number of thinnings, and are consequently better furnished with branches, though the timber is not so clean and straight as if they had been allowed to stand thicker on the ground. Natural vegetation is, likewise, abundant, and consists of the bilberry, crowberry, gorse, heath, ferns, and grasses common to such situations.

No. 25.—This consists of a number of small and recently-formed plantations and screen belts containing in all about 40 acres. The soil is of two distinct kinds—sandy loam and peaty loam ; the situations sheltered, and the distance inland from two to three miles. The Corsican pine has been largely planted in all these woods, but there is also a fair quantity of larch, Scots and spruce firs, as well as various kinds of hardwoods. All these plantations have been formed within the past ten years, but the greater number seven years ago. They are thriving well, but have as yet received no thinning, although one of the patches, which is composed principally of the Corsican pine, will require attention in this way during the present year.

No. 26 is a seaside plantation of nearly 20 acres in extent, and was formed eighteen years ago. Next to the shore the soil, as might be expected, is barren and sandy, but inwards it improves wonderfully, being of a loamy nature, intermixed with veins of clay and sand. The trees first planted were the Corsican and Austrian pines, sycamore, elm, white beam (*Pyrus aria*), and willow; while of shrubs the sea buckthorn, blackthorn, spindle-tree, tamarisk, barberry, and laurel occupied the more prominent places. Owing to the unfavourable surroundings many of the trees, particularly the hardwoods, have died out, and their places, next to the shore at least, have been filled by planting strong bushy plants of *Pinus Pinaster* and also more of the Corsican pine, this latter doing best of any down even to high water mark.

Gorse and broom seeds germinated freely, and a great portion of the sea barrier is now thickly covered by the former. Amongst the shrubs that have done best, particular mention may be made of the tamarisk, sea buckthorn, and Darwin's barberry, all these being invaluable plants for using along the sea coast.

No. 27 is 15 acres in extent; soil, an unkindly clayey loam, resting on rough gravel; situation, exposed to the south and west. The ground was originally planted with Scots fir, larch, birch, and alder, but owing to the unkindly nature of the soil and exposure to the strong south-western gales, many of them have died out, and the ground has been replanted with Corsican, Austrian, Scots and spruce firs, along with a few birch, oak, and alder. The drainage not being satisfactory, renewed efforts to drain the ground are now beginning to have effect, and the greater portion of it is now in a passable condition, and fairly suited for the successful cultivation of a crop of timber. In one corner of the wood where the soil was a nice kindly loam and not too damp, the first planted trees have thriven in a satisfactory manner, the average height being about 15 feet, bushy in proportion, and the Scots fir with fine glaucous green foliage. *Pinus Laricio* has also done well, and is of equal height with the Scots firs.

No. 28 was planted so as to afford shelter to a mountain village at nearly 1000 feet altitude. It is a long narrow strip, running parallel to the main road of the village, and consists of larch, Scots and spruce firs, as also a very considerable number of birch, sycamore, elm, and oak. Being fully exposed to the south-west, and the soil a poor, thin gravel, with a thin surface coating of peat, the trees have not grown fast, and although nearly thirty years planted, have not attained to a greater height than 18 feet. Thinning of the wood has taken place only twice, but the trees are by no means drawn up or weak, and are generally bushy and well-formed, especially the Scots fir. When thinned eight years ago many of the wind-shorn larches were removed, so that when viewed from a distance the plantation has the appearance of being composed wholly of pines.

No. 29 consists principally of ornamental plantations within the park, and extends to fully 300 acres. The soil in most parts is a free kindly loam, which is remarkably well suited for the growth of trees, the newer conifers in particular; and is at varying altitudes from sea-level up to about 100 feet.

The trees are, generally, of large size and well grown, and have been planted within the last sixty years, although many of the older trees, particularly the fine oaks around the mansion, must be fully two hundred years of age. The newer conifers have all been planted during the past forty-five years, and many of these, especially the Douglas firs, Corsican pines, Araucarias, and Cedars, have attained to large dimensions. The Douglas fir, which is more abundant than any of the other conifers, and numbers several hundreds, has been planted in a great variety of soils; but that in which it succeeds best is a well-drained alluvial deposit resting on gravel, and where partial shelter is afforded.

Many of these are from 60 feet to 70 feet in height, and with stems girthing at 3 feet up from 10 feet to 16 feet. The timber is of excellent quality, and has been used with satisfaction for general estate purposes. *Pinus Laricio* is also in great numbers, and thrives well on almost pure gravel, with a slight surface coating of decayed vegetable matter. The average size is from 50 feet to 70 feet, and the stems girthing from 5 feet to 9 feet at 3 feet up. *Pinus strobus*, *P. Cembra*, *P. halepensis*, *P. insignis*, *P. Austriaca*, *P. Pinaster*, and *P. pyrenaica*, all do remarkably well, and have formed, in many instances, fine bushy specimens of 50 feet in height. *P. Austriaca* in particular has been planted in quantity for the sake of the valuable shelter it affords, and hundreds of the trees measure from 4 feet to 7 feet in girth of stem.

Abies Nordmanniana, *A. grandis*, *A. nobilis*, *A. Webbiana*, *A. Pinsapo*, *A. magnifica*, and *A. Pindrow* are all well represented in healthy free-growing specimens. *A. grandis* on well-drained loam is 60 feet in height, *A. nobilis* and *A. Nordmanniana* fully 70 feet high; while of the others, well-grown trees of 30 feet and upwards are not uncommon. Of the Cedars, *Cedrus Libani* and *C. Deodara* have attained to large sizes, many of the former being from 12 feet to 14 feet in girth; while of the latter, specimens of 60 feet in height may be seen. Amongst the spruces that have done well and grown to be of large size, particular note may be made of *Abies Menziesii*, 68 feet in height; *A. orientalis*, fully 50 feet; *A. Smithiana*, 63 feet; *A. canadensis*, 30 feet; *A. nigra*, 50 feet. The former in particular is a lovely tree that thrives well in a dampish soil, and where partial shelter is secured. On gravelly soil it is apt to become rusty in appearance, and frequently dies out altogether. *Wellingtonia gigantea* and *Sequoia sempervirens* do well in several of the plantations, there being in one belt about a score of the former, each upwards of 60 feet in height. A good dampish loam suits this tree, but it must have plenty of room for the development of its long branches. Throughout most of the park woods *Thuja gigantea* has been planted, principally in the more open situations and around the margins for effect, it being one of the most valuable conifers we know of for planting indiscriminately. Even during the most severe storms, we have never known this tree to be uprooted, or to lose its leading shoot. It is very impartial as regards the quality of soil in which it is planted, for here it may be seen doing well in pure peat, gravelly loam, stiff loam, and decayed vegetable matter. The average height of this *Thuja*, planted twenty-three years ago, is 40 feet.

Cryptomeria japonica has, likewise, received a great amount of attention, being a fairly good sea-side tree, where partial shelter from direct cold cutting winds is afforded. In dampish but well-drained alluvial soil, it grows rapidly, and several specimens of fully 70 feet in height are to be seen. Scattered throughout most of these park woods are numerous large trees of *Araucaria imbricata*, ranging from 20 feet in height to upwards of 50 feet. This is a tree, more, perhaps, than any other, that dislikes codling, although, at the same time, it is by no means suitable for planting in wind-swept districts. To grow it in a satisfactory manner it must have plenty of room for perfect development of both root and branch. Amongst the Cypress tribe those that do best are *Cupressus Lambertiana*, a valuable tree whether for effect, shelter, planting in maritime situations, or for the finely-grained and lasting timber it produces; *C. Lawsoniana*, another elegant and easily-accommodated species; *C. Nutkænsis*, and *C. sempervirens*.

Juniperus chinensis, *J. recurva*, and *J. communis* thrive well on various kinds of soil, and being highly ornamental are well worthy of attention in parks and plantations. In peaty loam incumbent on blue slate, *J. recurva* thrives well, several specimens being fully 16 feet in height, and with a spread of branches covering a diameter of 14 feet. *Larix*, or rather *Pseudo-Larix Kœmpferi*, *Fitzroya patagonica*, *Salisburia adiantifolia*, *Taxodium distichum*, *Retinospora*, various species, *Cunninghamia lanceolata*, *Taxus adpressa*, *T. baccata*, and its yellow berried form, *Cephalotaxus Fortunei*, *C. pedunculata fastigiata*, and *Cryptomeria elegans*, all find suitable positions either on the lawn, in the parks, or woods, and grow in a satisfactory manner.

Many of the above-named conifers are planted in the natural soil, but in dealing with rare and valuable species, a quantity of thoroughly decomposed vegetable matter has been added to the soil in which they are planted. In all cases pits of large size were opened for the reception of the trees, and the soil well broken up and allowed to remain exposed to the atmosphere for as long as possible previous to the insertion of the plants.

Neither are hardwood trees neglected in these ornamental woodlands, for the copper beech, cut-leaved alder, finest varieties of thorn, scarlet horse chestnut, weeping birch, service tree, snake-barked maple, golden and silver elders, liquidamber, and many others, are planted in quantity, and are now of a good size.

Amongst the more ornamental flowered shrubs, *Weigelia rosea*, *Fuchsia Riccartoni*, *Hydrangea hortensis*, *Chimonanthus fragrans*, *Berberis Darwinii*, *B. Wallachii*, *Catalpa syringæfolia*, *Cornus sanguinea*, *Daphne Mezereon*, *D. laureola*, *Deutzia crenata*, *D. scabra*, *Euonymus europæus*, *Forsythia viridissima*, *Viburnum opulus*, *Syringa*, of sorts, *Spiræa Douglasii*, *Rhamnus frangula*, *Philadelphus coronarius*, and *Leycesteria formosa* find prominent places alongside the walks and drives, or in large irregular masses within the woods and along their margins.

The old oak trees around the mansion, and over the park generally, are in a good state of preservation, and of goodly proportions. Most of them contain from 60 feet to 100 cubic feet of timber, but one patch growing on shallow peat contains fully 100 trees of 130 cubic feet each. Along with these latter are a few larch trees of fully 90 feet in height, and girthing on an average 11 feet at a yard from the ground.

Ulmus Cornubiensis, a form of the English elm, has been planted largely, and many of the trees now stand 75 feet in height, and girth 8 feet at breast high. The sycamore, birch, beech, Spanish chestnut, and ash likewise do well, and from having been allowed plenty of room, and carefully looked to as regards pruning, are of large size and shapely in form.

Most of the park woods are what may be styled ornamental game preserves. Throughout the majority of them large clumps of rhododendron, laurel, privet, aucuba, laurestinus, and many other shrubs suitable for covert purposes have been planted.

In addition to the plantations described, there are several acres of newly formed woods, principally shelter belts, and experimental woods of *Abies Douglasii*, *Thuja gigantea*, and *Pinus Laricio;* but as the trees are of small size and only planted within the last few years, we do not consider they require any special remarks at the present time.

INTERNATIONAL EXHIBITION, EDINBURGH, 1886.

The Scottish Arboricultural Society's Exhibits.

Award:—Diploma of Honour.

The Council of the Scottish Arboricultural Society resolved to contribute a selection of the valuable and interesting articles which it had acquired from time to time, especially at the close of the Forestry Exhibition, 1884, to the International Exhibition of Industry, Science, and Art, held at Edinburgh in 1886. Application was made for the necessary space, which the Executive Council of the International Exhibition freely granted in the interests of Forest Science. An eligible site, in a very convenient position in Court 13, was set apart for the purpose. There the Society made an attractive and highly interesting display of the many rare, curious, and valuable specimens, of which it had become possessed during a series of years, and from a great variety of sources at home and abroad, chiefly with a view of forming a Forestry Museum. The space was laid out in the form of a small Court, No. 394; and the various articles were effectively arranged on Stands, or displayed on the walls of the Court, where they were seen and examined with much interest by the numerous visitors to the Exhibition.

The Secretary of the Society, Mr John M'Laren, jun., or his Assistant, was daily in attendance, and furnished to the Members visiting the Exhibition, and to all other inquirers, the fullest particulars regarding the articles exhibited, as well as giving information upon all topics connected with the aims and objects of the Society. The great interest taken in the exhibits by the general public, and the numerous questions they asked about the nature, properties, and uses of the different articles, clearly showed that the subject of Forestry in all its bearings has got a firm hold on the mind of the public, and that the Society's efforts are being appreciated by a rapidly widening circle of intelligent observers.

So highly was the work of the Society esteemed by the Jurors, that after fully examining the remarkably interesting and useful display of specimens of Forest products, and articles of scientific and practical interest in Forestry, they considered it worthy of the highest award made at the Exhibition—a "Diploma of Honour."

The following list gives a few details of the leading features in the display made by the Society:

A numerous assortment of the Tools used by Foresters in Britain, with Models of Implements and other appliances for the working of Forests and the conversion of timber.

An interesting collection of the Tools used in Forestry in the several Presidencies of India and British Burmah.

A complete set of the Tools used in the culture and manufacture of Willows in Bavaria, from J. H. Krahé.

Set of Peat-Cutting Tools, of a rather primitive pattern, from County Tipperary, Ireland.

Set of Tree-Planting Tools, of excellent design and workmanship, from Denmark.

Set of Tools used in the Forests of Sweden and Norway.

Improved Dendrometer, on Tripod, from D. F. Mackenzie, Morton Hall.

A New Calliper Tree Measurer, from Denmark.

An instructive Collection of the commercial products of the Forests of Ceylon; including medicinal and economic barks, seeds, gums, oils, fibres, and woods; cinchona bark in various stages of manufacture, and many other articles of interest, from John Alexander, Kirklees Estate, Ceylon.

A Collection of Specimens of the Woods of the Canadian Forests, from W. Little, Quebec.

A very interesting Collection of Woods from Natal, from D. M. Smythe, yr. of Methven, Perth.

A neatly arranged Collection of 117 varieties of Woods grown in Scotland, from D. F. Mackenzie, Morton Hall.

Several large Specimens of beautiful oak panelling from the old oaks growing in the existing remnant of the ancient Caledonian Forest in Dalkeith Park, from Robert Baxter, Dalkeith.

A fine Collection of 60 specimens of Woods, from the State of Perak, Straits Settlements.

Samples of Barks for tanning purposes; and a fine Specimen illustrating the remarkably quick growth of *Eucalyptus globulus*, from Algeria.

A large and fine Collection of Specimens of Timber and Bark, chiefly oak, grown in the Royal Forests of England.

Section of an old Yew Tree, 3 feet 10 inches in diameter, grown at Roseneath, Argyleshire, from the Duke of Argyle.

Section of an oak, 4 feet in diameter and 6 inches thick, from a tree still standing and growing on the Estate of Sands, Perthshire, from Laurence Johnstone of Sands.

A fine Collection of Woods grown on the Scone Estates, Perthshire, including wood of Douglas fir used for several purposes, and a Railway Sleeper of Silver fir which had been in use over seven years and is still quite sound and serviceable, from William M'Corquodale, Scone, Perth.

A very interesting Collection of 115 kinds of Wood, all grown on the Hopetoun Estates in West Lothian, from John M'Laren, Hopetoun.

An interesting Collection of Specimens of the Wood of the *Eucalypti*, from Australia.

A splendid Collection of the Woods used for Ordnance, and for other purposes by the War Department, from H.M. Secretary of State for War. This valuable and interesting Collection afforded a capital illustration of the great variety of Woods and other articles of Forest Produce which are used, and the purposes to which they are applied, in the science and art of war. Among others it included beautiful Specimens of the following Woods, each having the description here given attached to it.

1. Oak (Quebec), used for barrels, kegs, rounds of ladders, fittings of ammunition boxes, and operating tables.
2. Oak (Riga), used for operating tables and internal fittings of ammunition boxes.
3. Lime-Tree (Great Britain), used for cutting boards for collar makers.
4. Beech (Great Britain), used for bars and arches for saddles, and for fittings of ammunition boxes.
5. Oak (Odessa), used for barrels, kegs, rounds of ladders, fittings of ammunition boxes, and operating tables.
6. Oak (Dantzig), used for barrels, kegs, rounds of ladders, and operating tables.
7. Lancewood (West Indies), used for tripods for range finders.
8. Hornbeam (Great Britain), used for teeth of wheels, for heavy machinery.
9. Mahogany (Tobasco), used for levers, fittings of ammunition boxes, cradles for pack saddles, tackle blocks, and patterns.
10. Saul (Burmah), used for windlasses, gun carriages, bollards, rollers, quoins, and mortar beds.
11. Walnut (American), used for felloes of wheels for tropical service, pack saddles, and for barrack furniture.
12. Cedar (Cuba), used for panels of office waggons, linings of fuse boxes, model and pattern work.

13. Mahogany (Honduras), used for levers, fittings for ammunition boxes, cradles for pack saddles, tackle blocks, and patterns.
14. Elm (Great Britain), used for gun carriages, windlasses, railway trucks, naves of wheels, and tackle blocks.
15. Oak (African, Sierra Leone), used for windlasses, gun carriages, bollards, rollers, quoins, and mortar beds.
16. Cedar (Mexico), used for panels of office waggons, linings of fuse boxes, models, and pattern work.
17. Oak (Memel), used for barrels, kegs, and rounds of ladders.
18. Hickory (North America), used for waggons, forage and maltese carts, levers, sponge and rammer staffs, and ribs of pontoon boats.
19. Poplar (Great Britain), used for cutting boards for collar makers.
20. Ash (Great Britain), used for felloes of wheels, sponge and rammer staffs, handspikes, barrows, and hoops for casks.
21. Oak (Riga), used for barrels, kegs, and rounds of ladders.
22. Oak (Great Britain), used for frames of waggons, carts, and barrows, spokes of wheels, and gun carriages.
23. Elm, Wych (Great Britain), used for barge and boat work.
24. Sycamore (Great Britain), used for cutting boards.
25. Pine, Yellow (Quebec), used for pattern work, pontoon boats, sides of waggons, and medical boxes.
26. Pine, Kauri (New Zealand), used for pontoon equipment, tressel bridging, and saddle beams.
27. Pine, Oregon (Oregon), used for superstructure for bridging purposes.
28. Deal, Yellow (Petersburg), used for coal trucks, stretchers, and ammunition boxes.
29. Deal, Yellow (Gefle), used for signal rocket sticks, tool chests, poles, buckets, and ammunition boxes.
30. Boxwood (West Indies), used for mallets and measuring rods.
31. Abele (Great Britain), used for provision boxes and cutting boards.
32. Birch (Canada), used for barrack furniture.
33. Teak, Moulmein (Burmah), used for gun carriages and platforms.
34. Ebony, Black (Ceylon), used for turnery work.
35. Padouk (Burmah), used for bollards, windlasses, gun carriages, rollers, quoins, and mortar beds.
36. Walnut (Italy), used for felloes of wheels for tropical climates, and pack saddles for mountain service.
37. Greenheart (South America), used for gun carriages, mortar beds, windlasses, quoins, bollards, and rollers.
38. Lignum Vitæ (West Indies), used for sheaves of tackle blocks, for rollers, and for stretchers.
39. Iron Bark (Australia), used for gun carriages, mortar beds, windlasses, bollards, rollers, and quoins.
40. Sabicu (Cuba), used for gun carriages, mortar beds, bollards, rollers, and quoins.
41. Fir (Russia), used for pontoon equipment, gun platforms, and mortar beds.

42. Boxwood (Turkey), used for mallet heads.
43. Alder (Great Britain), used for sabots.
44. Elm (North America), used for forage and water carts, sponge and rammer staffs, and railway trucks.
45. Deal, White (Petersburg), used for packing cases.
46. Deal, Spruce (Quebec), used for life-saving rocket sticks.
47. Deal, Yellow (Archangel), used for signal rocket sticks, and chests for tools and small arms.
48. Pine, Pitch (North America), used for picket posts, and sleighs for moving 80 and 100 ton guns.

This Collection from the War Department included also examples of Gun Stocks in different stages of manufacture, from the raw block of Walnut to the finished article, for both the long Snider and the Martini-Henry Rifles; samples of peeled Willow and Alder woods, with Charcoal made therefrom, used in the manufacture of Gunpowder; Specimens of "Jack-Wood" from Ceylon, said to withstand the ravages of White Ants owing to its intense bitterness; Specimen of Elm used for a Chopping Block, at Colombo, Ceylon, eaten out by White Ants, and illustrating their destructive nature to wood articles; and a complete Mounted set of Cavalry Lances, with shafts of Ash, Bamboo, and Lance-wood.

A large and interesting Collection of Cones and Seeds in cases, bottles, and bags, all accurately labelled, from Vilmorin, Andrieux, & Co., Paris.

A great variety of seeds, barks, fibres, gums, resins, oils, woods, and other Forest Products, from the various Presidencies of India and Burmah.

A valuable Collection of fibres produced from indigenous plants; many Specimens of Woods, and Samples of Forest Produce, from the Island of Mauritius.

A Collection of Samples, in clear glass tubes arranged in cases, of about 500 kinds of Arboricultural, Agricultural, and Horticultural Seeds, with the Weeds and Adulterations commonly found among them, from Germany.

A fine Collection of Tree and Shrub Seeds, and of Cones, grown on the Stevenstone Estate, Devonshire, from James Barrie, Stevenstone.

Several fine Samples, in clear glass jars, of Scots fir and Common Spruce Fir Seeds, from Norway.

A large number of Samples of valuable fibres, gums, oils, seeds, barks, and other Forest Products, from the Islands of St Vincent and Tobago, West Indies.

A numerous and varied Collection of Ropes and Cordage, and of the materials for their manufacture, from India, Burmah, Ceylon, Cyprus, Mauritius, South Africa, Sierra Leone, and British Guiana.

A valuable Collection of Articles illustrating the manufacture of Paper from Wood, showing the different kinds of wood in their raw state; dressed and prepared for pulping; the various stages of maceration and the processes of pulping; and also many kinds of paper and cardboard of various qualities made therefrom, from British, Danish, German, and Scandinavian Manufacturers.

Samples of Wood Paper, from Japan; and of the leaves of the Palmyra Palm (*Borassus flabelliformis*) and the Talipot Palm (*Corypha umbraculifera*), used by the natives in the East for writing upon.

Section showing the point of union of *Abies morinda* grafted on *Abies excelsa.* The tree grew in the Grounds at Hopetoun House, Linlithgowshire; and after attaining a diameter of 15 inches at the graft in about sixty years, it began to show evident signs of decay, although other similarly grafted trees are thriving well; from John M'Laren, Hopetoun.

A fine Collection of Specimens of various descriptions illustrating the Art of Tree Pruning, and also the evil results of injudicious pruning, from D. M'Corquodale, Dunrobin, Sutherland, and the Comte des Cars, Paris.

Section of Stem of a Coffee Tree, showing the destructive work of the White Borer, *Xylotrechus quadrupes,* from Ceylon.

Section of a Pile, showing the ravages of the Sea Worm, *Xylophaga Teredo*, from Pont-de-Galle, Ceylon.

Section of Cedar of Lebanon, showing the ravages of the Giant Sirex; from Alexander Christie, Warwick Castle.

Several fine Specimens of the Nests of the Arboreal Termes (White Ants), which can be utilised in the manufacture of Papier Maché; from Dr Cleghorn of Stravithie, Fife.

A very interesting Collection of beautiful Japanese Models of charcoal kilns, timber slides, dams, and other appliances for the transport and conversion of timber in Japan.

Models of houses, huts, implements, household utensils, and other articles of domestic use, in India, Japan, Ceylon, South and West Africa, West Indies, and British Guiana.

Model of Wooden Bridge over the Almond River, Perthshire, from William M'Corquodale, Scone, Perth.

Some very curiously trained and dwarfed Specimens of *Abies firma, Larix leptolepis, Pinus densiflora,* and other trees, from Japan.

A fine Collection of Bamboo Stems, of different lengths and sizes, showing the numerous modes in which the Bamboo is utilised in Tropical Countries.

Specimens of Ornamental Wood Fencing and Lattice Work, from Denmark.

Specimens of Slate Fencing and Slate Labels, from A. D. Webster, Penrhyn, North Wales.

A Collection of beautiful Photographs of old and remarkable Trees, from Magnus Jackson, Perth.

Several fine Photographs and Illustrations of Forestry objects, from Dr Cleghorn of Stravithie, Fife.

A number of neatly framed Coloured Plates of Lawson's Pinetum Britannicum; from The Lawson Seed and Nursery Company, Limited, Edinburgh.

The Album of the Scottish Arboricultural Society, with the Photographs of Members.

The Collections of valuable Forestry Books and Periodicals which have been presented to the Scottish Arboricultural Society, with complete sets of the *Transactions, Proceedings,* and other publications, and the *Minute Book* of the Society since it was instituted in the year 1854.

ABSTRACT of ACCOUNTS of ROYAL SCOTTISH ARBORICULTURAL SOCIETY for YEAR 1886-87.

CHARGE.

Branch		£	s.	d.
I.	Cash in hand,	£0	16	0
II.	Arrears of Subscriptions received,	18	15	6
III.	Subscriptions due for current year, 1886-87,	196	9	6
IV.	Subscriptions for former years still in arrear,	58	17	6
V.	Sums received for Life Membership,	21	0	0
VI.	Sums received for Advertisements,	8	5	0
VII.	Dividend on Bank of Scotland Stock,	13	10	0
VIII.	Miscellaneous receipts,	6	6	0
IX.	Interest on Capital Account in Bank,	0	4	1
X.	Current Account with Bank,	27	17	10
		£352	1	5

DISCHARGE.

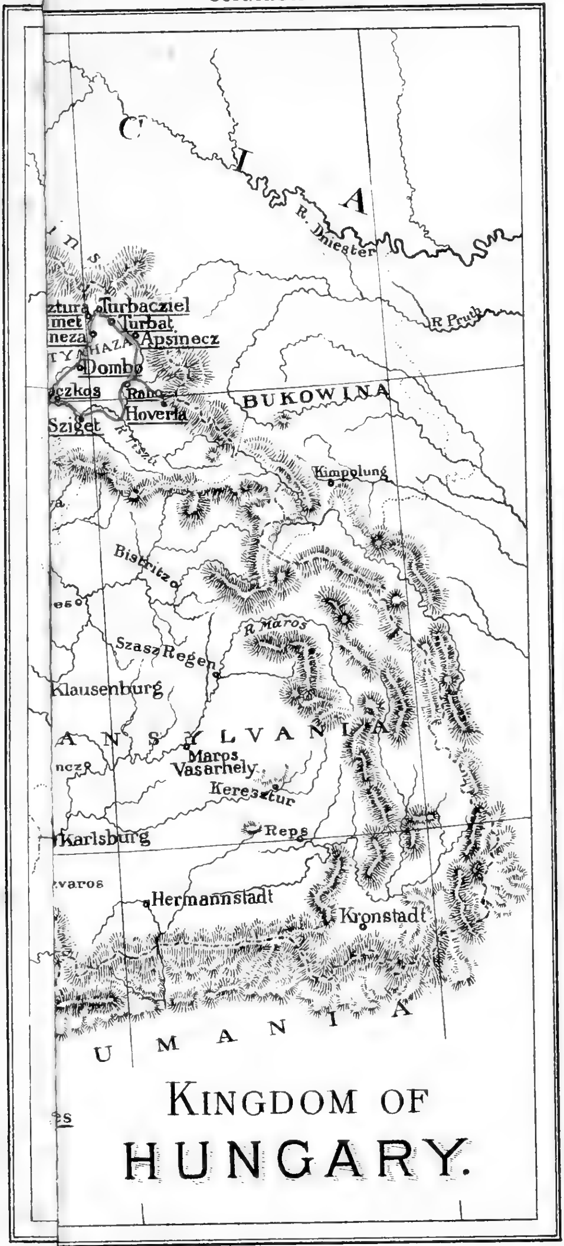
Branch		£	s.	d.
I.	Subscriptions outstanding for current year,	£117	11	6
II.	Subscriptions for former years in arrear,	58	17	6
III.	Prizes paid in money,	9	14	0
IV.	Accounts paid,	144	11	5
V.	Incidental expenses,	5	8	9
VI.	Amount of Life Subscriptions paid into Capital Account, with interest,	14	4	1
VII.	Interest paid on overdraft,	1	14	2
		£352	1	5

STATE of the FUNDS.

Sinking Fund, being price paid for £100 of Bank of Scotland Stock, and transfer of same,				£327	5	0
Amount of Capital Account,				32	6	1
				£359	11	1
Less overdrawn from Bank,	£45	7	5			
Salary due to Secretary and Treasurer,	40	0	0			
				85	7	5
				£274	3	8

Edinburgh, 29th November 1887.—I have examined the foregoing Account of Mr John M'Laren, Junior, as *Treasurer* of the Royal Scottish Arboricultural Society, for year from 21st July 1886 to 21st July 1887, and find the same to be correctly stated and sufficiently vouched. The total Funds of the Society are, as per State of Funds at close of this Account, £274, 3s. 8d.

JOHN ORD MACKENZIE, *Auditor*.


R. Dniester
R. Pruth
Turbacziel
Turbat
Apsinecz
Dombo
Hoverla
Sziget
BUKOWINA
Kimpolung
Bistritz
R. Maros
Szasz Regen
Klausenburg
Maros Vasarhely
Keresztur
Reps
Karlsburg
Hermannstadt
Kronstadt
KINGDOM OF
HUNGARY.

MAP OF COLONEL BAILEY'S TOUR IN HUNGARY, 1886.

The Red Lines show the Route travelled

ADVERTISEMENTS.

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TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

VOL. XII.—PART II.

SECRETARY AND TREASURER,
WILLIAM J. MOFFAT,
FELLOW OF THE BOTANICAL SOCIETY, EDINBURGH.

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

CONTENTS.

The Society, as a body, is not to be considered responsible for any statements or opinions advanced in the several papers, which must rest entirely on the authority of the respective authors.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

Royal Scottish Arboricultural Society.

EXCURSION 1889.

THE ANNUAL EXCURSION will take place on *Wednesday and Thursday, 7th and 8th August*, to SHERWOOD FOREST, NOTTINGHAMSHIRE, when the Estates of CLUMBER, THORESBY, RUFFORD, WELBECK, and WORKSOP will be visited. Due intimation will be made to the Members of the Route, Charges, etc.

Members who intend to join the EXCURSION will oblige by intimating the same to me as soon as possible, so that the necessary arrangements may be completed.

W. J. MOFFAT,
Secretary.

5 ST ANDREW SQUARE,
EDINBURGH, *May* 1889.

treated to an excellent discourse upon subjects of importance to Forestry, and upon many matters having a beneficial influence upon the welfare and prosperity of the Society. Therefore, I regret the more that I am not gifted with the eloquence necessary to address you in the same effective style; nor am I possessed of the practical knowledge and training to enter with success upon a technical discussion of any special branch of the wide subjects of Arboriculture and Sylviculture, or what we know by the simple and comprehensive term of FORESTRY; but, if you will kindly bear with me for a short time, I will endeavour

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

VIII. *Address delivered at the Thirty-fifth Annual Meeting, 7th August*, 1888. By Malcolm Dunn, Dalkeith.

Gentlemen,—In the absence of the President, Sir Herbert Eustace Maxwell, Bart., whose Parliamentary duties make it impossible for him to be with us to-day to give the usual Address, it has fallen to my lot, as a Vice-President, to undertake the duty of presiding at this Meeting, and to do the best I can, at short notice, to deliver the "Opening Remarks by the Chairman," as intimated in the Billet.

For many years it has been customary for the President to open the Annual Meeting with an Address on some topic of a special or general interest to foresters, and designed to promote the advancement of Arboriculture. From the able and learned gentlemen who have previously filled this chair on thirty-four similar occasions, the members present have always been treated to an excellent discourse upon subjects of importance to Forestry, and upon many matters having a beneficial influence upon the welfare and prosperity of the Society. Therefore, I regret the more that I am not gifted with the eloquence necessary to address you in the same effective style; nor am I possessed of the practical knowledge and training to enter with success upon a technical discussion of any special branch of the wide subjects of Arboriculture and Sylviculture, or what we know by the simple and comprehensive term of Forestry; but, if you will kindly bear with me for a short time, I will endeavour to glance at some of the more prominent topics of the day in connection with Forestry, and particularly those likely to interest the members of this Society.

Looking back to the year 1854, when our Society first saw the light, we may say that systematic Forestry, as now understood, was then in its infancy. Our esteemed ex-President, Dr Cleghorn, was, at the same period, engaged in evolving, in the midst of his official avocations, that great scheme of Forest Conservancy, which he began to put into execution in 1856 in the Madras Presidency. A few years later, Dr Cleghorn took an active part, in association with Sir Dietrich Brandis, in establishing in the various Presidencies that system of forest management which is now an important feature of the rural economy of the Government of India, and full of promise in the future development of that magnificent country. Forestry, in a practical form, was then unheard of in any of the numerous Colonies and Dependencies of the British Empire, in all of which it is now receiving more or less attention, and furnishes a subject for much speculation and discussion by those who are interested in the prosperity of our Colonies, as to the best methods for afforesting the extensive treeless wastes and arid tracts, which are too common a feature in many of them. At the same date, comparatively little had been done in Britain to improve the methods of Forestry adopted by our forefathers a couple of centuries ago, when first they began to utilise waste lands, by covering them with forest trees. The systems they practised in forming their woodlands, and in sheltering their fields and ornamenting their domains with plantations of trees and shrubs, were still, to a great extent, slavishly followed. Several generations of tree-planters had succeeded each other, working on almost identical lines; and although, judged by more modern experience, their ideas might be somewhat crude, they were fairly successful in rearing beautiful plantations for the adornment of the landscape, and thrifty woods for sheltering many a bleak hillside. Is there much wonder then, that, before the advent of railways and the numerous appliances of modern civilisation with which we are now so familiar, there was little disposition to strike out into new and improved methods, or that the ordinary forester did not care to trouble himself about aught but what his father had practised before him? However, the time came when a few ardent and intelligent foresters clearly saw, that if their profession was to hold its own in the struggle for life, something farther must be done, so that knowledge might be acquired with greater facility by their brethren, and the means afforded to raise themselves and their profession to the higher standard demanded by the necessities of modern times.

The Scottish Arboricultural Society was therefore instituted, in 1854, by a few able and enthusiastic foresters, with a view to promote a better knowledge of the science and art of forestry, and the adoption of the best methods for the management of our woods and forests. Following up the scheme so judiciously laid down by the original pioneers, the Society has diligently persevered on the path so skilfully traced, and has striven, by every legitimate means, to foster a love of the profession among its members, to promote a correct knowledge of the various systems and details of modern forestry, and especially to institute a suitable education for young men, and the best possible method of training, to qualify them for carrying out with credit and success the manifold functions of a forester.

As an instance of the enterprise and zeal of the Society, we may point to the announcement made by the Marquis of Lothian, then *President*, at the Annual Meeting in 1882, that the Council had resolved to promote an International Forestry Exhibition (the idea having originated with some members of the Council in the spring of that year) to be held at Edinburgh as soon as the necessary arrangements could be completed. This marked a great step in advance; and when that unique and remarkable Exhibition was carried to a successful issue in 1884, the members of this Society had good reason to congratulate themselves on the wonderful amount of public interest and enthusiasm it had drawn towards the subject of Forestry, and the warm and liberal support which the Exhibition received from all parts of the world where forests exist, and where national and commercial interests depend largely upon them.

Aroused in a great measure by the deep public interest excited by the Forestry Exhibition, this Society, along with others, took steps to press upon the Government, by petition and otherwise, the great want experienced in this country of a regular system of education and training for foresters, similar to that so long employed, and with such excellent results, in most European countries, especially in France and Germany. The subject was ultimately brought before Parliament, and chiefly at the instigation of Sir John Lubbock, Bart., a Select Committee of the House of Commons was appointed in 1885, "to consider whether, by the establishment of a Forest School or otherwise, our Woodlands could be made more remunerative."

This Select Committee on Forestry sat in 1885, 1886, and 1887, and had full power to send for persons, papers, and records, so that the investigation might be as complete and exhaustive as possible. After due deliberation, the Committee proceeded to collect evidence by the examination of educational experts, and of a selected number of other witnesses possessed of a more or less practical knowledge of the subject of inquiry. Thirty-one witnesses were examined, most of them at considerable length, during the eight days on which evidence was taken. They fairly represented the various interests involved in the question in each of the three kingdoms, and among them were the following ten distinguished members of this Society:—Sir James Campbell, Bart.; Sir Richard Temple, Bart.; Sir Joseph D. Hooker; Dr Cleghorn of Stravithie; Mr Robert Dundas of Arniston; General Michael; Mr Alexander Mackenzie; Mr John M'Gregor; Mr William M'Corquodale; and Mr John Grant Thomson; so that the Society was amply represented before the Committee. It is, however, to Dr Cleghorn that the credit is due of pointing out to the Committee, in the course of his evidence in 1885, the aims and objects of the Society, and the good work which it has done in promoting the better training of foresters, in spreading a knowledge of improved methods of forestry, and in stimulating an interest among landowners and others concerned, in the proper treatment of our woodlands, and of the importance of forest teaching as a great national desideratum. Mr John M'Gregor also gave information as to the work of the Society when examined in 1887; and much useful and practical evidence, bearing directly on the question of inquiry, was furnished to the Committee by the other members of this Society.

Having received all the evidence which they considered necessary, and matured their deliberations, the Forestry Committee agreed to a Report, which was issued by Parliament on the 3d of August 1887, in which they declared themselves satisfied by the evidence, "that the establishment of Schools of Forestry, or some similar method of instruction and examination in Forestry, would be desirable." With the view of carrying this into effect, the Committee recommended the creation by the Government of a Forest Board; and we are led to believe that this Board will be formed in connection with the new Department of Agriculture and Rural Affairs, which it is intended to establish during this session of Parliament. Let us hope that when the Forest Board is created, such an able chief as our ex-President, the Marquis of Lothian, may be placed at the head of it. His great knowledge of and keen interest in Forestry, and his practical experience as President of the International Forestry Exhibition, and of this Society from 1879 to 1882, pre-eminently qualify him for the office.

In accordance with the recommendation of the Forestry Committee, the Royal Scottish Arboricultural Society will be entitled to a representative on the proposed Forest Board. Seven other societies and institutions connected with rural affairs are to have the same privilege of sending a representative to the said Board, which will also comprise the Director of Kew Gardens, three Members of each House of Parliament, and a certain number of owners or managers of large woodlands. Great care has evidently been taken to have all institutions and interests, in any way concerned in our woodlands and their management, duly represented on the Board; and if the various public bodies who possess the privilege are careful to elect thoroughly efficient members to represent them, we may look forward with confidence to the establishment of proper institutions for the training of all grades of foresters that the necessities of the Empire may require either at home or abroad.

We would no doubt have greatly preferred an independent Department of Forestry, the head of which would be in direct communication with the Government of the day, and responsible to it for all that concerned his Department. The Forestry Board may have considerable difficulty in obtaining full consideration from the Department of Agriculture, of many important questions with which it will be called upon to deal. The multifarious duties and affairs connected with Agriculture must absorb most of the time and the principal attention of the Department, and leave but a small margin for either Forestry or Horticulture, both of which are to be included in its scope. In any case, foresters should earnestly make the best of the circumstances, and the result may be more satisfactory than present appearances lead us to anticipate.

Assuming that our foresters will soon be enabled to acquire that complete and systematic training of which they have long felt the want, it may be asked, and with reason, What are the prospects of foresters receiving remunerative employment, after they have fully qualified themselves for their profession? This is a question which I have looked into with care, examining it in various aspects, and I trust that my hearers will not consider that I take an over sanguine view, when I say that it appears probable there will be no lack of employment for duly qualified men, and that the remuneration will be at least equal to that received by any other profession, in qualifying for which the same amount of time and money has been expended. The owners of large estates are every day becoming more alive to the fact that their woods and waste lands must be managed with the best skill and intelligence that it is possible to command, so as to make them a permanent source of income, instead of the almost worthless burden which they have often proved to be in the past.

The area of the United Kingdom is computed to be, in round numbers, 121,000 square miles, or about 77 millions of acres. Of this area one-half, or thereabout, is held by those whom Bateman, in his treatise on the Modern Domesday Book, styles "the Great Landowners of Great Britain and Ireland." These Owners of large Estates, to the number of about 2600, hold from 3000 acres each, up to the enormous area of 1,358,546 acres owned by the Duke of Sutherland, the greatest landowner in the United Kingdom. Generally speaking, it is upon these vast estates that the large tracts of waste and treeless land is found. The owners of smaller areas cannot afford to allow land to remain waste and unprofitable, and as a rule the proportion of waste or land of small value to arable and woodland is much less on small than on large properties.

Here, then, is scope enough for the employment of at least *one* well-trained forester *on each* of these large estates, and to clothe the bare and profitless wastes on some of them with healthy and remunerative forests would furnish work for several skilled foresters. From the Parliamentary returns in the Modern Domesday Book, already referred to, it appears there are about 12 millions of acres in the United Kingdom, nearly all included in these large estates, the annual value of which does not exceed an average of 1s. 3d. per acre. Allow a deduction of one-third for high altitudes and land unsuitable for the growth of forest trees, there still remains 8 millions of acres of land which might be covered with forests, to the great advantage of the owners and the immense benefit of the country. Granting that a third of the area is valueless for growing timber trees, and probably of small value for any other useful purpose, the value of the remaining two-thirds will be proportionably increased. Still, at the highest estimate, the yearly rental, from all present sources, is considerably under 2s. per acre; and at that low rental the land is plainly not of much value for grazing purposes. Such land, properly planted, would, after the trees had attained a certain size, in all probability afford as much grazing for stock, under proper regulations, except in Pine woods, as it had furnished before being planted. It would also give far better shelter and cover for deer and other game, which would still be a source of considerable revenue. The greater portion of this land, lying at an altitude of 300 to 1500 feet above sea level, is well adapted for the growth of forest trees, and only requires to be properly laid out, planted, and managed by duly qualified foresters to greatly increase the annual income derived from it, after paying all expenses and allowing for all contingencies. In addition to this, the working of the forests, and the collection and manufacture of the various products, would supply well-paid labour to a much more numerous rural population than now inhabits those districts, and would thus help to solve one of the great social problems of the day,—How best to retain in rural districts a happy and industrious working population?

Nor is there the slightest danger of over-stocking the country with forests, supposing every acre of these 8 millions was planted. The total area at present under woodlands in the United Kingdom is calculated to be about 2,788,000 acres, the smallest proportion to the total acreage of the country that we find in any well-regulated European state. With the 8 millions added, the woodlands would only cover 14 per cent. of the total area, a proportion which is exceeded by several of the northern countries in Europe.

We thus see that there is no want of room for a great extension of the area of timber tree forests in the United Kingdom, and a consequent demand for well-educated and trained foresters, who can manage with success those important enterprises. It may be said that the owners of the land have the will, but some of them have not the means to plant extensively. This is a difficulty, however, that can be overcome in the usual manner, either by

Government loans, or by forming public companies to supply the means. Money is cheap, and the security is good; and those who first begin planting operations on a proper scale, and in a judicious manner, are likely to reap the greatest reward.

We now turn for a moment to the events of the year which has passed since we last met in this hall. The first event to which I will refer was the highly successful Excursion of the Society immediately after our last meeting, when, by the gracious permission of the Queen, the members enjoyed the privilege of inspecting the beautiful woodlands around Balmoral, and the famed Scots Pine forest of Ballochbuie, a full account of which has been published and sent to every member.

The issue of the Report of the Forestry Committee of the House of Commons took place on the 3d of August, as already stated, and caused a considerable amount of discussion in the public journals. It was favourably received and criticised by most authorities, although it raised but a limited amount of enthusiasm amongst professional foresters, owing chiefly to it failing to recommend a definite system of forestry instruction under proper authority, in accordance with the strongly felt want of professional men. A summary of the evidence and report has appeared in the *Transactions* for the last three years, and most of the evidence of value to foresters has been given in detail.

In the month of October last the Society had the honour to have the designation of "The *Royal* Scottish Arboricultural Society" conferred upon it by Her Most Gracious Majesty the Queen, by which title it will henceforth be known. The part of the *Transactions* lately issued comprises some valuable papers, and compares favourably with former issues. Towards the end of 1887, the Council were able to make a favourable arrangement with the proprietor of the *Farming World*, by which Forestry articles and correspondence on topics of more or less importance have appeared in its pages, and every effort of the kind deserves the hearty support of all interested in the subject.

In Forest Literature, the most important publications, in English, which have appeared during the year are the valuable Reports issued by the Forest Department of India, by several of our Colonies, and particularly by the Government of the United States. Many of these books have been presented to the Society, and are added to the library.

It is right that I should allude here to an important event which takes place to-day at our Annual Dinner; I mean the presentation of a Testimonial to our highly-esteemed friend, Dr Cleghorn of Stravithie, from his numerous friends at home and abroad, in recognition of his eminent services to Science and Art, and especially to Forestry. In accordance with Dr Cleghorn's well-known generosity and anxiety to benefit others, he has resolved to devote a sum equal to the value of the Testimonial, over £200, to forming a Library of Forest Literature for the free use of Forest students and others. Through the active and kindly interest of the Director of the Museum, General Sir R. Murdoch Smith, it has been arranged that the Library is to be located in the Museum of Science and Art in Edinburgh, where excellent facilities exist for its accommodation. When placed there, it will be easily accessible to students, foresters, and all who are interested in the subject. The Library will be known to all future generations as "The Cleghorn Forest Library," in grateful remembrance of the esteemed donor. To us, as a Society, this is the most important announcement, in connection with Forest Literature, which has ever been made at our Meetings. The Library will prove an immense boon to future generations of young foresters, by placing within their reach, free of all cost, a most valuable collection of standard works on Forestry and its cognate subjects. I trust that all will endeavour to reap the fullest benefit from this generous and well-timed gift, for which foresters of all grades must feel deeply grateful.

So much, gentlemen, for the past and present; and, in conclusion, I sincerely hope that every member of this Society will make it a point to do his best to increase its future prosperity and usefulness.

PRESENTATION

TO

HUGH CLEGHORN OF STRAVITHIE,

M.D., LL.D., F.R.S.E.

On Tuesday, 7th August 1888, the annual dinner of the Royal Scottish Arboricultural Society was held in the Waterloo Hotel, Edinburgh, when the occasion was taken advantage of to present Dr Cleghorn of Stravithie with his Portrait, subscribed for by his numerous friends, at home and abroad, as a mark of their esteem for his personal qualities, and appreciation of his services to science and arboriculture in India and this country. The chair was occupied by Professor Bayley Balfour, and Mr M. Dunn, Dalkeith, officiated as croupier. Among others present were the guest of the evening, Dr Cleghorn of Stravithie; Sir William Muir, K.C.S.I., Principal of Edinburgh University; General Maclagan, R.E., Professor Sir Douglas Maclagan, Colonel Dods, Dr Lundie, Messrs J. E. Dovey, C.A., Edinburgh; James Watt, J.P., Carlisle; William Erskine, Edinburgh; James Kay, Rothesay; James Robertson, Panmure; John M'Laren, Winchburgh; John M'Laren, junior, Perth; A. Milne, Edinburgh; A. A. Green, Edinburgh; R. Baxter, Dalkeith; and W. J. Moffat, Secretary, Edinburgh.

The Secretary intimated letters of apology from a wide circle of friends who were unable to be present, in which they expressed the greatest interest in the object of the Presentation, and conveyed their warmest wishes that Dr Cleghorn might be long spared in health and happiness.

The CHAIRMAN gave the loyal and patriotic toasts in appropriate terms, which were warmly responded to. General MACLAGAN, formerly of the Indian Service, replied for the Army, and spoke of the friendship which he entertained for Dr Cleghorn, with whom, in his work in Northern India, he had been intimately associated for some years.

Sir WILLIAM MUIR, in proposing the health of Dr Cleghorn and asking him to accept the Portrait, said,—I have received a letter from Sir Dietrich Brandis, ex-Inspector-General of Forests in India, dated 14th July, in which he writes:—"It is a great source of regret that I shall not be able to be present on 7th August, on the occasion of the presentation of a memorial to Dr Cleghorn. Would you do me the favour to mention that I am extremely sorry I cannot attend, as the duty which I have undertaken for the India Office, to conduct the senior students at Cooper's Hill on their autumnal tour, will make it impossible for me to be present." Proceeding, Sir William Muir said:—While my acquaintance with Dr Cleghorn began only in 1861, when at Cairo on our way to India, Sir Dietrich Brandis has kindly furnished me with an account of Dr Cleghorn's earlier Indian career, to which I will take the opportunity of referring on one or two points. After marching about with his regiment for a year or two in the Madras Presidency, Dr Cleghorn was enabled to lead a more settled life, when he at once applied himself to scientific work. He early perceived the immense importance of the tropical forests. He saw that as the population spread out, the people were tempted to invade the forests and cultivate within them. He was one of the first of those who were at the bottom of the grand Forestry work now being carried on in India. Early impressed with the devastating results of what was known as "Koomri" cultivation, as far back as thirty years ago he was instrumental in getting orders issued by the Government to stop that wasteful system. It was just such a man as our friend who could best carry out Forestry measures amongst the people of India without appearing tyrannical or overbearing. As Sir D. Brandis writes:—"Dr Cleghorn was able to carry his point in regard to Koomri cultivation, because he was known to be a true friend of the natives; he entertained feelings of warm sympathy towards them, and had made himself familiar with their modes of life and systems of husbandry. As a medical man his name was widely known, and he had acquired much influence among the native population. When urging the discontinuance of Koomri cultivation in Madras, as he had previously urged it in Mysore, he knew that he was proposing measures which in the end would be highly beneficial for the people themselves. Dr Cleghorn's single-minded desire to promote the welfare of the people was evident to those who at that time were in influential positions in Madras, and the confidence which they placed in him was the secret of his success in this important matter." In 1850, when the British Association was in Edinburgh, our esteemed guest was appointed, along with some other eminent men, to report upon tropical forests and the influence which they exerted on the climate and the resources of the country. That report has had an important effect on the movement in India for the conservation of the vast and rich forests there. In 1856, he was appointed Conservator of Forests in Madras; and in 1861 he brought out a book on the "Forests and Gardens of South India," which was extremely useful in letting people see the value of the forests, and what ought to be done to assist their cultivation. In 1864 he made an important investigation into the vast forests of the Punjab, and in acknowledging his report the Government of India gave him the proud title of "the Founder of Forest Conservancy." He was afterwards appointed a Commissioner to report on what measures should be taken for the systematic cultivation of the forests of India. It was then at Calcutta and Barrackpore that I saw much of our friend in the bright domestic life over which a cloud of bereavement has recently so sadly come. In 1867, when Dr Brandis came home, Dr Cleghorn was appointed to officiate as Inspector-General of the Forests of India. In 1869 he returned to this country, and since then he has taken an active part in the work of the India Office. Many a young man must have a pleasant recollection of the kindly way in which he was introduced to the service by our friend. When he retired, the Government of India said of him:—"His long services from the first organisation of Forest Management in Madras have without question greatly conduced to the public good in this branch of the administration; and in the Punjab also Dr Cleghorn's labours have prepared the way for the establishment of an efficient system of Conservancy and working of the Forests of that province." Since our friend became a resident in Edinburgh, he has been an ardent member of the Botanical Society, of which he has been President. Of recent years he has been an Examiner in Botany for the University of Edinburgh; and for eighteen years has been Chief Examiner in Forestry for the Highland and Agricultural Society, an office which he continues to hold with great satisfaction to all concerned. He was elected a member of the Scottish Arboricultural Society in 1865, while still in India. Soon after his return to this country he was duly elected to the Council of the Society, and in 1872 he was appointed President, being re-elected in 1873, and again in 1883, 1884, and 1885. During his second term of office the International Forestry Exhibition was held in Edinburgh, in 1884. Dr Cleghorn took the lead in carrying out that great undertaking, the first of its kind held in the British Empire, and the success of that unique and interesting Exhibition was largely due to his untiring industry and enthusiastic labours. As a witness before the Forestry Committee of the House of Commons he gave, along with others, valuable evidence, which has induced the Government to propose the formation of a Forest Board to inquire into and promote the proper education and practical training of young men for Forest service; and which has also led in part to the establishment of a Forest Branch in the Engineering College at Cooper's Hill, Surrey. In all Forestry matters, and especially those connected with the welfare and prosperity of the Arboricultural Society, our guest has always taken a keen and intelligent interest, and has never spared time nor trouble in carrying out anything that would be for the good of foresters or the advancement of Forestry. His services at the time of the Forestry Exhibition and since have been of extreme value, and I hope that as the result we shall have a School of Forestry here, and that Scotland will have a large share in the future administration of Forestry in the Kingdom. At home in Fife, and in Edinburgh, our esteemed friend is known for his interest in the welfare of all around him, and warm sympathy with every philanthropic movement having for its object the good of the people. He weeps with those who weep, and rejoices with those who rejoice. May he long be spared to be of use to us all, and may we long see his genial face among us.

In asking Dr Cleghorn to accept his Portrait, Sir William Muir said that they were met to tender an expression of their affectionate regard for him, and he added, the fund was subscribed to by all classes—peers, Indian judges, members of Parliament, principals and professors of Universities, generals and colonels of the Army, foresters, and horticulturists. He asked Dr Cleghorn to accept it as a small token of their regard. The Testimonial also comprised £200, which, in accordance with Dr Cleghorn's suggestion and approval, was to be applied to forming the nucleus of a library of suitable books, to be called "The Cleghorn Forest Library," to be placed in the Museum of Science and Art, Edinburgh.

The proposal was received by the Company with the warmest enthusiasm; and, in replying,

Dr Cleghorn said,—Dear friends, in returning thanks on this to me very interesting occasion, I fear that I cannot adequately express my feeling of gratification at this unexpected presentation, and especially the pleasure superadded by the kindly words of my valued friend, Principal Sir William Muir. It is very dangerous for any frail mortal to venture to speak of himself, or to refer to his past career; but after the too generous allusions to various incidents of my life which have been made to-night, this can scarcely be avoided.

In early life I was brought up with a tutor in the country, and trained to rural pursuits and acquaintance with agricultural routine. I had an excellent education—first at the High School of Edinburgh, and afterwards at the University of St Andrews. In 1837, I became an apprentice for five years of the eminent surgeon, Professor Syme (from whom I learned much, both from his hand and his head), and graduated M.D., Edinburgh, in 1841. In the following year, at twenty-two years of age, I received an appointment in the East India Company's Service, and sailed for Madras in the troopship "Wellington."

After a few years of marching and counter-marching with different regiments in Southern India, between Dharwar and Trichinopoly, I obtained a civil charge in the Mysore Commission, with the superintendence of a jail, vaccination, and other duties. Here, for the first time, I had a considerable amount of leisure, and resolved to follow the advice previously given to me by Sir Joseph Hooker, viz., to study one plant a day for a quarter of an hour; and which I did after the morning's duty in the jail and hospital was over. About this time also, my honoured University teacher, the late Sir Robert Christison, sent me a list of *inquirenda* and *desiderata* relating to Indian drugs, which I endeavoured to follow up. Pursuing this plan steadily, I soon acquired a knowledge of the Flora of the Province of Mysore. As time advanced, official references were made to me in regard to the Medical and Economic Plants of India, and other duties were added, such as preparing a collection of native raw produce for the Local Museum. In 1848, I was sent home, invalided by Mysore fever, and took up residence at Torquay for three winters. In 1851 my papers were drawn up for resigning the Service; but before sending them in, I resolved to try another voyage round the Cape of Good Hope, and was preparing to start, when Professor Forbes Royle, of King's College, London, asked me to assist him in arranging the raw produce for the Great Exhibition of 1851. I gave up my intended voyage, and was occupied for several months in classifying the exhibits in the Indian Section. In 1852, finding my health improved, I returned to Madras; and, having resumed military duty, Sir Henry Pottinger, then Governor, appointed me to the Chair of Botany and Materia Medica in the Madras Medical College. To this the duties of Port and Marine Surgeon, and afterwards of the District Surgeoncy of St. Thomé, were added. I remained in Madras till 1856, when I was transferred to the Revenue Department by Lord Harris, and called upon to undertake the formation of the Forest Department in the Madras Presidency. In 1861, I received instructions from the Governor-General of India (Lord Canning) to proceed to the Punjab to examine the forests of the Western Himalaya, and to institute a systematic plan of Conservancy and management. I spent three years in exploring the countries adjacent to our north-west frontier, including part of Kashmir and the Trans-Indus territory. During this period, I learned much from my laborious and experienced friend and coadjutor, Sir D. Brandis.

In 1869, I retired from Indian life, and have since lived amongst you, endeavouring to discharge such duties, public and private, as have devolved upon me.

After Sir William Muir's kind allusions, I need not refer to the part which fell to me in connection with the International Forestry Exhibition in 1884, or to such assistance as I was able to render in stirring up public interest in the claims of Forest Education upon the State, towards which some progress was made in the recent appointment by the House of Commons of a Select Committee to deal with the subject. That Committee has reported in favour of a Forest Board, and I venture to hope that in due time we shall see one or more Schools of Forestry established.

I cannot sit down without again acknowledging the great kindness which has prompted this Presentation. The list of donors to the Testimonial, which has been handed to me, has greatly touched me, and I notice with special pleasure that it includes not a few of the junior officers in the Forest Department of India. To me it has been a pleasant duty to aid many young recruits in their training for the Indian Service, and I have been much gratified by receiving a visit from some of them at my home in Fife when they return on furlough. I notice also the names of a large number of Scottish foresters, old and young, whose faces are well known to me, as I have often had the pleasure of meeting them at our annual gatherings.

The Portrait shall remain at Stravithie as a memento of this occasion, and in considering the best object to which the Testimonial Fund could be devoted, I may be allowed to say that I desired to confer a benefit on foresters in general, and young foresters in particular, and I believed that a Forest Library placed in a public institution like the Industrial Museum, where all could have access to it under proper regulations, would best conduce to that result. It has been a pleasure to me to know that this proposal has received the cordial support of Sir R. Murdoch Smith, K.C.M.G., the Director of the Museum.

The CROUPIER, in proposing "The Royal Scottish Arboricultural Society," said it was never in better working order, the membership was flourishing, and a healthy vigour existed in all its branches, which the Members should strive to maintain.

Colonel DODS proposed "The University of Edinburgh," and expressed the hope that they might be successful at an early date in establishing a Chair of Forestry in the University.

In replying, Sir WM. MUIR said he hoped they might, at some not distant time, have a Chair of Forestry in the University; but, as they were aware, they were now in a very constrained position. They had been looking to Parliament for a long time to give them the liberty they desired, but the much-needed legislation, in the shape of the Universities Bill for Scotland, did not come. Members went on talking about other things which they had much better leave alone. Home Rule was a very good thing in its way, and he hoped they would have it in the University to the extent of enabling them to make the changes desired. As to the proposed transfer of the Botanical Garden, the University did not want it. They would much rather that it remained under the management of the Government, and open to the public at large, and he trusted that the representations that had been made would prevent its being handed over to the University.

Mr KAY gave "Kindred Societies," for which Sir DOUGLAS MACLAGAN responded. Mr DUNN proposed "The Landed Proprietors," to whom the Society was much indebted for privileges it received, and the hospitality extended to its members when visiting the woodlands on their estates. Dr CLEGHORN, in acknowledging the toast, said the administration of land was quite as difficult as farming now-a-days; but there was much pleasure to be derived from the management of land, apart from the mere question of revenue. Mr ROBERTSON gave "The Nursery and Seed Trade," for which Mr MILNE replied. The Croupier proposed "The Secretary of the Testimonial Fund," and Mr JOHN M'LAREN, jun., acknowledged the toast, remarking that no one could know Dr Cleghorn without having his heart drawn out in affection to him. Mr MILNE, in proposing the health of the Chairman, congratulated Professor Bayley Balfour on the appointment which he had recently received, and expressed his belief that he would worthily maintain the traditions of the Chair of Botany in the University of Edinburgh.

The CHAIRMAN, in replying, said it was a peculiar pleasure to him to occupy the Chair so long filled by his father, and afterwards by Professor Dickson. He hoped that in the future, as in the past, the Botanic Garden over which he presided would be closely linked with the interests of the Royal Scottish Arboricultural Society. As to the proposed School of Forestry, he hoped it might be possible in some way to utilise the very great resources at the Botanic Garden and Arboretum, and to that end he sincerely trusted that the efforts of the Arboricultural Society would be successful in preventing the transference of the Garden to the University.

The health of the Croupier having been proposed by Mr ERSKINE, "Auld Lang Syne" was sung, and the company broke up.

X. *On the Comparative Value of Exotic Coniferæ as Ornamental or Timber Trees in Britain.* With Table of Measurements. By THOMAS WILKIE, Forester, Tyninghame, East Lothian.

There is nothing which adds more to the attractions and amenity of a place than the careful selection and distribution of hardy, ornamental, and timber trees, the setting and growth of which gives shelter and ornament to both estate and mansion. Receiving "all things richly to enjoy," we have a diversity of leafage and outline in plants which enables us to make a selection from almost every part of the known world, such as is calculated to produce that appearance and effect which we desire.

Our experience and knowledge of the hardiness and ornamental effect of the more recently introduced species and varieties of conifers is being gradually extended, and from numerous reports thereon we may now with some accuracy select those best calculated to suit the soil, climate, and exposure of particular localities. It is not to be expected that one can actually describe the peculiar properties of each species, or of any plant in particular, from a point or in a manner to be at once just and pleasing to every observer, as each individual has his own peculiar tastes, fancies, and beliefs as regards both ornament and value. From my own experience, I shall endeavour to give a short description of those most commonly grown and which are useful for timber purposes; and also make reference thereto as far as their ornamental effect is concerned.

This being a very numerous family of plants, I have purposely omitted a full description of many of the less useful species, so as to keep my report within moderate dimensions. The figures in the Table are chiefly gleaned from reports by travellers and good home authorities, and some have been collected by myself. I cannot, however, be held responsible for the statements of others, which I have had no opportunity to corroborate. I believe that man, animals, and plants are more especially adapted for, and will prosper best in, those parts and temperatures where nature has placed them; hence, we cannot rationally expect that exotic conifers will succeed in every case. Had travellers given us full particulars as to soils, exposures, altitudes, and extremes of temperatures, our knowledge of the suitability of each variety would have been more cheaply gained; because, when we can set plants in soils, exposures, altitudes, and temperatures such as those in which we find them growing naturally, we will then have a more uniform success.

I shall first treat of the FIR tribe, including the Hemlock, Spruce, and Silver Firs; all of which are evergreen. These, when growing alone, or promiscuously among deciduous trees having attractive outlines, produce a pleasing effect in the landscape, especially during the spring and autumn months, when their tints blend more distinctly with that of other trees than during the summer season.

THE HEMLOCK FIRS.

Abies Albertiana (Prince Albert's Fir).—Introduced in 1851. Habitat, Oregon and British Columbia, where it grows to 150 feet in height, and from 12 to 18 feet circumference. It much resembles the better known species, *A. canadensis;* and is quite hardy. A very free growing and useful tree, its graceful drooping branches and pyramidal form rendering it always attractive.

A. canadensis (the Hemlock Spruce).—Habitat, Canada and the United States. Introduced about 1736. It has numerous slender drooping branches, clothed with short broad leaves of a light green colour on the upper and glaucous on the under side. In its young state it is a useful ornamental tree, of a branchy habit, and suitable for open exposed altitudes. It is of no value as a timber tree in this country. In America the bark is much used in tanning, but the tree is not grown in sufficient numbers in Britain to make the bark an article of commerce.

A. Douglasii (the Douglas Fir).—Habitat, California, Oregon, and British Columbia; was introduced in 1827. Perhaps more has been written about this fir than any other of recent introduction. Although of a spreading habit where it has room to grow, it is among the fastest timber-producing trees of the Fir tribe; but when too fast grown the wood is of a rough and second-rate quality. Possibly, with the exception of the larch, this fir is the most valuable, commercially, of all the exotic conifers. Hitherto it has been grown in too limited numbers, and under exceptional treatment, to enable us to put a proper value upon its timber. If treated like our common forest trees, my belief is, that it will not supersede some other species of fir. From the table at the end of this Report, it will be seen that *Abies Menziesii* grows at as high altitudes in its native habitat; and in some places in this country it is producing as much, if not more, timber than the Douglas Fir; and before we place the latter at the top of the list, we must see its value better tested as a common forest tree. As yet the larch is the tree "par excellence" for forest planting; and I question very much if the Douglas Fir were once tested as well as the larch has been, but that its supposed superiorities will vanish. This dark-green tree, grown as a single specimen, is of an open habit of growth, and rather ornamental.

A. D. Stairi.—This distinct variety, which originated at Castle Kennedy, Wigtownshire, is almost white in spring. It assumes a colour approaching the type in summer, and a silvery tint in autumn, and generally loses its leaves before the next season's growth appears. It is of a dwarfish habit, and is a unique specimen for the lawn.

A. Pattoniana (Patton's Fir).—Habitat, California and Oregon. Introduced in 1851. It grows at altitudes ranging up to 10,000 feet, and attains heights of 150 and 200 feet, and girths of 16 and 20 feet; a very ornamental tree. Its leaves are light-green above, and glaucous beneath.

The Spruce Firs.

Abies alba (the White Spruce). — Habitat, British North America; introduced about 1700. Height, 40 to 50 feet; has longer and more glaucous leaves than *A. nigra;* and is a very attractive tree, especially when standing singly, or set amongst others of a sombre green colour.

A. Alcoquiana (Alcock's Fir).—Habitat, Japan; introduced in 1861. A conical growing and distinct tree, and a very free grower in this country. It is perfectly hardy, and I think no planter should omit this valuable species, either for ornament or profit.

A. excelsa (the Norway Spruce).—Habitat, middle and north of Europe; introduced about 1548. It thrives well, attains to a great height, and is a very useful timber tree, the wood being light and elastic, and suitable for a variety of purposes. Its durability depends a good deal on the altitude at which it grows, the soil it grows in, and the management to which it is subjected. The colour of the wood is either a reddish or yellowish white, and contains much less resin than the Scots pine. It weighs 65 lbs. 11 oz. per cubic foot when green, and 35 lbs. 2 oz. when quite dry. Its ashes furnish potash, and its trunk resin, from which Burgundy pitch is made. The timber takes a high polish, is used for gilding upon, and, like the pear, takes a rich black stain. This tree is an excellent and cheap nurse, and being dense in the foliage, it may be said to be a storehouse of heat. It is of a conical form, and being an excellent non-conductor, it protects the ground from cold and drought. The tree luxuriates on north and east exposures in deep loams or a moist sandy soil, and on such it is believed to produce timber in this country equal, or almost so, to that grown in Norway.

A. e. alba (the White Fir of Norway) is of a finer foliage, and by far the most ornamental of the varieties, especially in the early stage of the season's growth, when the young shoots throw a profuse whitish green tint upon the graceful and pendant twigs and older grass-green foliage of the tree.

A. e. nigra (the Black Fir of Norway).—As a single specimen this is a handsome tree till about 15 feet high, if it is allowed plenty of room, and the foliage is well retained. When older and full of vigour, it assumes a drooping habit, and then somewhat resembles *Abies morinda*.

A. e. pendula (the Weeping Fir of Norway).—A most graceful tree, especially if grown in a moderately moist soil. Its drooping habit and dark glossy green leaves at once arrest the eye, and show to great advantage when growing amongst deciduous trees.

A. e. variegata (the Variegated Norway Fir).—This has its leaves blotched with yellow, and is of a dwarfy and rather compact habit; certainly a unique variety, though I do not consider it attractive.

The dwarf varieties of the Norway Spruce are also worthy of a place in all collections, particularly on account of their neat appearance and ornamental effect, such as the following:—*A. e. Clanbrasiliana, dumosa, elegans, Finedonensis, inverta, mutabilis, pygmea*, and others.

A. Menziesii (Menzies' Fir).—Introduced in 1831. Habitat, North-West America, from latitude 42° to latitude 67° North; attaining its greatest dimensions about the mouth of the Columbia River. It does not attain to the size of the Douglas Fir in its native country; but its timber is of excellent quality, and used for a great variety of purposes. In suitable sites in Britain, and in deep moist loam, it is a rapid growing and very handsome tree; its beautiful silvery foliage and long wavy branches being very attractive in ornamental grounds. It is of a wide-spreading habit, and the branches require plenty of room to fully develop their graceful proportions. Some of the finest Menzies' Firs in Scotland are growing in the policies at Castle Menzies in Perthshire. As a timber tree, it promises to be one of the best of recently introduced conifers.

A. morinda (the Himalayan Spruce).—Introduced from India in 1818. It grows at high altitudes, and to a height of 150 feet, girthing from 12 to 20 feet. The tree is a very sombre figure in the landscape. It has a coarse open-grained wood, useful for purposes to which fir timber is generally applied; and contains a large amount of resin in its sapwood.

A. nigra (the Black Spruce).—Introduced about 1700. Habitat, North-East America, and westward as far as Wisconsin. In its native country it attains a height of 60 to 80 feet, with a girth of 4 to 6 feet. Its timber is strong, light, and tough, and used for a great variety of purposes; being durable for inside work, although perishing rather quickly when exposed. As an ornamental tree, it is not often used, but when grown in open places in a moist retentive soil, it forms an attractive tree, of a dark spiral habit, the branches often loaded with cones, and having a striking effect among other trees of spreading habit and lighter foliage.

A. obovata (the Siberian Spruce).—Introduced by Ledebour from Siberia, where it grows abundantly, and varies in height from a tree of 100 feet to a tiny bush on bleak exposures. Considered by some authorities to be a variety of *A. excelsa*, but does not closely resemble the latter.

A. orientalis (the Eastern Spruce). — Introduced in 1839. Habitat, Armenia. An elegant and very ornamental tree; with short leaves, about one-half as long as *A. excelsa*. This species is of a pleasing and graceful appearance, of a very hardy nature, and much admired in collections.

A. polita (the "Tiger's Tail" Fir of Japan).—Introduced in 1861. Habitat, Japan; largely used by the Japanese for ornamental work. Its leaves are prickly, and of a colour somewhat resembling the Gorse when aged. In habit it is much like the Black Norway Spruce. A picturesque and useful tree.

The Silver Firs.

Picea amabilis (the Lovely Silver Fir).—Introduced in 1831. Habitat, Oregon and British Columbia, where it grows to a height of 200 feet, and a girth of 20 feet. It does best in a moderately moist soil, and when luxuriating in such in this country, its appearance warrants the name it bears, being lovely at all seasons.

P. balsamea (the Balsam Fir).—Introduced in 1697. Habitat, Canada, Nova Scotia, and North-eastern United States. Though neither an ornamental nor timber tree of much value, the resin which it produces in abundance furnishes the Canada Balsam extensively used in medicine and manufactures.

P. bracteata (the Santa Lucia Silver Fir).—Introduced in 1853. Habitat, California. A tree of great height, but proportionally rather small in girth. The branches are spreading, the lower ones decumbent; and its exquisite form and beautiful appearance make it an acquisition to the lover of ornamental conifers.

P. cephalonica (the Cephalonian Silver Fir).—Introduced in 1824. Habitat, Greece. Its prickly-pointed leaves and dilated petioles render this a very distinct variety. I find it a very free growing ornamental tree, and commercially valuable.

P. grandis (the Tall Silver Fir).—Introduced in 1831. Habitat, California and British Columbia. I find this not only a grand ornamental tree, but the most rapid grower of all the Silver Firs. In its native habitat, in low moist situations, it grows to 280 feet in height, and often girths 21 feet. Such enormous growth may well tempt us to plant it more frequently.

P. lasiocarpa (the California Silver Fir).—Introduced in 1851. Habitat, California, where it attains a height of 100 to 150 feet. It is a general favourite with planters, and, both as regards ornament and value, is equal to almost any of the Silver Firs. This elegant Silver Fir is also known as *P. concolor*, *P. Lowiana*, and *P. Parsonsii*.

P. magnifica (the Stately Silver Fir).—Introduced in 1851 by John Jeffrey, collector for the Oregon Association. Habitat, Northern California and Oregon. A grand acquisition to any collection, and deserves a trial as a timber tree, seeing it reaches a height of 250 feet in its native country.

P. nobilis (the Noble Silver Fir).—Introduced in 1831. Habitat, California and Oregon, where it attains a height of 200 to 300 feet, and a girth of 12 to 18 feet. It is a very hardy species, and thrives well in this country. When growing on peaty or rich alluvial soils, it assumes a peculiar richness of colour, and is a favourite with the ornamental planter.

P. Nordmanniana (Nordmann's Silver Fir).—Introduced in 1848. Habitat, the Crimea and Caucasus. Being later in starting into growth than *Picea pectinata*, it is hardier, grows more freely when young, and for either use or ornament is certainly the most valuable of the two.

P. pectinata (the Common Silver Fir) was introduced in 1603. It is a native of Central Europe, and the north and west of Asia. A mountain tree, rising to the zone of the Scots pine, and often reaching a height of 150 feet. Its towering height and stately figure are too well known to need description. It has been found that a cubic foot of the wood of a full-grown tree when green weighs 66 lbs. 14 oz., and when dry 37 lbs. 9 oz. In Britain it is less hardy than the Norway fir, and requires a lower situation.

Many interesting varieties of the Common Silver Fir have been produced in this country, among which may be named *P. p. tortuosa*, the branches of which are characteristically crooked and twisted; *P. p. fastigiata*, of an upright columnar habit; *P. p. pendula*, a fine weeping evergreen tree; *P. p. variegata*, and *P. p. nana*, two pretty forms for the ornamentation of lawns.

P. Pinsapo (the Spanish Silver Fir).—Introduced in 1839. Habitat, the mountains in the north and middle of Spain. This is a very fine ornamental tree, with beautiful silvery green foliage, and, as it has a very dense habit of growth, it is suitable for planting to hide any untidy or objectionable sight.

P. religiosa (the Mexican Sacred Silver Fir).—Introduced in 1838. Habitat, Mexico, where it grows at altitudes of 8000 to 12,000 feet, and to a height of 100 to 150 feet, with a girth of 15 to 18 feet. It is easily distinguishable by the shortness of its cones, which very much resemble those of the Cedar of Lebanon, but are smaller. The hardiness of this tree has so far been doubtful; but ornamentally it is pleasing and attractive.

P. sibirica (the Siberian Silver Fir).—Introduced in 1820. Habitat, Siberia and the Altai Mountains. This species only succeeds well in damp stiff land. The leaves are dark green above, and silvery beneath, and, when shaken by the wind, they are very attractive.

Amongst other species worthy of a place in all collections, from an ornamental point of view, are *P. cilicia*, the Cilician Silver Fir; *P. Fraseri*, Fraser's Silver Fir; *P. Pindrow*, the Indian Silver Fir; *P. Veitchii*, Veitch's Fir; *P. Webbiana*, Captain Webb's Silver Fir; and several varieties of the species already mentioned, all being of a highly ornamental character.

The most of this family are fibrous-rooted, and should therefore be planted in free open soils, in which they always grow to advantage. None of the species are well adapted for growing in cold, bleak, open exposures; but all of them do fairly well when moderately sheltered. They show to great advantage till about 20 or 30 feet in height, and as forest trees are general favourites.

The Pines.

The Pine family, of which the Scots Pine, *Pinus sylvestris*, is the type, is a very numerous one, and hence I shall confine my description to the larger growing and ornamental species.

Pinus Austriaca (the Austrian Pine).—Introduced in 1835. A well-known tree, of a strong robust habit of growth. It is the best pine I know for shelter, and for planting in exposed situations near the sea-coast. Timber coarse grained and knotty; not equal to that of the Scots Pine.

P. cembra (the Swiss Stone Pine).—Introduced about 1746. Habitat, Central Europe and Siberia. A well-known pine; useful both from a commercial and ornamental point of view, and perfectly hardy.

P. c. pumila, from Eastern Siberia and Japan, is a neat dwarf ornamental variety, and useful for lawns.

P. contorta (the Twisted Pine).—Introduced in 1831. Habitat, North-West America, as far south as California. Its timber is almost valueless; but the tree is very unique and ornamental, having long, slender, and curiously-twisted branches.

P. excelsa (the Himalayan Pine).—Introduced about 1827. Habitat, the Himalaya Mountains. This elegant pine grows from 90 to 100 feet high in its native country, where the timber is in much repute. In this country it is found in most collections, and forms a handsome ornamental tree, when growing in a light warm soil and sheltered site. It does not thrive in cold or damp soils, and bears exposure indifferently. The long slender branches, gracefully clothed with bluish-green, glaucous leaves, contrast pleasantly with that of other darker foliaged trees. The tree is full of clear limpid turpentine, which flows from the slightest incision of the bark.

P. insignis (the Remarkable Pine).—Introduced in 1833. Habitat, California. This tree well deserves its name, being very ornamental, and a general favourite. Its leaves are a lively grass-green colour. The wood has been favourably compared with that of other pines; but unfortunately the tree is not hardy until of a good size, and our severe winters have killed many fine specimens. In the south of England, in Ireland, and in the south-west coast of Scotland, many grand specimens are growing and thriving well.

P. Jeffreyi (Jeffrey's Pine).—Introduced in 1852. Habitat, the Shasta Valley in California. This pine very much resembles *Pinus ponderosa;* and, like the latter, it is perfectly hardy, and has leaves about 8 or 9 inches long. Its wood is also valuable, and the tree ornamental.

P. Lambertiana (the Sugar Pine). — Introduced in 1827. Habitat, California and north-west of America. Grown under favourable circumstances in its native habitat, a tree which had been blown down was found to be 215 feet in length, and girthed 16 feet. In addition to its value as timber, which is good, and its ornamental effect, its seeds, which have a sugary taste (hence the common name), are used as food.

P. Laricio (the Corsican Pine).—Introduced in 1759. Habitat, Corsica, Spain, Italy, Greece, Germany, and the Caucasus, where it grows from 60 to 150 feet high, with a proportionate girth. It is a free growing tree when once established, but difficult to transplant when of any size. Its branches grow in regular whorls, with leaves of a cheerful green. Its wood is of fair quality, and it is a good ornamental tree.

There are several varieties of *P. Laricio,* such as *P. L. Caramanica, compacta, contorta, nana, pendula,* and others, all of which are curious or ornamental, and deserve a place in large collections of choice trees.

P. macrocarpa (the Large-coned, or Coulter's Pine).—Introduced in 1832. Habitat, California; growing in 36° of latitude, at an elevation of 3000 to 4000 feet. It attains a height of 100 feet, and a girth of 9 to 12 feet. Remarkable for the size of its cones, which are sometimes 14 inches long and 6 in diameter. The large seeds are edible. If moderately sheltered, and grown on a dry, porous soil, it is perfectly hardy in this country, and is a good ornamental pine. Also known as *P. Coulteri.*

P. mitis (the Yellow Pine).—Introduced in 1739. Habitat, New England States and Georgia, North America. This is the pine which produces the valuable "yellow pine" timber of commerce. The tree does not often exceed 80 feet in height. Although possessing no special ornamental property, it should be planted for the sake of its timber. Its habit of growth very much resembles that of *Pinus sylvestris*, and the trunk is almost of uniform girth for nearly two-thirds of its length.

P. monticola (the Mountain Pine). — Introduced in 1831. Habitat, California and Oregon. In its native country it is frequently seen 100 feet in height and sometimes 6 feet in girth. Its leaves have a distinct silvery tint. The timber is said to be white, strong, and durable. It is a fine ornamental, free growing tree, and perfectly hardy.

P. Pallasiana (the Crimean Pine). — Introduced in 1790. Habitat, the Crimea. This is a much finer ornamental tree than the Corsican Pine, which it resembles, but it is more inclined to spread its branches; which are numerous, large, horizontal, and declining; the lower ones being sometimes nearly as thick as the stem. Timber, coarse grained and knotty, but durable.

P. Pinaster (the Cluster Pine).—Introduced in 1596. Habitat, South of Europe. The ornamental effect of this pine is not much appreciated; neither is the quality of its wood. It has often been highly recommended for seaside planting, but with ruinous results in the following instances. Soon after reading a favourable report upon this pine which appeared a number of years ago, a landed proprietor on the west coast planted it extensively, with the result that scarcely a plant survived the first year. I have also tried it, and the failure could not have been greater if I had used a tropical plant. There is said to be several varieties of the Pinaster, and possibly we may not have the hardiest one, which grows so abundantly in the west of France. Unless we can import the hardiest variety, I don't think we shall ever grow the maritime pine in sufficient numbers on our sea-board to supply us with pitch, tar, resin, and other products of the Pinaster. I would advise the British landowner rather not to purchase them than risk their failure on bleak seaside exposures.

P. ponderosa (the Western Pitch Pine).—Introduced in 1827. Habitat, Western North America. Grows at high altitudes, and to large dimensions, in its native habitat. Its timber is of excellent quality. In its sturdy habit of growth it somewhat resembles the *Araucaria*. If luxuriating well, its dark-green leaves are from 8 to 10 inches long, and closely arranged on the branches. It is perfectly hardy here. A useful and peculiarly grand species for effect. It is also known as *P. Beardsleyi*, *Benthamiana*, *deflexa*, *Parryana*, and *Sinclairiana*, and is the "Yellow Pine" of California.

P. rigida (the Pitch Pine).—Introduced in 1759. Habitat, ranging from New England to Virginia, and generally found on light, friable, and sandy soils. In such it grows to 70 or 80 feet in height. This is the well-known "Pitch Pine" of commerce. Is quite hardy here, and grows at about the same rate as the Scots pine; hence, is worthy of being more freely planted. Its resinous shoots and small clusters of cones make it very ornamental and attractive.

P. Sabiniana (Sabine's, or the Nut Pine).—Introduced in 1832. Habitat, California, where it grows to a moderate height. It is very hardy, but its wood is not in much repute. It has very large cones, and the leaves are from 11 to 14 inches long. As an ornamental tree, the rambling habit of its growth and the long-twisted leaves give it a very picturesque appearance.

P. Strobus (the Weymouth Pine).—Introduced in 1705. A native of Canada and the Eastern United States, and a good timber tree, often reaching 100 to 150 feet in height. Here it is perfectly hardy, and grows very well on dry porous soil, but is more useful as an ornamental than a timber tree.

P. Tæda (the Loblolly Pine).—Introduced in 1713. Habitat, Florida, Virginia, Carolina, etc. This is the Virginian "White Pine" of commerce, and a valuable forest tree in its native country. From this tree the resin is extracted by making incisions in the bark, from which it flows freely. Frankincense is said to be produced from the resin, and to be composed of two kinds of resin, mixed with oil of turpentine.

Among less valuable timber trees, but most of which are useful ornamentally, are the following Pines:—*P. Apulcensis*, *P. Ayacahuite*, *P. Balfouriana*, *P. cembroides*, *P. Devoniana*, *P. excelsa*, *P. flexilis*, *P. Gerardiana*, *P. halepensis*, *P. inops*, *P. koraiensis*, *P. leiophylla*, *P. longifolia*, *P. Massoniana*, *P. montana*, *P. muricata*, *P. oocarpa*, *P. parviflora*, *P. patula*, *P. pinea*, *P. pungens*, *P. resinosa*, *P. Russelliana*, *P. serotina*, *P. Teocote*, *P. Torreyana*, and *P. tuberculata*. Some are natives of Mexico and Central America, while others are from India, China, Japan, and other tropical or semi-tropical countries, and consequently less hardy than those from temperate latitudes. The chief characteristics of some are their form of growth, of others in the size and arrangement of their cones, and, in several instances, in the variegated colour or peculiar arrangement of their leaves. In the sunny south of England and Ireland, and mild south-west coast of Scotland, the planter should add most, if not all, of them to his collection, but in less congenial climates I question the wisdom of experimenting with many of them.

The Pine is pre-eminently the tree of the mountain, and being an evergreen is always pleasing to look upon. When massed together, or grown as single specimens among deciduous trees, pines show to great advantage at all seasons of the year.

The Araucaria.

Araucaria imbricata (the Chili Pine).—Introduced in 1796 from Chili, where it grows in vast forests to a height of 100 to 150 feet, producing strong, beautifully-grained and durable wood. It is one of the most popular of the ornamental conifers, and may be seen on almost every lawn or pleasure ground. Its seeds, which are very nutritious, are highly prized as food by the native Indians. The Araucaria family are not exclusively Chilian, but grow also in Polynesia and Australia. *A. imbricata* is, however, the only hardy species in our climate, and delights in a friable, well-drained soil, and open site, as it is found to bear exposure to the wind better than most exotic conifers.

The Cedar.

Cedrus atlantica (the Mount Atlas Cedar).—Introduced about 1841. Habitat, the Atlas Mountains, Algeria. A most useful tree both as regards value and ornament, is perfectly hardy, and grows luxuriantly in positions where the larch becomes blistered.

C. Deodar (the Deodar, or Indian Cedar).—Introduced in 1831. Habitat, Himalaya Mountains. This is a moderately hardy, useful, and well-known ornamental tree, of common occurrence in pleasure grounds. A valuable timber tree in India.

C. Libani (the Cedar of Lebanon). — Introduced in 1676. Habitat, Mount Lebanon, Syria. In Scripture and in history, both ancient and modern, we find reference made to this tree. Its outline is so well and generally known, that, as an object of ornament, no description is necessary. Its wood is very valuable, and is known to have lasted for centuries.

The Cypress.

Cupressus Lawsoniana (Lawson's Cypress).—Introduced in 1855. Habitat, California. Height, 100 feet. Unquestionably this is the grandest and best known of all the American Cypresses. A large and highly ornamental tree, producing useful and valuable timber. It should be grown extensively in every collection. Several beautiful varieties have been raised, and are now much grown in this country, amongst which may be named *C. L. alba-spica, argentea, argenteo-variegata, aureo-variegata, erecta viridis, filiformis, gracilis, lutea nana*, and *pygmæa*.

C. lusitanica (the Cedar of Goa).—Introduced in 1683, and said to be from the East Indies. Height, 50 feet. A remarkably handsome low tree, but not very hardy in Britain.

C. macrocarpa (the Large-fruited Cypress).—Introduced in 1838. Habitat, Upper California. Height 80 feet. This is a tree of very pleasing effect, but only moderately hardy, and impatient of cold cutting winds.

C. m. Lambertiana (Lambert's Cypress).—Introduced about 1840. This is generally considered a variety of *C. macrocarpa*. From a parcel of seed received from a well-known collector in California upwards of a dozen varieties were raised, amongst them the true type of *C. Lambertiana;* and I therefore conclude that they are merely seminal varieties.

C. Nutkaënsis (the Nootka Sound Cypress).—Habitat, British Columbia and Oregon. Introduced about 1850. This is, perhaps, better known as *Thuiopsis borealis*, and has a considerable resemblance to *C. Lawsoniana*, but is a more robust growing tree, with a paler green aspect. In its native country it attains a height of 80 to 100 feet, and produces yellowish fragrant wood, light, easily worked, and durable, and valuable for all open-air purposes. It is one of the hardiest, as well as one of the most beautiful, of all the cypress tribe, and thrives well in favourable sites. Being one of the best and most useful of ornamental conifers, it should be freely introduced by all planters. There are several variegated varieties, all of which are valuable as ornamental trees.

C. sempervirens (the Common Cypress).—Introduced before 1548. Habitat, South of Europe, Greece, Turkey, Persia, and Asia Minor. The tree is of a pyramidal or upright habit of growth, and attains a height of 50 to 100 feet. Its wood is hard and fragrant, of a remarkably fine close grain, and is very durable, having a beautiful reddish hue, and is a most valuable tree in its native country. It is used in Britain as an ornamental tree.

In 1803 a tree of *C. s. horizontalis*, growing in Chelsea Botanic Garden, when measured by Lord Aberdeen, was found to be 150 feet in height and 24 feet in circumference at four feet from the ground, certainly the largest cypress in this country at that time. One feels curious to know if this fine old tree still lives.

C. thyoides (the White Cedar). Syn. *Chamæcyparis sphæroidea.*—Introduced in 1736. Habitat, Eastern United States. Height, 70 to 80 feet; and grows luxuriantly in low-lying swampy ground. Its wood in America is considered superior to that of any other tree for making shingles for roofs. Several varieties of the White Cedar are found in collections, but none of them are so valuable as the type for timber, although they are all hardy and ornamental.

C. torulosa (the Tufted Cypress).—Introduced in 1824. Habitat, the Himalayas. A moderately hardy and very handsome tree.

Remarks.—The cypresses to which I have referred are what may be termed forest trees; and, in addition, other purely ornamental ones might be mentioned, such as *C. funebris*, *C. Goveniana*, *C. Knightiana*, and *C. Macnabiana*, all more or less hardy, and useful for ornamenting pleasure grounds.

The Juniper.

Juniperus chinensis (the Chinese Juniper).—Introduced in 1804. Habitat, China and Thibet. One of the best of the family, and along with several of its pretty varieties is a very useful ornamental tree.

J. excelsa (the Greek Juniper).—Introduced in 1806. Habitat, Greece and Asia Minor. This, and especially the variety *J. e. stricta*, are very beautiful lawn shrubs or small trees, and worthy of a place in all collections.

J. virginiana (the Red Cedar).—Introduced in 1664. Habitat, North America. This is a well-known and useful tree, and the timber furnishes the "cedar" wood used for pencils. The true "pencil cedar," however, is the wood of *J. bermudiana*, the Bermuda Juniper, but the tree is too tender to stand our winters.

There are several other species and many varieties of Juniper that are very interesting, and all deserve a place in ornamental grounds, although few or none of them produce timber in this country of any commercial value.

The Larch.

Larix europæa (the Common Larch).—Introduced about 1629. Habitat, Central Europe and Siberia. The most valuable of all our coniferous trees. The wood is applicable for almost any purpose, and weighs when green 68 lbs. 13 oz.; and when dry

36 lbs. 6 oz. per cubic foot. The wood makes a first-class charcoal; the sap furnishes the Venice turpentine of commerce; the branches exude the manna of Briançon; and the bark supplies excellent tannin. The tree being thus useful in all its parts, we may well ask—Where is its equal or substitute to be found?

Loudon mentions the following ten varieties of the common larch, and describes them as being distinct, namely—*L. e. compacta*, *L. e. Dahurica*, *L. e. flore albo*, *L. e. flore rubro*, *L. e. Fraseri*, *L. e. intermedia*, *L. e. laxa*, *L. e. pendula*, *L. e. repens*, and *L. e. sibirica;* but none of them are equal to the normal form.

L. Kæmpferi (the Golden Larch).—Introduced in 1846. Habitat, China. Height at high elevations, 50 feet, and in more congenial positions, 120. Not only a highly ornamental and very effective tree, but as timber its value is indisputable. It is quite hardy, but too slow growing for a timber tree in our climate, and unless it succeeds better in the milder climate of Devon or Cornwall, it is not of much use in Britain.

L. microcarpa (the Tamarac, or Hackmatac).—Introduced in 1739. Habitat, Canada and the United States east of the Mississippi. The American larch is a most distinct, hardy, useful, and ornamental species, and now cultivated with profit. The weeping variety of the American larch, *L. m. pendula*, is of a robust character in its youth, but more graceful when aged.

The Incense Cedar.

Libocedrus chilensis (the Chilian Arbor-Vitæ).—Introduced in 1847. Habitat, the Andes, Chili. Height, 60 to 80 feet. Its wood is very useful and valuable, and emits a strong odour whilst burning. It is moderately hardy, distinct, and ornamental, and succeeds best in sheltered valleys.

L. decurrens (the Californian White Cedar).—Introduced in 1853. Habitat, California and Oregon. Height, 120 to 140 feet, and a girth of about 20 feet in its native country. It is possibly the best known and ornamental of Jeffrey's introductions through the Oregon Association, and it is tolerably hardy in Britain.

The Chinese Arbor-Vitæ.

Biota orientalis (the Chinese Arbor-Vitæ).—Introduced in 1752. Habitat, China and Japan. This genus, once associated with, is now separated from, the *Thuias*. The largest is the typical variety, attaining to a height of 30 feet; but there are numerous other varieties, all very ornamental, especially *B. o. aurea*, and *B. o. elegantissima*, which are favourites with all planters.

The American Arbor-Vitæ.

Thuia gigantea (the Giant Arbor-Vitæ). — Habitat, North-West America. Introduced in 1853. In its native habitat it reaches a height of 150 feet, its tall slender form being a striking feature in the landscape along the Columbia River, where the tree attains its greatest dimensions. It is a fast-growing and elegant tree, and perfectly hardy in this country. Both as a timber and ornamental tree, it is worthy of extensive use. It thrives best in a deep rich moist loam, but will grow in most varieties of soil, if not water-logged, and the site is sheltered. This useful tree is, perhaps, best known as *Thuia Lobbi*, and sometimes as *T. Menziesii.*

Thuia occidentalis (the Common American Arbor-Vitæ). — Habitat, Canada, and the New England States. Introduced before 1597. It grows to a height of 40 to 50 feet, and supplies a useful timber in its native habitat, which is much used for fencing and other out-door purposes, being light and very durable. It is well known and much used as an ornamental tree or large shrub in this country, and is one of the best coniferous hedge plants. It prefers a moist soil, on a cool bottom, on which it thrives admirably. There are several fine ornamental varieties of this Arbor-Vitæ, all of which should be planted in suitable places by collectors of choice plants.

The Japanese Arbor-Vitæ.

Thuiopsis dolabrata (the Hatchet-leaved Thuia).—Introduced in 1853. Habitat, Japan, where it forms, when young, a specially handsome pyramidal tree, and attains a height of 50 to 60 feet. As an ornamental tree in this country it is equalled by few of the exotic conifers, and should be freely introduced, as it is quite hardy, and thrives well in any sheltered position, but prefers a deep moist loamy soil. There are two beautiful varieties, *T. d. lætevirens* and *T. d. variegata*, both of which merit a place among all collections of conifers.

The Cryptomeria.

Cryptomeria elegans (the Elegant Cryptomeria).—Introduced in 1861. Habitat, Japan. Height, 30 feet. It is generally too tender for our climate, but in rich soils, and where sheltered, it succeeds fairly well. The dark bronzy tint of its foliage in winter makes it a great acquisition wherever it thrives.

C. japonica (the Japan Cedar).—Introduced in 1844. Habitat, Japan and China. Produces timber of an excellent quality, as was shown in the exhibits from Japan at the Edinburgh Forestry Exhibition, and attains a height of 100 to 150 feet. *C. j. Lobbi* is an effective variety, forms a very pretty tree, and is moderately hardy. There are several other fine varieties, which, though generally rather tender, are worthy a trial by the collector.

The Japanese Cypress.

Retinospora filifera (the Thread-like Retinospora).—Habitat, Japan; where it grows to a height of 50 feet in sheltered hollows.

R. obtusa (the Japan Cypress).—Introduced in 1861. Habitat, Japan; growing to a height of 60 to 100 feet, with a girth of 15 feet near the base. It is a most useful timber tree in Japan, and furnishes a light, white, and smooth-grained wood in general demand for a great variety of purposes. It is quite hardy in this country, and should be extensively planted as an ornamental tree; but its timber has still to be tested, and is not likely to supersede any of our forest trees.

R. pisifera (the Pea-fruited Retinospora).—Introduced in 1861. Habitat, Japan; where it attains a height of 50 to 80 feet. Its timber is of great value, and much used in Japan. It is perfectly hardy, and thrives well in this country, and forms a very attractive small tree.

All of the Retinosporas are of a hardy nature, and to me appear the most lovely of conifers. There are numerous distinct varieties of several of the species, but they are of less value commercially, though more so ornamentally, than the normal types.

The Ginkgo.

Salisburia adiantifolia (the Maiden-Hair Tree, or Ginkgo).—This remarkable conifer seems to unite the pine and oak tribes in the singular form of its leaves. It was introduced in 1754. Habitat, Northern China. Height, 70 to 100 feet. Its timber is very close grained, receives a fine polish, and resembles citron-wood. A valuable timber tree; quite hardy in Britain, and rather unique as a coniferous tree, and should be in all collections.

The Sequoia Tribe.

Sciadopitys verticillata (the Umbrella Pine).—Introduced in 1861. Habitat, Japan. Height, 70 to 100 feet. Exceptionally peculiar in the arrangement of its leaves, 20 to 30 being set in double whorls on the point of each shoot, and resemble by their mode of growth an inverted umbrella. The leaves are of a light-green colour. The tree is hardy, and with me has done well since it was planted in 1879. Evidently two varieties, or male and female, are in cultivation. With me one bears very small cones, and is less robust in growth than the other. This is a valuable decorative tree in any collection.

Sequoia sempervirens (The Californian Redwood).—Discovered by Mr Archibald Menzies, on the north-west coast of North America, in 1796. Introduced 1846 by Hartweg. Height, 270 feet; and a girth of 30 to 40 feet. Although not of a very hardy nature in its young state in this country, yet, in good soils where moderately sheltered, it has stood fairly well. Its timber is valuable, and of good quality. As an ornamental tree it has an effect which is all its own, being so very distinct and peculiar in leaf and habit of growth that no one need mistake it. Even the most cautious of planters should give this gigantic conifer a kindly place amongst his select forest trees.

Taxodium distichum (The Deciduous Cypress).—Habitat, Southern States of North America. Introduced about 1640. A tree of gigantic proportions in its native country, where it attains a height of 120 feet, and a girth of 40 feet. It is peculiarly a moisture-loving tree, and reaches its fullest development in the swamps and marshes of the Southern United States. It there furnishes a valuable timber, light but strong, of a fine grain, splits easily into shingles, is very durable, and is much used for all economic purposes. In this country it is not often seen in a luxuriant condition, although it is moderately hardy, and thrives well in favourable spots, especially in the south of England and Ireland. It naturally prefers moist or swampy situations, and should never be planted on dry and exposed sites. A striking characteristic of this tree is the curious growths or "knees," which rise from the roots to a height of a foot or two above the surface of the ground. They are somewhat conical in shape, and partake of the nature of roots. Generally they are hollow, and in that state are said to be used by the negroes in the Southern United States as beehives. The pendulous variety, *T. d. pendulum*, is a very beautiful object, but will only thrive in the most favourable situations.

Wellingtonia gigantea (The Mammoth Tree).—Discovered in the mountains of California in 1852, and introduced to this country in 1853 by Mr William Lobb, collector to Messrs Veitch and Sons, Chelsea, London. Height from 300 to 350 feet, and girth 60 to 80. An oft-described tree, and one which only the traveller is privileged to look upon in all its glory. This may justly be said to be the grandest production of tree growth in the world, and imagination dwarfs into insignificance the best of our British giants. It has been conjectured that some of those monster trees must have been growing for at least 3000 years. As timber it is less valuable than many other exotic trees. In this country it stands the climate well; but, in order to encourage its growth, it should be planted in a rich alluvial soil productive of free growth, and thrives best in sheltered places.

A beautiful variety originated in Mr Hartland's Nurseries, Cork, about twenty-five years ago, and appears under the name *W. g. aurea variegata*. When in a young state, this is one of the most ornamental of choice conifers. It is not so robust as the parent, and I imagine it will be always more dwarf in growth. Another very distinct variety is *W. g. pendula*, one of the finest of all the weeping conifers, and a great acquisition to any collection. It was sent out from the Knowefield Nurseries, Carlisle.

The Yew.

Taxus brevifolia (the Californian Yew).—Habitat, California, Oregon, and British Columbia. Introduced in 1854. A tree in its native habitat attaining a height of about 50 feet. It is quite hardy, and useful for all purposes for which the common yew is employed.

T. canadensis (the Canadian Yew).—Habitat, Canada and the New England States. Introduced about 1800. It is of a low spreading habit, and is commonly known in America as "Ground Hemlock." It is useful for planting under the shade of other trees, where few plants of any kind will grow.

T. cuspidata (the Japanese Yew).—Habitat, the island of Jesso, Japan, where it grows to a moderate-sized tree, with a stem of two feet in diameter. It is a distinct species, and worthy of a place in all collections of exotic trees.

TABLE, giving the Botanical Name, Year of Introduction, Native Country, Height and Girth of Natural Trees, and Altitude at which they are found growing: the Common Name, Year when Planted, and Place and County where the recorded Specimens grow; Altitude of Site above sea-level; and the Year in which the Measurements were recorded.

Botanical Name.	Introduced.	Native Country.	Height.	Girth.	Altitude.	Common Name.	When Planted.	Place.	County.	Height.	Girth.		Altitude.	Year of Record.
			Feet.	Ft.	Feet.					Feet.	Ft.	In.	Feet.	
Abies Albertiana,	1851	British Columbia and Oregon,	150	18	1 to 6,000	Prince Albert's Fir,	1853	The Cairnies,	Perth,	56	6	6	..	..
,, *canadensis*,	1736	Canada and United States,	80	..	....	Hemlock Spruce,	..	Dalkeith,	Edinburgh,	45	10	6	180	1888
,, *Douglasii*,	1827	North-West America,	250	30	1 to 10,000	Douglas Fir,	1830	Raith,	Fife,	100	11	0	..	..
,, ,,	1827	Do. do.,	250	30	....	Do.,	1834	Lynedoch,	Perth,	92	10	10	80	1884
,, *Pattoniana*,	1851	California and Oregon,	150	12	8 to 10,000	Patton's Fir,	..	....	....	..	....		..	..
,, *alba*,	1700	British North America,	50	6	4,000	White Spruce,	1870	Tyninghame,	Haddington,	12	1	1	50	1888
,, *Alcockiana*,	1861	Japan,	100	..	....	Alcock's Spruce,	..	....	....	..	....		..	..
,, *excelsa*,	1548	Europe,	130	15	....	Norway Spruce,	1750	Invercauld,	Aberdeen,	100	9	8	1110	1867
,, *Menziesii*,	1831	North-West America,	100	15	....	Menzies' Spruce,	1858	Strathfieldsaye,	Hants,	87	4	10	..	..
,, ,,	1831	Do. do.,	100	15	....	Do.,	1858	Castle Menzies,	Perth,	82	9	0	200	1884
,, *Morinda*,	1818	Himalaya Mountains,	150	20	6 to 12,000	Himalayan Spruce,	1863	Brahan,	Ross,	20	....		120	..
,, *nigra*,	1700	North-East America,	80	6	....	Black Spruce,	1865	Hopetoun,	Linlithgow,	17	1	2	..	1880
,, *obovata*,	..	Siberia,	100	8	2 to 5,000	Siberian Spruce,	..	....	....	..	....		..	..
,, *orientalis*,	1839	Black Sea Region,	80	8	1 to 3,000	Eastern Spruce,	1865	Hopetoun,	Linlithgow,	26	1	9	..	1880
,, *polita*,	1861	Japan,	100	9	....	"Tiger's Tail" Spruce,	1881	Ardkinglas,	Argyll,	3	0	4	..	1888
Picea amabilis,	1831	British Columbia and Oregon,	200	20	3 to 5,000	Lovely Silver Fir,	1865	Hopetoun,	Linlithgow,	12	1	8	..	1881
,, *balsamea*,	1697	Canada and E. United States,	60	5	....	Balsam Fir,	..	Invergarry,	Inverness,	23	2	3	..	1876
,, *bracteata*,	1853	Southern California,	150	6	6,000	Santa Lucia Fir,	..	Hopetoun,	Linlithgow,	5	0	5	..	..
,, *cephalonica*,	1824	Greece,	60	9	2 to 5,000	Cephalonian Fir,	..	Whittinghame,	Haddington,	46	6	1	200	1881
,, *grandis*,	1831	North-West America,	200	21	....	Tall Silver Fir,	..	Riccarton,	Edinburgh,	66½	....		..	1884
,, *lasiocarpa*,	1851	California,	150	18	3 to 7,000	Californian Silver Fir,	..	Do.,	Do.,	50	....		..	1884
,, *magnifica*,	1851	Do.,	250	25	....	Stately Silver Fir,	..	Hopetoun,	Linlithgow,	6	0	6	..	1881
,, *nobilis*,	1831	British Columbia and Oregon,	300	18	8,000	Noble Silver Fir,	1830	Coul,	Ross,	75	8	0	110	..
,, *Nordmanniana*,	1848	Caucasian Mountains,	100	15	3 to 6,000	Nordmann's Fir,	1850	Whittinghame,	Haddington,	60	4	10	200	1881
,, *pectinata*,	1603	Central Europe,	150	20	2 to 7,000	Common Silver Fir,	1692	Roseneath,	Dumbarton,	150	24	0	..	1867
,, *Pinsapo*,	1839	Spain,	80	7	4 to 6,000	Spanish Silver Fir,	1865	Hopetoun,	Linlithgow,	22½	2	1	..	1880
,, *religiosa*,	1838	Mexico,	150	18	8 to 12,000	Mexican Sacred Fir,	..	....	....	..	....		..	..
,, *sibirica*,	1820	Siberia,	60	6	2 to 5,000	Siberian Silver Fir,	..	....	....	..	....		..	..
Pinus austriaca,	1835	Central Europe,	80	9	....	Austrian Pine,	1832	Hopetoun,	Linlithgow,	41	3	7	..	1867
,, *Cembra*,	1746	Do. and N. Asia,	100	9	4 to 6,000	Swiss Stone Pine,	1864	Balmoral,	Aberdeen,	40	3	6	..	1887
,, *contorta*,	1831	North-West America,	30	5	....	Twisted Pine,	..	....	....	..	....		..	..
,, *excelsa*,	1827	Himalaya Mountains,	100	8	5 to 12,000	Himalayan Pine,	1863	Brahan,	Ross,	23	....		120	..
,, *insignis*,	1833	California,	80	8	....	Remarkable Pine,	1857	Castle Kennedy,	Wigtown,	36	5	6	..	1875
,, *Jeffreyi*,	1852	Do.,	150	16	....	Jeffrey's Pine,	1865	Hopetoun,	Linlithgow,	13	1	1	..	1881
,, *Lambertiana*,	1827	Do.,	250	30	....	Sugar Pine,	1865	Do.,	Do.,	25	1	8	..	1881
,, *Laricio*,	1759	Southern Europe,	140	12	2 to 6,000	Corsican Pine,	1832	Do.,	Do.,	41	3	7	..	1867
,, *macrocarpa*,	1832	California,	100	12	3 to 4,000	Coulter's Pine,	..	Scone,	Perth,	38½	4	6	..	1884
,, *mitis*,	1739	Eastern United States,	80	10	....	Yellow Pine,	..	Dropmore,	Berks,	..	....		..	..
,, *monticola*,	1831	California and Oregon,	100	6	....	Mountain Pine,	..	Scone,	Perth,	62	6	0	..	1884
,, *Pallasiana*,	1790	Crimea,	80	8	....	Crimean Pine,	..	....	....	..	....		..	..
,, *Pinaster*,	1596	S. of Europe,	80	7	....	Cluster Pine,	1832	Hopetoun,	Linlithgow,	45	4	3	..	1865
,, *ponderosa*,	1827	Oregon and California,	200	24	4 to 7,000	Western Pitch Pine,	..	Do.,	Do.,	20	2	1	..	1881
,, *rigida*,	1759	Eastern United States,	70	8	....	Pitch Pine,	..	Dropmore,	Berks,	..	....		..	..
,, *Sabiniana*,	1832	California,	70	8	....	Nut Pine,	..	Hopetoun,	Linlithgow,	8	....		..	1881
,, *Strobus*,	1705	Eastern North America,	160	12	....	Weymouth Pine,	1757	Do.,	Do.,	64½	8	6	100	1867
,, *Tæda*,	1713	S. E. United States,	80	9	....	Loblolly Pine,	..	Dropmore,	Berks,	..	....		..	..
Araucaria imbricata,	1796	Chili,	150	12	2 to 6,000	Chili Pine,	..	Do.,	Do.,	61	....		..	1881
Cedrus atlantica,	1841	Atlas Mountains, Africa,	100	14	5 to 8,000	Mount Atlas Cedar,	1865	Hopetoun,	Linlithgow,	31	2	9	100	1881
,, *Deodara*,	1831	Himalaya Mountains,	200	30	6 to 12,000	Indian Cedar,	1834	Dropmore,	Berks,	71				
,, *Libani*,	1676	Lebanon Mountains,	80	40	6 to 7,000	Cedar of Lebanon,	1767	Hopetoun,	Linlithgow,	83	20	6	100	1881
,, ,,	1676	Do. do.,	..	..	....	Do.,	1707	Beil,	Haddington,	75	18	2	.	1881
Cupressus Lawsoniana,	1855	Northern California,	100	7	....	Lawson's Cypress,	1865	Brahan,	Ross,	24	....		..	..
,, ,,	1855	Do. do.,	100	7	....	Do.,	1860	Dalkeith,	Edinburgh,	40	3	9	200	1888
,, *lusitanica*,	1683	India and Portugal,	50	4	....	Cedar of Goa,	..	....	....	.	....		..	
,, *macrocarpa*,	1838	California,	80	6	....	Large-Fruited Cypress,	..	Taymouth,	Perth,	55	....			1884
,, *m. Lamberti*,	1840	Do.	80	6	....	Lambert's Cypress,	1865	Hopetoun,	Linlithgow,	25	....			1881
,, *nutkaensis*,	1850	British Columbia,	100	8	....	Nootka Sound Cypress,	1864	Dalkeith,	Edinburgh,	36	2	3	200	1888
,, *sempervirens*,	1548	S. of Europe and W. Asia,	100	10	....	Roman Cypress,	..	Penrhyn,	Carnarvon,	32				1885
,, *thyoides*,	1736	Eastern United States,	70	6	....	White Cedar,	1880	Ardkinglas,	Argyll,	12	0	10½	..	1888
,, *torulosa*,	1824	Himalaya Mountains,	60	6	6 to 12,000	Tufted Cypress,	1865	Hopetoun,	Linlithgow,	20	...		.	1881
Juniperus chinensis,	1804	China,	25	2	....	Chinese Juniper,	..	....	....	..	...		.	..
,, *excelsa*,	1806	Greece and Syria,	40	4	8 to 12,000	Greek Juniper,	..	....	....		...		.	..
,, *virginiana*,	1664	Eastern United States,	60	3	....	Red Cedar,	..	....	....		....		.	..
Larix europæa,	1629	Central Europe,	100	9	3 to 5,000	Larch,	..	Taymouth,	Perth,	130	16	6	.	1884
,, *Kæmpferi*,	1846	China,	120	14	....	Chinese Larch,	..	....	....					
,, *microcarpa*,	1739	Canada and E. United States,	90	7	....	Black Larch,	..	Ardkinglas,	Argyll,	12	1	2	.	1888
Libocedrus chilensis,	1847	Chili,	80	6	....	Chilian Arbor-Vitæ,	..	....	....	.				..
,, *decurrens*,	1853	California,	140	20	4 to 6,000	Californian White Cedar	1865	Brahan,	Ross,	18	...		..	..
,, ,,	1853	Do.,	140	20	4 to 6,000	Do.,	1867	Riccarton,	Edinburgh,	34½				1884
Biota orientalis,	1722	China and Japan,	30	4	.	Chinese Arbor-Vitæ,	1865	Hopetoun,	Linlithgow,	17	. .		..	1881
Thuia gigantea,	1853	North-West America,	150	12	..	Giant Arbor-Vitæ,	1867	Riccarton,	Edinburgh,	36½			.	1884
,, ,,	1853	Do. do.,	150	12	....	Do.,	..	Linton,	Kent,	50	.		..	1881
,, *occidentalis*,	1597	Eastern North America,	50	6	....	American Arbor-Vitæ,	..	Inverary,	Argyll,	25	.		.	1880
Thujopsis dolobrata,	1853	Japan,	60	6	2 to 8,000	Japanese Thuia,	..	....						..
Cryptomeria elegans,	1861	Do.,	60	7	....	Elegant Japan Cedar,	..	Linton,	Kent,	20			.	1881
,, *japonica*,	1844	Do.,	150	15	1 to 2,000	Japanese Cedar,	..	Penrhyn,	Carnarvon,	70				
,, *j. Lobbi*,	1853	Do.,	100	12	....	Lobb's Japan Cedar,	1865	Braban,	Ross,	20			120	1887
Retinospora filifera,	1863	Do.,	50	6	...	Thread Retinospora,	..	....	....					
,, *obtusa*,	1861	Do.,	100	12	.	Japanese Cypress,	..	Hopetoun,	Linlithgow,	4	....		..	1881
,, *pisifera*,	1861	Do.,	80	10	....	Pea-fruited Cypress,	1880	Ardkinglas,	Argyll,	14	1	1	..	1888
Salisburia adiantifolia,	1754	Northern China,	100	12	..	Maiden-Hair Tree,	1842	Dalkeith,	Edinburgh,	48	4	3	180	1888
Sciadopitys verticillata,	1861	Japan,	100	10	....	Umbrella Pine,	..	Bangholm,	Do.,	8½	....		..	1888
Sequoia sempervirens,	1796	North-West America,	270	40	....	Redwood,	1845	Strathfieldsaye,	Hants,	64	8	6	..	1877
,, ,,	1796	Do. do.,	270	40	....	Do.,	..	Stoneleigh,	Warwick,	60	....		..	1877
,, ,,	1796	Do. do.,	270	40	....	Do.,	..	Moncrieff,	Perth,	36	5	3	100	1877
Taxodium distichum,	1640	S. E. United States,	120	40	....	Deciduous Cypress,	..	Sion House,	Middlesex,	90	....		..	1881
Wellingtonia gigantea,	1853	California,	350	80	5 to 7,000	Mammoth Tree,	1856	Powderham,	Devon,	60	10	0	..	1881
,, ,,	1853	Do.,	350	80	5 to 7,000	Do.,	1857	Orton,	Hunts,	50	7	0	..	1877
,, ,,	1853	Do.,	350	80	5 to 7,000	Do.,	1858	Castle Menzies,	Perth,	48	14	4	..	1884
Taxus brevifolia,	1854	North-West America,	50	8	2 to 7,000	Californian Yew,	..	....	....	..	....		..	..
,, *canadensis*,	1800	Canada,	30	6	....	Canadian Yew,	..	....	....	..	....		..	..
,, *cuspidata*,	1853	Japan,	40	7	....	Japanese Yew,	..	....	....	..	....		..	..

In compiling the above Table, I have had great difficulty in finding out the exact dates at which the various species were introduced to Britain, much divergency of opinion existing about some of them, but the latest, and probably the best authority on the subject, Veitch's "Manual of Coniferæ," is generally followed. Neither have travellers abroad been at all careful, in many instances, in giving the nature of the soil, altitude, exposure, and extremes of temperature of the localities where they have found Conifers growing naturally in the most thriving condition, else it would have been a comparatively easy matter to select the best positions on an estate for each species, and thus given them a fair chance to prove their adaptability and usefulness to the British planter. It would be well if all travellers would bear this in mind, and report accordingly; otherwise, intending planters must proceed with great caution, to save themselves much anxiety and serious loss. Many apparently useful species of Conifers are of too recent introduction to furnish any reliable data as to their merits and comparative value for economic and ornamental purposes. Hence, means should be employed wherever there is the opportunity to work out the particulars relating to these valuable exotics, in order that eventually a just comparison may be made between [illegible]

Other Exotic Conifers.

Among other useful and ornamental Exotic Conifers, all more or less hardy, in the United Kingdom, and worthy of the attention of collectors and landscape planters, are the following:—The Tasmanian Cypress, *Arthrotaxis imbricata*, a neat and ornamental foliaged tree; the Chinese Yew, *Cephalotaxus Fortunei*, and *C. pedunculata*, small bushy trees, and fairly hardy; several species of *Podocarpus* from Chili, New Zealand, Tasmania, China, and Japan; the Huon Pine of Tasmania, *Dacrydium Franklinii;* the Californian Nutmeg, *Torreya myristica;* and the *Torreya nucifera* of Japan; the Kauri Pine of New Zealand, *Dammara australis;* the *Cunninghamia sinensis*, from Southern China; the Patagonian Cypress, *Fitzroya patagonica;* the Plum-fruited Yew, *Prumnopitys elegans*, from the Andes of Chili; and Prince Albert's Yew, *Saxe-Gothæa conspicua*, a curious and interesting member of the coniferous family, from the southern parts of Chili and Patagonia.

Remarks.—Of the commercial value, per cubic foot, of the timber of these exotic conifers, we have not yet had sufficient experience of them to enable us to give reliable figures. A generation or two must pass away ere this can be done with any approach to accuracy. It is open to doubt if many exotic trees will produce as good and durable wood as when grown in their natural habitats; although the larch is a notable example of high-class timber when grown in Britain, away from its natural habitat in Central Europe. I hope, however, that those exotic conifers, now planted and growing in this country, will long survive in healthy vigour, so that future generations will behold trees, it may not be equal to those grown in American and other genial climes, but such as we have not had the pleasure of looking upon in our day. Encouraged by hope, let us plant for future generations trees which shall not only be majestically grand and lovely, but such as are also really useful; and, as we gradually come to know the properties of each, give faithful record thereof, and thus do all we can by hand and pen to advance the successful growth of the best timber trees, as well as those of an ornamental character.

See accompanying Table for measurements of specimen conifers grown in Britain.

XI. *The Douglas Fir* (Abies Douglasii) *in Scotland.* By Dr W. Schlich, Professor of Forestry, Cooper's Hill Engineering College, Staines, Surrey.

Amongst the exotic timber trees which have been introduced into Europe during the present century, the Douglas fir has attracted more notice than any other species, owing to its remarkably quick growth during early youth. Specimens growing in free positions are believed to have laid on a mean annual increment of as much as 3 cubic feet, while only 1 cubic foot, at the most, could be expected on a larch tree; and even in a few fully stocked woods the increment appeared exceedingly great.

In the *Gardeners' Chronicle* of October 8, 1887, p. 427, an extract from the *Perthshire Constitutional* was published, which drew attention to the oldest plantation of pure Douglas fir in Britain, situated at Taymount, on the estate of the Earl of Mansfield, in Perthshire. In the extract this plantation is spoken of in glowing terms, but only a few scanty measurements are given, so that it is difficult for the reader to arrive at any definite idea on the progress of the plantation, whereby he can compare it with that of our indigenous timber trees. Besides being of very rapid growth, it has been claimed for the Douglas fir that it is not liable to disease—an advantage, which, if it really did exist, would be of great weight.

Such general statements are often misleading, and I determined to take the first opportunity to inquire somewhat more fully into the matter. Accordingly during a short tour in Scotland in July 1888, I measured a sample plot in the Taymount Douglas fir plantation, and I also measured, by way of comparison, a sample plot in an adjoining Scots pine plantation. The results of these measurements seem to me of sufficient interest to deserve publication.

The plantation at Taymount is situated about seven miles to the north of Perth, in 56½° northern latitude, and at an elevation of about 200 feet above the level of the sea. The ground slopes very gently towards the south-east, and the soil consists of so-called "stiff till," which, in this case, may be described as a loamy clay, retaining moisture well. The locality may safely be given as first or best quality for the growth of trees. The rainfall has been put down at 28 inches annually. The area of the plantation amounts to 8 acres. It was planted by Mr William M'Corquodale, forester and wood-surveyor to the Earl of Mansfield, who may be said to be the senior wood-manager in Scotland, in the spring of 1860, in the following manner: Douglas fir, four years old, 9 by 9 feet; larch, four years old, one between every two Douglas firs, and an additional line between every two lines of fir, so that the plants stood $4\frac{1}{2}$ by $4\frac{1}{2}$ feet, each acre containing 2151 plants, of which 538 were Douglas fir, and 1613 larch. The plants of Douglas fir were two years' seedlings, and two years' transplanted. The plantation made a good start, and the firs are said to have taken the lead at once. The larch were gradually thinned out, until the last disappeared before the year 1880, since which time the plantation has been pure Douglas fir. The first regular thinning of the Douglas fir occurred in 1887. Before that thinning, about 277 trees remained per acre, the remaining 261 having gradually disappeared during the previous twenty-seven years. Of the 277 trees seventy-five per acre were thinned out in 1887, so that now, in 1888, the countings showed 202 trees per acre.

No accurate statistics are in my possession regarding the material removed by thinning up to date. At the present moment the area is well stocked, and any small interruption of the leaf canopy by the thinning of 1887 will disappear by the end of 1889, when the cover overhead will, barring accidents, be again perfect. Thus, the thinning of 1887, though fairly heavy, was by no means too heavy.

On a sample plot, measuring four-tenths of an acre of average appearance, all the trees were carefully measured by myself, personally, on July 20, 1888, at height of chest, or 4 feet 6 inches from the ground. A selected sample tree was felled, by the kind permission of Mr M'Corquodale, and carefully measured, and thus the cubic contents of the tree were ascertained, separated into solid wood and branches. The former includes all wood over 3 inches diameter at the small end. In the present case none of the branches measured as much as 3 inches in diameter, so that the solid wood represents the stem of the tree from the ground up to a diameter of 3 inches. The following table shows the growing crop per acre:—

Diameter of Tree at 4 Feet 6 Inches above the Ground, in Inches.	Number of Trees of each Diameter.	Total Sectional Area at 4 Feet 6 Inches, in Square Feet.	Diameter of Tree at 4 Feet 6 Inches above the Ground, in Inches.	Number of Trees of each Diameter.	Total Sectional Area at 4 Feet 6 Inches, in Square Feet.
4	3	·26	12	20	23·56
5	12	1·64	13	35	32·26
6	3	·59	14	17	18·17
7	7	1·87	15	20	24·54
8	10	3·49	16	8	11·17
9	17	7·51	17	2	3·15
10	15	8·18			
11	33	21·78	Total, . .	202	158·17

From the above data it follows that the average sectional area per tree is $= \frac{158{\cdot}17}{202} = {\cdot}783$ square feet, which corresponds to a diameter of 12 inches.

The sample tree of average development, which was felled, showed the following dimensions:

Diameter at 4 feet 6 inches above the ground, .	11·78 inches.
Sectional area ,, ,, ,, . .	·757 sq. ft.
Height, ...	60 feet.

At 48 feet from the ground the stem showed a diameter of 3 inches, and here the top was cut off. These 48 feet were divided into eight sections of 6 feet length each, each section measured in the middle, and thus the following data obtained:

Number of Section.	Length of Section in Feet.	Mean Diameter of Section in Inches.	Volume of Solid Wood in each Section in Cubic Feet.
1	6	12·5	5·11
2	6	10·0	3·27
3	6	9·5	2·95
4	6	8·5	2·36
5	6	7·0	1·60
6	6	6·5	1·38
7	6	5·0	·82
8	6	3·5	·40
Total, .	48	...	17·89

The top, 12 feet in length, and the branches, were stacked, and found to fill a space of 50 cubic feet, which may perhaps be put as equal to $50{\cdot} \times {\cdot}15 = 7{\cdot}5$ cubic feet of woody matter. In the present paper this wood will not be taken into account.

From the contents of the sample tree, the volume of solid wood per acre was calculated according to the following equation:—

Volume of sample tree : volume per acre = sectional area of sample tree : Sectional area of all trees per acre ; or $17{\cdot}89 : x = {\cdot}757 : 158{\cdot}17$, and $x =$ volume per acre $= \frac{17{\cdot}89 \times 158{\cdot}17}{{\cdot}757} = 3738$ cubic feet of solid wood over 3 inches in diameter, exclusive of top and branches.

By dividing the volume by the age of the trees (32) the average annual production of wood is obtained : $\frac{3738}{32} = 117$ cubic feet, exclusive of previous thinnings ; or, if only the time since planting (28 years) is taken into account :—Average annual production of solid wood $= \frac{3738}{28} = 133$ cubic feet, exclusive of previous thinnings.

By way of comparing these results with the production of one of our indigenous trees, I measured the trees on a sample plot of one-tenth of an acre—in a very uniform plantation of Scots pine, situated at a short distance from the Douglas fir plantation. This Scots pine plantation had been established in a somewhat elevated spot, which was formerly of a swampy description. The locality must be classed as of second quality only, compared with the locality in which the Douglas firs grow. It was drained and planted in 1847—that is forty-one years ago—with four years old plants of Scots pine ; it has been thinned three times, and it will again be thinned in 1889. On July 20, 1888, the area was fully stocked. Omitting all suppressed trees, the survey yielded the following results :—

Diameter of Tree at 4 Feet 6 Inches above the Ground in Inches.	Number of Trees of each Diameter.	Sectional Area at 4 Feet 6 Inches, in Square Feet.
5	40	5·45
6	70	13·74
7	70	18·71
8	90	31·42
9	100	44·18
10	70	38·18
11	40	26·40
12	10	7·85
Total, . .	490	185·93

It will be noticed that this plantation shows a greater sectional area per acre than the Douglas fir plantation.

The mean height of the wood was found to be 45 feet, and from the available data it was ascertained that the volume of solid wood (3 inches diameter and upwards) amounted to 5015 cubic feet per acre. By dividing this number by 45—the total age of the trees, I obtained :—Average annual production of solid wood $= \frac{5015}{45} = 111$ cubic feet, exclusive of previous thinnings; or, if only the time since planting is taken into account :—Average annual production of solid wood $= \frac{5015}{41} = 122$ cubic feet.

If now we compare the average annual production of Douglas fir and Scots pine, we find—Douglas fir = 117 resp. 133, against Scots pine = 111 resp. 122 cubic feet. Here, then, is an almost inappreciable difference, especially if it is considered that the quality of the soil in the Scots pine wood is decidedly inferior to that of the soil in the Douglas fir wood. Unfortunately I had no opportunity of measuring a larch wood in the vicinity of Taymount, but it is well known to all foresters that, up to an age of forty-five years, at any rate, larch produces a greater volume than Scots pine, so that I may safely say :—"If grown in a well-stocked or crowded wood and in localities of equal quality, Douglas fir is not likely to produce more solid wood during the first thirty or forty years than the larch, and probably also not more than Scots pine."

The explanation is, that, although the individual Douglas fir develops more rapidly in diameter and in height than a Scots pine or larch, it requires, at any rate in Scotland, much more space; and consequently an acre of land will hold only a much smaller number of trees. Moreover, I shall further on show that it is more tapering than the important European conifers.

On the other hand, the growing stock of a Douglas fir wood consists of much larger trees (though smaller in number) than an equally old larch or Scots pine wood, and this is a great advantage where big timber fetches higher prices than moderate-sized timber. This advantage will, however, to a considerable extent, disappear with advancing age, when our indigenous timber trees reach the size usually demanded in the market.

Although the Taymount plantation gives some valuable information respecting the early development of Douglas fir compared with that of Scots pine, it leaves us as yet completely in the dark as to the further progress of production with advancing age. We have detailed and accurate information of the rate of increment of various European conifers, such as Scots pine, spruce, and silver fir, but our oldest pure plantation of Douglas fir consists of trees now only thirty-two years old. As regards the production per acre in its native home nothing reliable is available.

Hough, in his *Elements of Forestry* (1882), tells us that the Douglas fir reaches in Oregon to the enormous size of 200 to 300 feet in height, and from 15 to 20 feet in diameter; he adds, however, that the tree is more commonly about 150 feet high and from 4 to 8 feet in diameter. In America the trees are said to stand near each other, but this they certainly do not in the Scottish plantations; on the contrary, here an acre can, owing to the spreading nature of the branches, accommodate only a small number of trees compared with other species. On the whole, the matter requires considerable further investigation. This could best be done by a competent forester proceeding to North America and making suitable measurements on the spot. Such a step was actually taken, in 1885, by Dr H. Mayr, a Bavarian forester and botanist. He visited the localities in which the Douglas fir thrives best, and he has promised to publish the information which he has gathered. So far, however, he has only favoured us with a few notes published in forest journals, and as he has proceeded to Japan as Professor of Forest Botany in the Japanese Forest School, his experience of the Douglas fir may not become available for years to come.

Pending further investigation, I may be permitted to gather together what useful information is available at present, and to draw such conclusions as may appear permissible. The following[1] information is at my disposal:—

(1.) Measurements in the Taymount plantation.

(2.) Height growth of two Douglas firs on the same estate, planted in 1834.

(3.) Information supplied by Dr H. Mayr.

(4.) Examination of a Section of a full-grown Douglas fir, deposited in the Cooper's Hill Forest Museum.

(Ad. 1.) The details of the measurements made in the Taymount plantation have been given above.

(Ad. 2.) The Douglas firs, planted in the year 1834, were about four years old when planted, so that the trees were about fifty-seven years old in 1887, when they showed a height of about 90 feet.

(Ad. 3.) Dr Mayr informs us in the *Allgemeine Forst und Jagd Zeitung* of February 1886, p. 61, that the Douglas fir reaches the highest degree of perfection in the moist valleys of the Cascade Range Mountains, which run parallel to the Pacific coast. He found that in those localities the average height of full-grown mature Douglas firs, grown on soil of the best quality, amounts to

[1] Much general information is, no doubt, available, but for the present object only actual measurements can be used.

213 feet, with a diameter of 6½ feet, measured at 6½ feet above the ground. In the same locality, on gravelly soil, the trees only reached an average height of 148 feet, and a diameter of 2·6 feet. Again, in the Rocky Mountains, in Montana, at the same elevation and degree of latitude as on the west coast, the Douglas fir reaches, on best soils only, the same dimensions as on the gravelly soil of the Cascade Range Mountains, that is to say, a height of 148 feet, and a diameter of about 2·6 feet. The latter dimensions are not more than what our silver fir will attain in localities of the first quality. The part of the Cascade Range where the Douglas fir grows, has an annual rainfall of about 64 inches, while in Montana only 24 inches fall. Dr Mayr believes that the development of the Douglas fir is proportionate to the rainfall; respectively to the degree of moisture in the air.

(Ad. 4.) The cross-section in question was sent from America for exhibition in Europe; it was then made over to Kew, and by the kindness of the Director of Kew Gardens it was lately presented to the Cooper's Hill Forest Museum. The section shows a total diameter, including the bark, of 7 feet 9 inches, and the counting of the concentric rings indicates a total age of 515 years. A careful examination of the section has yielded the results exhibited in the subjoined table:—

Age in Years.	Diameter in Inches.		Sectional Area in square feet.		
	Total.	Increment during every 25 years.	Total.	Increment during every 25 years.	Increment during every 100 years.
25	10·9	10·9	0·648	0 648	
50	14·3	3·4	1·115	0·467	
75	18·4	4·1	1·847	0·732	
100	23·0	4·6	2·885	1·038	2·885
125	26·1	3·1	3·715	0·380	
150	29·5	3·4	4·746	1·031	
175	33·0	3·5	5·940	1·194	
200	36·6	3·6	7·306	1·366	4·421
225	41·9	5·3	9·575	2·269	
250	47·1	5·2	12·100	2·525	
275	51·6	4·5	14·522	2·422	
300	56·6	5·0	17·473	2·951	10·167
325	60·7	4·1	20·096	2·623	
350	65·2	4·5	23·186	3·090	
375	69·6	4·4	26·421	3·235	
400	74·8	5·2	30·516	4·095	13·043
425	77·7	2·9	32·928	2·412	
450	81·5	3·8	36·228	3·300	
475	84·6	3·1	39·036	2·808	
500	87·4	2·8	41·663	2·627	11·147
515	89·5	...	43·689		
Including the bark.	93·0				

This table exhibits some very remarkable facts. In the first place, it shows that the tree was still making good increment at an age of 515 years, which is higher than that usually attained by the European larch, Scots pine, spruce, and silver fir. Secondly, it shows that the enormously rapid increase of the diameter during the first twenty-five years is suddenly followed by a much smaller and an approximately even increment during each of the following nineteen periods of twenty-five years. I have represented the progress of the diameter increment in the following drawing, which will give a clear idea of it:—

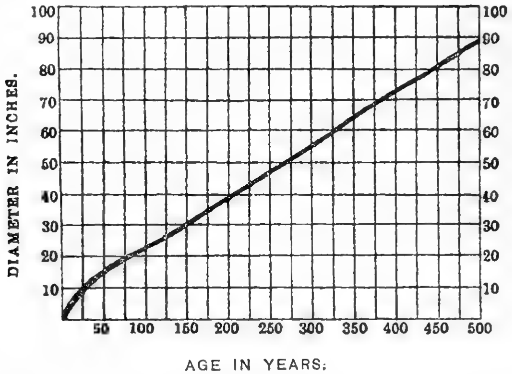


Diagram showing the increase in diameter of the trunk of the Douglas Fir, according to Age.

Thirdly, the sectional area increases, on the whole, steadily. The periodic increment increases up to the age of 400 years, when it commences to fall. Taken by centuries, we find that the fourth century yielded the largest increment. The appended graphic representation will make this clear:—

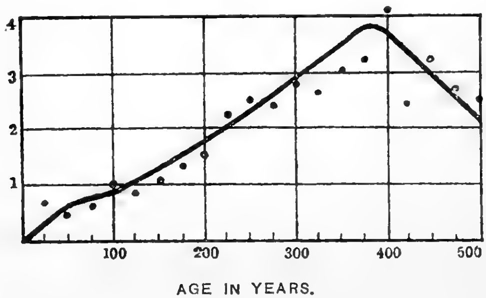


Diagram showing the periodic increment of every Twenty-five years in Square Feet.

Fourthly, the rate of growth indicated in the section up to the year thirty resembles that of the average tree in the Taymount plantation in a striking degree, as the following figures will show:—

Diameter of average tree at Taymount at 4 feet 6 inches above the ground, ...	12 inches.
Diameter of thirty years' growth on the section from America, ...	11·9 inches.

Assuming, then, that the average tree in the Taymount plantation will show a future development similar to that shown on the above mentioned cross-section, I have endeavoured to forecast the volume of solid wood, or growing stocks (3 inches and upwards in diameter), which an acre of land of the first quality is likely to contain at various periods.

In order to facilitate my task I shall commence by giving such data for the silver fir, obtained by careful and extensive measurements on the Continent. The volume, or cubic contents of a standing tree, is best calculated by the following formula:—

$$s \times h \times f.$$

Here s represents the sectional area taken at a convenient height above the ground, usually the height of the chest of a man, or about $4\frac{1}{2}$ feet; h indicates the height or length of bole; and f indicates a certain co-efficient called "the form figure." The product of $s \times h$ represents a cylinder with a base equal to that of the tree at 4 feet 6 inches from the ground, and a length equal to the height of the tree, the volume of which is considerably larger than that of the tree, as the latter tapers from the base upwards; hence f is a fraction of 1, and as the product, $s \times h$, is thus reduced by multiplying it with f, the latter is sometimes called the reducing factor.

During late years a large number of silver fir woods of varying age, from early youth up to muturity, have been carefully measured, arranged in different qualities—best, middling, and inferior—by ascertaining their height, sectional area at height of chest, and their cubic contents; by dividing with the product of height by sectional area ($h \times s$) into the volume, the form figure has been ascertained. The tables thus constructed can now be applied to the measurement of standing woods without any fellings whatever, by merely measuring the height and sectional area, and by taking the form figures from the tables.

The following extract shows the mean volume of solid wood in a well-stocked silver fir wood growing in a locality classed as belonging to the first quality up to an age of 140 years, beyond which age no figures are available :—

Age, Years.	No. of Trees per Acre.	Mean Height in Feet.	Sectional area at Height of Chest, Square Feet per Acre.	Form Figure for Solid Wood.	Volume of solid wood (3 Inches diameter and upwards) Cubic Feet per Acre.	Mean Tree.	
						Sectional area, Square Feet.	Diameter Inches.
32	1745	17	93	·65	1,032	·053	3·1
50	931	42	177	·47	3,458	·190	5·9
75	433	75	243	·47	8,532	·561	10·1
100	213	97	295	·46	13,291	1·385	15·9
125	126	109	335	·45	16,291	2·659	22·1
140	101	114	353	·44	17,720	3·495	25·3

In order to prepare a similar table for Douglas fir, it is necessary to ascertain the total sectional area per acre, the mean height, and the form figures for the years 50, 75, 100, 125, and 140; and this, with the scanty material at present available, can only be done in a rough and preliminary manner.

Sectional Area.—We know that the sectional area of a dominant (or leading) tree is as follows :—

At the age of 50 years,	. . .	=	1·115 square feet.
,, 75 ,,	. . .	=	1·847 ,,
,, 100 ,,	. . .	=	2·885 ,,
,, 125 ,,	. . .	=	3·715 ,,
,, 140 ,,	. . .	=	4·307 ,,

In order to ascertain the total sectional area per acre at these periods, we must ascertain the number of trees which a well-stocked acre is likely to contain at the same periods. We know (1.) that a well-stocked acre contains 202 Douglas firs at the age of thirty-two years; (2.) that 101 silver firs 140 years old, of a mean sectional area of 3·495 square feet, find room on an acre; (3.) that generally a Douglas fir requires at least as much room as a silver fir of the same sectional area, and, in fact, somewhat more, owing to the somewhat more spreading nature of the branches; and (4.) that a Douglas fir 140 years old shows a sectional area of 4·307 square feet.

Taking these facts into consideration, the following numbers of Douglas firs per acre have been estimated :—

At the age of 32 years,	. . . . .	202
,, 50 ,,	. . . . .	150
,, 76 ,,	. . . . .	125
,, 100 ,,	. . . . .	100
,, 125 ,,	. . . . .	88
,, 140 ,,	. . . . .	80

By multiplying these numbers with the mean sectional area per tree, the total sectional areas of all trees per acre are obtained.

(*b.*) *Height.*—The following facts are at our disposal: (1.) A Douglas fir thirty-two years old has a mean height of 60 feet; mean annual height growth $= 22\frac{1}{2}$ inches; (2.) a Douglas fir fifty-seven years old has a mean height of 90 feet; mean annual height growth (from thirty-second to fifty-seventh year) $= 14$ inches; both grown in Perthshire. (3.) Mature Douglas firs in the most favourable localities of North America are reported to reach a mean height of 213 feet; such trees are often up to 500 years old, but it is not known at what age the height growth ceases; let us assume that it is very slight after the age of 250 years. With these facts before us, the heights up to an age of 140 years may be estimated as follows :—

At the age of 32 years,	. . . . .	60
,, 50 ,,	. . . . .	82
,, 75 ,,	. . . . .	105
,, 100 ,,	. . . . .	125
,, 125 ,,	. . . . .	141
,, 140 ,,	. . . . .	150

(*c.*) *Form Figure.*—The form figures for silver fir are :—

At the age of 32 years,	. . . . .	·65
,, 50 ,,	. . . . .	·47
,, 75 ,,	. . . . .	·47
,, 100 ,,	. . . . .	·46
,, 125 ,,	. . . . .	·45
,, 140 ,,	. . . . .	·44

The form figure of the Taymount plantation shows ·39 for an age of thirty-two years. This is very considerably below the form figure for silver fir, and it is in accordance with the facts of the case. The Douglas fir is a much more tapering tree than the silver fir, and the highest form figures which can be expected may perhaps be placed as follows :—

At the age of 32 years,	=	·39
,, 50 ,,	=	·38
,, 75 ,,	=	·38
,, 100 ,,	=	·37
,, 125 ,,	=	·36
,, 140 ,,	=	·35

By utilising the figures thus estimated, the following table for the Douglas fir has been calculated :—

Age, Years.	No. of Trees per Acre.	Mean Height in Feet.	Sectional Area at Height of Chest, Square Feet per Acre.	Form Figure for Solid Wood.	Volume of Solid Wood (3 Inches Diameter and upwards), Cubic Feet per Acre.	Mean Tree.	
						Sectional Area, Square Feet.	Diameter, Inches.
32	202	60	158	·39	3,738	·782	12·0
50	150	82	167	·38	5,204	1·115	14·3
75	125	105	231	·38	9,217	1·847	18·4
100	100	125	288	·37	13,322	2·885	23·0
125	88	141	327	·36	16,599	3·715	26·1
140	80	150	345	·35	18,112	4·307	28·1

Let us now compare the volume of the Douglas fir with that of the silver fir :—

Age.	Growing Stock per Acre in Cubic Feet.		Mean Annual Increment in Cubic Feet per Acre.	
	Douglas Fir.	Silver Fir.	Douglas Fir.	Silver Fir.
50	5,204	3,458	104	69
75	9,217	8,532	123	114
100	13,322	13,291	133	133
125	16,599	16,291	133	130
140	18,112	17,720	129	127

This table indicates that under a rotation of up to about ninety years the Douglas fir, owing to its more rapid development in early growth, yields larger returns of solid wood than the silver fir. Under a rotation of 90 to 120 years the returns in volume are about equal. Under a rotation of more than 120 years the Douglas fir will again yield larger returns of volume than the silver fir. The latter is of little consequence in this country, because no landed proprietor would think of working his plantations under a rotation of more than 120 years, unless he had a particular fancy to see large trees on his estate. Attention must also be drawn to the fact that the mean annual increment culminates between the years 100 and 125, so that a rotation of, say, 110 to 120 years will yield, in the long run, a larger number of cubic feet of solid wood than either a shorter or longer rotation, both in the case of silver fir and, as far as I can judge, also of Douglas fir.

The above data, it must always be remembered, refer only to the final cuttings. I have no data whatever which would enable me to compare the intermediate returns (thinnings) of Douglas fir and silver fir. I may also draw attention to the fact, that the numbers of cubic feet given above refer to the actual volume of solid wood. In order to obtain the number of cubic feet calculated from the quarter girth, as is usual in this country, the numbers must throughout be reduced by about one-fourth (or, more accurately, 22 per cent.).

I have compared the returns of the Douglas fir with those of the silver fir, because we possess accurate tables giving the volume-yield of the latter at different ages. It would have been more to the purpose to substitute the larch for the silver fir, but unfortunately the laws of increment of the former have not as yet been so minutely studied and recorded as in the case of the latter. So much, however, is known, that the larch develops much more rapidly than the silver fir during youth, and that it yields larger returns of solid wood under a rotation of seventy-five years, and perhaps even eighty years, in favourable localities; under a higher rotation the volume-yield of the silver fir is greater than that of larch. Hence it may be safely said, that under a rotation of seventy-five, and perhaps even eighty years, the larch will yield as much solid wood as the Douglas fir whenever they are grown in regular fully stocked woods, and in localities of equal quality—with this difference, that the material yielded by the Douglas fir will consist of a smaller number of trees per acre, with a greater mean diameter per tree.

The laws of increment of Scots pine are well known. On good localities, like that of Taymount, the growing crop of a fully stocked acre compares as follows with that of Douglas fir:—

Age.	Volume of Solid Wood per Acre in Cubic Feet.		Mean Annual Increment per Acre in Cubic Feet.	
	Douglas Fir.	Scots Pine.	Douglas Fir.	Scots Pine.
50	5,204	5,600	104	112
75	9,217	7,900	123	105
100	13,322	9,300	133	93

Under a rotation of fifty years Scots pine may even yield a little more material than the Douglas fir, but later on it drops considerably behind.

Quality of the Timber.—The next point of importance is the quality of the timber. The wood of the Douglas fir has a great reputation, and in America its quality is believed to be equal to that of larch timber. In how far the Douglas fir grown in this country will come up to that standard remains to be seen. The larger sized trees so far cut on the Scone estate have been freely bought at the same rates as those usually paid for larch, but sufficient time has not elapsed to show the comparative merits of home-grown Douglas fir and larch timber.

A few words must now be added with regard to the *safety of production.* First of all it is an undisputed fact that Douglas fir can, in this country, only be successfully grown in sheltered localities, because its leading shoot, and even the lateral branches, are very liable to be broken by wind. This reduces the area suitable for its cultivation very considerably.

Then there can be no doubt that the Douglas fir, in order to yield large volume returns, requires good fertile and fresh or moist soil, in fact, soil on which any other species will produce a large volume of timber. Such land can, moreover, be used to greater advantage for field crops. What we specially require are species which will do well, or at any rate fairly well, on lands which are not suitable for field crops.

Finally, it has been said that the Douglas fir is not exposed to any *disease*, while the larch, for instance, suffers so much in this respect. With regard to this point, it will be as well not to shout until we are safely out of the wood. It will be remembered that the larch disease did not show itself in Scotland until about sixty years ago. Only quite lately Mr M'Gregor, who has been on His Grace the Duke of Athole's estates for more than forty years, pointed out to me, that he has never seen the larch cancer on any of the old larch trees, except on those parts of the trees which have been formed during the last sixty years. This certainly seems to indicate that the disease did not exist before about the year 1820.

No doubt exists now that the larch cancer is the result of the ravages of a fungus (*Peziza Willkommii*), the spores of which enter the tree through wounds which were caused by insects (aphis), frosts, violence, etc. Only a few days ago, and after I had commenced this article on the Douglas fir in Scotland, I saw in a German forest journal, a notice of the discovery of an injurious fungus on the Douglas fir. Dr von Tubeuf, a pupil of the celebrated pathologist, Dr R. Hartig of Munich, has now described a fungus, *Botrytis Douglasii*, which is parasitic on the Douglas fir: it has been noticed during the last ten years, in several widely separated localities in Germany, on the trees in the experimental plantations which have been made of late years. As far as is known at present, the fungus attacks in the first place the young shoots, the needles of which turn brown or grey, the whole being ultimately spun over with mycelium; it then extends and ultimately kills the plants. It has also been found that this same fungus can be cultivated on two to six years old plants of silver fir, spruce, and larch. Dr von Tubeuf found, as a general rule, that those Douglas firs were specially attacked which grow in fully stocked areas, so that the branches of the trees interlaced; and in these cases the lower branches were more attacked than those higher up. He also noticed that free standing trees were free of the disease, and he naturally draws the conclusion, that infection depends on a high degree of moisture, such as is found in dense woods, while free-growing trees, exposed on all sides to drying air currents, escaped. Now, what does this mean? Simply that the Douglas fir must be grown in thin open woods, and if so, good-bye to any high returns per acre, such as silver fir, larch, or even Scots pine will yield.

Generally, Dr von Tubeuf adds some very sensible remarks, of which I give the following extracts. He says:—

"In introducing an exotic species, the first question should be whether, if grown in the same locality, it possesses any real advantages over our indigenous species, either in consequence of a superior quality of wood, rapid growth, large dimensions, active reproductive power, etc., or by more successfully resisting any unfavourable conditions of the soil or climate, or by being less subject to natural enemies, such as game, animal or vegetable parasites, etc.? A further most important question is, whether with the exotic tree we are likely to introduce new enemies to our indigenous trees? and in this respect we need only remind the reader of the imported enemies of the potato, the Colorado beetle, the enemies of the vine, etc. . . .

"Of our own enemies of trees, a large number attack without distinction the exotics lately introduced—Curculio, Bostrychus, cockchafers, caterpillars, and beetles, attack exotics like indigenous trees; *Trametes radiciperda* (one of the most formidable of fungi) destroys the wood of the Douglas fir like that of any other species."

These words deserve serious consideration. It is more than probable that the Douglas fir will, with us, in the course of time, develop its full share of enemies, if not more, considering that it is an exotic species.

Before concluding, I desire to express a hope that my object in publishing these notes on the Douglas fir may not be misunderstood. The cultivation of the tree in Great Britain and Ireland looks at present very encouraging, and I trust that experiments will be continued; but I deprecate altogether rushing into extensive plantings, as advocated by the correspondent of the *Perthshire Constitutional*, until time has shown that the tree really deserves to supersede the species hitherto cultivated by us, and of which we know what to expect. My personal opinion is, that the Douglas fir will just as little revolutionise our sylvicultural operations as the Weymouth pine has been able to do, though great things were expected of it at one time. There is a great difference between nursing up a single tree in a fine soil and under otherwise favourable conditions, and the growing of a species on a large scale for economic purposes; in the former case only exceptional results present themselves to the eye, while in the latter case averages must be looked for and reckoned with.

XI. *Old and Remarkable Trees on the Rolle Estate, Stevenstone, Torrington, Devon.* By James Barrie, Forester, Stevenstone. [Plates II. to V.]

The Stevenstone Estate, the property of the Hon. Mark G. K. Rolle, occupies a central position in the northern division of the County of Devon. The park in front of the mansion ranges in altitude from 400 feet to 500 feet above sea-level. The soil is a strong loam, the subsoil sandy clay, resting on shillet rock, with a very uneven surface. The climate is mild, and the soil in general is favourable for the production of large hardwood timber trees.

I purpose in this report to supply the particulars of twelve noteworthy trees on this property. Although none of them may be connected with historic events, yet they can be favourably compared with many other notable trees in the South of England. There are numerous other large trees on the property, but to give a minute description of them individually, along with their picturesque features and habits of growth, would extend this report much beyond the prescribed limits.

The accompanying album contains photographs of the twelve trees, and also of a section of the base of the stem of each tree, so as to convey a fair idea of their appearance and dimensions. Each photograph is numbered, and these numbers correspond with those given in this report.[1]

The first nine trees are situated in the deer park, some close to, and others within one mile of the mansion. The trees numbered 10, 11, and 12 are distant from the mansion about five, seven, and nine miles respectively.

The measurements of each tree are given in a tabulated form at the end of this report, so as to be more convenient for reference.

No reliable statement can be made as to the age of these trees, but I believe the majority of them are fully 200 years old.

No. 1. Spanish Chestnut, *Castanea vesca.*

(See Plate II.)

This is a grand specimen, and a splendid type of what an old ornamental park tree should be. It is growing 70 yards south of Stevenstone House, is still healthy, and increasing in size yearly.

[1] The handsome album furnished with the Report is added to the Society's Library. It contains twenty-four beautiful photographic illustrations, giving a full view, and a stem section, of each of the twelve trees described.—Ed.

Portions of the top have been broken off by storms at different times, which have reduced the height of the tree in proportion to the great thickness of its bole. The circumference of the bole, at 3 feet high, is 22 feet 6½ inches, and the tree contains 721 cubic feet of timber.

No. 2. Ash, *Fraxinus excelsior.*

A fine tree which stands about 300 yards south from the mansion-house in the middle of a group of walnut and other trees. At 30 feet high it divides into three large limbs, and is a healthy, fast-growing tree. At 3 feet up, it girths 14 feet 1 inch.

No. 3. Spanish Chestnut, *Castanea vesca.*

(See Plate III.)

This splendid tree stands 40 yards south of the flower garden, and is one of the best of the old and remarkable trees on this property. At 3 feet high it girths 18 feet. It has a fine balanced and wide-spreading head of branches, with a diameter of 100 feet, and the tree contains 833 cubic feet of timber.

No. 4. Beech, *Fagus sylvatica.*

A remarkably fine specimen, which grows about 120 yards east of the mansion. This tree has got a peculiar large opening in the bole on the east side, 19 feet long, 12 inches wide outside, and 2 feet diameter in the middle of the bole, which is quite hollow up to 19 feet, where the tree forms a round, clean stem to 33 feet high. Even with this defect it would be difficult to select a handsomer example of a park tree. The top rises to 96 feet high, with a diameter of 72 feet, and the branches sweep down all round to within reach of the deer in the park.

No. 5. Abele Poplar, *Populus alba.*

This beautiful tree stands on the west side of the park, close to the drive to Weekbottom, and forms an excellent contrast among other ornamental deciduous trees. It reaches to a height of 96 feet, with a clean bole of 46 feet 6 inches, and girths 11 feet 7 inches at 3 feet high.

No. 6. Oak, *Quercus pedunculata.*

A very fine specimen of an oak, which stands close to the Week drive, on the east bank, near the bottom of the park, and is one of the many fine oaks on this bank. The circumference of the stem, at 3 feet high, is 17 feet 3 inches, and the tree contains 572 cubic feet of timber.

No. 7. LIME, *Tilia Europæa.*

A beautiful tree, standing on the north side of the east approach to the mansion, and 23 feet from the road. It is a fine healthy tree, towering to a height of 100 feet, contains 404 cubic feet of timber, and girths 11 feet 7½ inches at 3 feet high.

No. 8. OAK, *Quercus pedunculata.*

(See Plates IV. and V.)

Another fine specimen of an oak, which is growing on the east bank of the smallest pond near the middle of the park. It presents a healthy and vigorous appearance, and is likely to make a very large tree. It girths, at 3 feet from the ground, 17 feet 2½ inches, and contains 472 cubic feet of timber.

No. 9. ENGLISH ELM, *Ulmus campestris.*

This grand old elm grows on the north side of the largest pond in the park, at 37 feet from the water's edge. It has lost several fine limbs by strong gales; still it contains no less than 544 cubic feet of timber, girths 16 feet 2 inches at 3 feet up, and towers to a height of 100 feet.

No. 10. OAK, *Quercus pedunculata.*

In front of Beam House, and 90 yards away from it, stands this grand specimen, one of the finest of the old and remarkable oak trees in North Devon. It grows on the lawn adjoining the river Torridge, and is a very healthy tree with a fine balanced head of 107 feet diameter. It contains 500 cubic feet of timber, and girths, at 3 feet up, 17 feet 6 inches.

No. 11. BEECH, *Fagus sylvatica.*

This remarkably handsome tree is growing 200 yards south of the Umberleigh Station of the London and South-Western Railway, and on the east bank of the River Taw. The trunk of this gigantic tree is divided on the north side to near the ground, and at a height of 17 feet 3 inches from the base it wholly divides into two ponderous stems, one of which ramifies into four and the other into six very large limbs, and afterwards into a number of smaller limbs, forming a splendid head 94 feet high and 86 feet 6 inches in diameter. It girths 30 feet 7½ inches at 3 feet, and 25 feet 3 inches at 5 feet up; and contains 988 cubic feet of timber.

No. 12. Silver Fir, *Picea pectinata.*

A splendid specimen, and one of the largest fir trees on this property. It grows in a meadow, in deep, rich loam, and stands about 150 yards from Hudscott House. The circumference of the bole at 3 feet from the ground is 16 feet 1 inch. The height of the tree is 96 feet, and its cubic contents 522 feet.

Table.—Giving the names, dimensions, and cubic contents of the foregoing Twelve Remarkable Trees.

	Name of Tree.		Girth at 3 Feet from the Ground.		Girth at 5 Feet from the Ground.		Height of Bole.		Diameter of Top.		Total Height of Tree.	Cubic Contents.
No.	Common.	Botanical.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	Ft.
1	Chestnut, Spanish,	*Castanea vesca,* .	22	6½	22	4	8	6	80	0	52	721
2	Ash, ...	*Fraxinus excelsior,* .	14	1	13	3	30	0	77	0	88	372
3	Chestnut, Spanish,	*Castanea vesca,* .	18	0	16	11	12	6	100	0	86	833
4	Beech, . .	*Fagus sylvatica,* .	15	6	13	9½	33	0	72	0	96	388
5	Poplar, Abele, .	*Populus alba,.* .	11	7	10	4½	46	6	74	0	92	296
6	Oak, ...	*Quercus pedunculata,*	17	3	15	3½	18	6	84	0	90	572
7	Lime, . . .	*Tilia Europæa,* .	11	7½	11	5½	16	0	76	0	100	404
8	Oak, ...	*Quercus pedunculata,*	17	2½	15	6½	13	6	86	0	68	472
9	Elm, English, .	*Ulmus campestris,* .	16	2	15	0	20	0	64	0	100	544
10	Oak, ...	*Quercus pedunculata,*	17	6	15	0	12	3	107	0	70	500
11	Beech, . .	*Fagus sylvatica,* .	30	7½	25	3	17	3	86	6	94	988
12	Silver Fir, . .	*Picea pectinata,* .	16	1	15	2	12	6	50	0	96	522

XII. *The Comparative Value of Exotic Coniferæ as Ornamental or Timber Trees in Britain.* By A. D. WEBSTER, Forester, Holwood Estate, Kent.

How difficult it is to plant for future effect and utility is well known to every arboriculturist, unless indeed we are content to do as our forefathers did, and think it wiser, to prevent mistakes, simply to copy where they have been successful. The wisdom of such a policy, in most instances at least, we would not think of denying; yet it will be agreed by all that it would be folly not to give a fair trial to the many beautiful conifers introduced to Britain, particularly during the past three-quarters of a century.

The comparative value of exotic coniferæ as ornamental or timber trees in Britain is to the arboriculturist a subject of vast importance, but one that has as yet received little attention.

That many of the newly introduced conifers are highly ornamental and useful in the embellishment of our parks and grounds, and several of great value in commerce, is well known; although it must be admitted that our knowledge of most of them is far from perfect. In the following notes, the result of fifteen years' experience of these trees on three estates, where almost every species had a fair trial, only such kinds are treated of as have some claim on the arboriculturist for ornament or utility. In many cases, owing to large numbers of certain conifers having been planted, ample opportunity has been afforded for testing the quality of wood produced, while as all three estates contained lowland and mountainous ground, and in one case a considerable tract of peat bog with a large area of chalk, the soils, altitudes, and situations that are most suitable for each species have been carefully considered and duly noted from time to time.

To render this paper concise and of easy reference, the names of the trees have been arranged alphabetically, but not in order of merit, either as ornamental or timber-producing species, their comparative value in these respects being, however, duly noted. This method of arrangement may seem unsatisfactory, but in reality it is not so, for several conifers are both highly ornamental and valuable for the quality of timber they produce; and it would in some measure involve a reiteration of statements to treat such under the two headings of ornamental and useful.

1. *Abies Albertiana* (Prince Albert's Fir). — This graceful conifer, with its drooping branches and delicate feathery sprays

of foliage, silvered on the under side, is one of the most ornamental that has yet found its way into this country. The foliage is much admired, particularly so in early summer when each twig is terminated with a tuft of golden-green leaves surmounted by the darker green of the previous year. The whole contour of Prince Albert's Fir, particularly when grown in suitable soil—a peaty loam—is gracefully irregular, the long and lithe branches and pendulous branchlets imparting a refined air that never fails to attract attention. For lawn and park planting it is much in request, and may be described as the most beautiful of its class. As a timber tree, *Abies Albertiana* is not likely to attract much attention, at least in this country, although, as exhibited at the Forestry Exhibition in Edinburgh, the wood seemed of excellent quality; and thanks are due to the forester to the Right Hon. J. Inglis of Glencorse, Midlothian, for the practical way in which the timber was tested for fencing posts. One of those exhibited had been in the ground five years, and appeared to be little the worse. The upward annual growth of this spruce is fairly rapid; the average of fifteen specimens growing under favourable circumstances being 20 inches. At Hafodunos, in North Wales, one of these trees in thirty-five years produced $48\frac{1}{2}$ feet of wood, or fully $1\frac{1}{3}$ feet per annum. Habitat, British Columbia and Oregon. Introduced in 1851.

2. *A. Alcoquiana*[1] (Alcock's Fir).—This is one of the most distinct, beautiful, and desirable of Japanese conifers, and one peculiarly well suited for the climate of Britain. Its chief attraction, and that which distinguishes it from all other species, is the striking and beautiful contrast in colour between the upper and under sides of the leaves; for, while the former is tinged with a golden hue, the latter is, in the majority of specimens, of a silvery grey. When only a yard in height, this pretty spruce is a model of beauty, the dense habit of growth and pleasing outline being the admiration of all beholders. Regarding its value as a timber tree in this country, it would be hazardous to advance an opinion, too short time having elapsed since its introduction for any specimen to have attained maturity. When better known and more widely diffused, this handsome, hardy, and easily-managed spruce will occupy a front rank in ornamenting

[1] *A. Ajanensis* is here described as *A. Alcoquiana.* The upper and under sides of the leaves are wrongly described. The silvery, and what appears to be the under side, is in reality the upper.—ED.

our parks and grounds. Introduced in 1861 from the Island of Nippon, Japan.

3. *A. amabilis* (Lovely Fir).—This handsome tree is not common in this country, probably owing to the confusion which, until recently, existed respecting the identity and nomenclature of this and others of the North-West American Firs. When planted in suitable soil (the finest specimens I have noted are growing in reclaimed peat bog) *A. amabilis* is of rapid growth, one specimen in particular growing under favourable circumstances having for several successive years made an upward growth of 15 inches. As an ornamental tree it is second to no other conifer, the easily-arranged, semi-decumbent branches and great wealth of intense bluish-green foliage rendering it as unique as it is beautiful. Little is known regarding the quality of timber of this tree in the British Isles. Habitat, Oregon and British Columbia. Introduced in 1831.

4. *A. brachyphylla* (Short-Leaved Japanese Fir) is well worthy of attention, it being perfectly hardy and highly ornamental. From what we have seen of this unusually pretty fir, it is certainly well worthy of extended culture, particularly where a bright-foliaged and not too densely-branched conifer is in request. Introduced about the year 1870. Habitat, the Island of Saghalien and Japan.

5. *A. bracteata* (Santa Lucia Fir).—Too much cannot be said in favour of this little known tree, for, with its long and thick deep-green foliage, erect habit, and generally pleasing contour, it is beyond doubt one of the most handsome of the many conifers with which California has enriched our Empire. Even the cones are so distinct from those of any other member of its tribe, being thickly covered with long leaf-like bracts, that recognition of the species from these alone is not difficult. The largest, best furnished, and most healthy specimen of *A. bracteata* that I have seen is growing in a soil largely composed of peat, and partially sheltered from the prevailing winds of the district. After becoming established the upward growth of this tree is fairly rapid, the annual addition to the height of the specimen referred to, for five consecutive years, averaging 13½ inches. Being of recent introduction, few opportunities of testing the quality of the timber have been afforded. Native of Santa Lucia, in South California, and introduced in 1853.

6. *A. Brunoniana* (Indian Hemlock Fir) cannot be considered

as perfectly hardy in this country—a matter which is to be regretted, for it is undoubtedly the handsomest of all the Hemlock Spruces. There is a beautiful and fast-growing specimen in the Red Lodge Nursery at Southampton, which, for twenty-five years, has made an annual upward growth of nearly 10 inches. The branches are of easy arrangement, while the pendulous branchlets are thickly studded with inch-long leaves, glaucous on the under side, and suffused with a milk-white bloom. Habitat, Nepaul and Sikkim. Date of introduction uncertain.

7. *A. canadensis* (Hemlock Spruce).—No evergreen tree or shrub can excel this conifer for richness of foliage or beauty of outline; and during spring or early summer the young, drooping shoots of a lively yellowish-green contrast finely with the dark sombre green of the older foliage, and form a combination that for pleasing effect is certainly hard to match. An erroneous opinion is gaining ground, that the Hemlock Spruce is not suited for the climate of Britain; even Loudon and Michaux have little to say in its favour; and as a veteran American Arboriculturist some time ago remarked, English nurserymen have generally followed suit by regarding the tree in a similar light. True it is we have no such specimens as are recorded from "the far West," and equally true is it that this spruce will not flourish and put on its best garb when planted anywhere and anyhow with us, no more than do the majority of foreign importations; but treat the Hemlock Spruce in a rational manner, and as its nature requires, and it will ere long be found that few trees are more amenable to cultivation, and, perhaps, none repay more fully the bestowal of a little extra care and attention at the time of planting. Numerous instances of the rapid growth of this conifer in the British Isles might be adduced. A moist, deep, rich, but light soil and sheltered situation are its chief requirements.

Few trees in Britain attain the age or size at which the wood is mature; but specimens that have come under my notice might be reckoned as second class in the pine list. The late Mr Speed, gardener at Chatsworth, who had unusual opportunity of observing the tree and testing the quality of the wood, reported the latter as hard and heavy. In its native country the wood of the Hemlock Spruce is not much in request, being coarse and crooked grained, and liable to splinter. It is sawn into boards of an inferior quality, adapted for mining purposes, flooring of barns, wharves, and out-buildings. The bark is used for tanning purposes, and in America realises about fifteen shillings per ton. A native of North America, Canada, the New England States, etc. Introduced about the year 1736.

8. *A. cephalonica* (Mount Enos Fir).—This handsome fir is well adapted for general use in our country, and whether planted singly on the lawn, or mixed with others in the woodland, is at all times a pleasing object, and worthy the attention of planters. Unfortunately, in some districts, and especially when planted in unsuitable situations, young trees are apt to suffer from late spring frosts. That, however, should be no detriment to its extended use, as, by a proper selection of soils and sites, success in the cultivation of this tree is not difficult. A stiffish soil, such as a good clayey loam, thoroughly drained, and a northern or western aspect, will be found most suitable, as these considerably retard early growth, the great evil to which the tree is susceptible in our clime.

As an ornamental conifer this fir is of at least second-rate importance, the long and lithe branches being well clothed with dark olive-green foliage, while the whole contour of the tree is remarkably pleasing. The timber of home-grown trees which I have used experimentally for several purposes appears to be good and durable, but sufficient time has not elapsed since the experiments were made to speak with certainty; so far, however, they are satisfactory, and tend to prove that the wood, when of mature age, will be of value for many out-door purposes. According to General Sir Charles Napier, the timber produced in its native wilds is of excellent quality; and he informs us that, in pulling down some houses which had been built from a hundred and fifty to three hundred years before, the wood from the Black Forest (on the Black Mountain, Cephalonia) was found as hard as oak, and perfectly sound. In the seventeenth century wood was supplied from this forest for the whole of the Ionian group of islands, as well as for the arsenal in Corfu. The wood is extremely resinous. Under favourable circumstances, the rate of growth is about 10 inches a year; but the production of timber is somewhat slow. Three specimens of fifty years' growth, which I measured, were 38 feet each on an average, or about 9 inches annually since they were planted. Introduced from Cephalonia in 1824.

9. *A. concolor*.—This species is nearly allied to *A. grandis*, but readily distinguished by the rather irregular arrangement of leaves, and by the upper and under surfaces being nearly the

same colour. The cones, which are usually produced singly, are larger, and the seeds much weightier, than those of *A. grandis.* It is more liable to be injured by spring frosts than that species, and this is noticeable when the trees are growing side by side and under similar conditions in every way. As a first-class ornamental conifer it is worthy of extended culture and of greater attention than it has hitherto received. The leaves are of a whitish hue, changing to a pale green as they grow old, the upper and under surfaces being of the same colour. When it has attained to a height of a dozen feet the colour of the foliage is very pleasing. The outline is symmetrical without being stiff. To produce rapid growth the tree must be planted in elevated ground. Regarding the quality of timber produced by this tree in Great Britain little is known, too short time having elapsed since its introduction. A native of the Southern Rocky Mountains. Introduced in 1851.

10. *Abies* (*Pseudo-tsuga*) *Douglasii* (Douglas Fir) is in certain situations one of the most valuable timber trees that have yet found their way into these islands. As regards the actual produce of timber in a given time, it is far ahead of any other tree grown in this country, not excepting the *Wellingtonia* or *Sequoia.* We state this from measurements recorded by ourselves for a number of years of trees grown under similar conditions as regards soil, altitude, and situation. The greatest amount of timber produced by the Douglas fir in this country during fifty years is no doubt that of which we kept a record, viz., 240 feet, or nearly 5 feet per year for half-a-century. The tree here referred to as having produced this almost fabulous quantity of wood is growing on an estate in North Wales, and is of the following dimensions:—Girth of stem at 3 feet up, 11 feet 9 inches; and at 21 feet up, 8 feet 4 inches; 42 feet in length of the butt contains 217 feet of excellent clean timber. Another Douglas fir, growing within a few yards of the former, has a girth of stem at 3 feet from the ground of 13 feet 8½ inches; and 24 feet in length of the stem contains exactly 131 feet of wood. In a plantation of this fir formed twenty-two years ago, the average sizes we found to be as follows:—Height, 76 feet; girth of stem at 24 feet up, 4 feet; cubic contents, fully 50 feet.

The timber produced in this country is of excellent quality, being light but strong, works readily, has a pleasant yellowish tinge, and takes on a good polish. By way of experiment we have used the wood rather extensively for fencing purposes, for doors, in boat-building (principally as masts), and for various other purposes, and with excellent results; although it would be premature to speak with perfect certainty, for sufficient time for a fair trial has not elapsed since the experiments were instituted.

As an ornamental tree for the park or lawn the Douglas fir is of great value, its graceful outline and wealth of foliage being special attractions. When planted in clumps or masses it is effective, the beautiful rich green foliage being pleasing in the extreme, particularly in early spring, when the young leaves are becoming fully developed, for then the contrast between these and the dark green—almost yew green—of the older foliage is strikingly distinct.

In planting the Douglas fir for ornament, ample space should be allowed for the development of all the branches, as, if the trees are crowded together, the lower branches die off, and thus greatly mar the effect. It is difficult to say as to the distance apart at which these trees should be planted, much depending on the soil, position, and altitude at which they are grown. A safe average, under ordinary conditions as to soil and situation, would be 20 feet, the standards ultimately left being 40 feet apart, thus giving, in the majority of instances, ample room for the spread of branches.

The Douglas fir is a tree eminently adapted for cultivation in this country, but to grow it satisfactorily it must be planted in sheltered hollows, for experience has proved that it is ill-adapted for bearing storms, even at a few feet above the sea-level. It is well to bear this fact in mind, and to plant it only where it will be screened from the prevailing winds. Such situations are plentiful on almost every estate; and if it is intended to grow this handsome and valuable fir in a satisfactory way, its peculiarities must be attended to, for experience has proved it does not thrive on exposed ground. A native of North-West America. Introduced in 1827.

11. *A. Engelmanni* (Engelmann's Spruce), with its deep green foliage, rather short, stiff, and horizontal branches, and spire-like contour, is destined to rank high amongst ornamental conifers in this country. It is hardy, of rather slow growth, and, so far as we know, proof against insect pests. Owing to its recent introduction nothing is known as to the value of timber produced in the British Isles. In its native country the timber is said to

be excellent and durable. A native of the Rocky Mountains, and introduced in 1864.

12. *A. excelsa* (Norway Spruce).—Whether as a hardy shelter-giving tree, or for the quantity of fairly good timber it produces, the common or Norway spruce must ever rank high in the list of exotic conifers which have been found suitable for culture in the British Isles. It is acknowledged by all to be a tree in every sense well adapted for extensive planting. It luxuriates at high altitudes fully exposed to our worst winds, and at the same time produces a great quantity of timber of excellent quality and well suited for general constructive purposes. The wood of the Norway spruce, like most other English grown timber, has fallen sadly into disfavour, but there can be little doubt that in a few years, when foreign supplies will be on the wane, its many good qualities will again bring it to the front. The wood is valuable for a great variety of purposes, but being of a knotty character, it is difficult to work. When clean grown it is valuable for roofing material (for which it has been long used in Scotland), flooring, pit props, fencing rails, and packing boxes.

As an ornamental tree, the fine proportions and well-clothed stem of the Norway spruce are rarely seen to advantage, and it may be for this reason that it is seldom found occupying the prominent position it deserves as a decorative species. For park and lawn ornamentation it is worthy of greater attention, as it is one of the best and most effective of hardy conifers. Habitat, Europe, as far south as the Alps and Pyrenees. Introduced previous to 1548, but exact date not certain.

13. *A. firma*, known in most collections under the name of *A. bifida*, is only seen in this country as an ornamental tree, few specimens having attained to anything approaching maturity. The somewhat stiff but deep glossy green foliage, and erect habit of the tree as revealed in home grown specimens, render it one of great value for ornamental planting. It is found to be hardy. Introduced from Japan in 1861.

14. *A. Fraseri.*—Introduced from North Carolina in 1811, has little to recommend it either for ornament or utility in these Islands. It is of low growth, with slender branches, and leaves deep green above and silvery underneath.

15. *A. grandis* (Great Silver Fir).—This is truly a handsome conifer, and well adapted for ornamental planting; the soft, rich, green foliage, densely branched stem, and symmetrical habit being

recommendations rarely combined in one species. The timber produced in this country is of excellent quality, being weighty, resinous, and the concentric rings firmly packed. The largest specimen which I have cut down, and only stern necessity compelled its removal, was, exclusive of the broken top, 72 feet in height, measured 26 inches in diameter at the butt end, and contained 73 feet of timber. On measuring some of the annual rings near the bark, I found them to average one inch in thickness, which speaks highly in favour of the tree as a rapid timber-producer. When felled and stripped of its branches, the balsamic fragrance, from the quantity of resin the tree contained, was perceptible at a considerable distance—further than I have ever noticed even in the Douglas fir—and the circumstance was commented upon amongst the woodmen employed in removing it. The average upward rate of growth of *A. grandis* in this country is 17 inches, while the quantity of timber produced in fifty years by the large specimen referred to gave an annual average of nearly 1½ cubic feet. When cut into boarding, the wood resembled in appearance the common silver fir, but was, perhaps, darker, of greater specific gravity, and of firmer texture. It works well and takes a good polish, but from the rapid rate of growth the graining is somewhat rough, though perfect in delineation. The timber was used experimentally for many purposes, but sufficient time has not yet elapsed for us to speak with certainty regarding its lasting qualities; so far, however—and it is now five years since the tree was felled—it seems quite sound, and likely to remain so for many years to come. A comparison of the timber of this tree grown in Britain with that exhibited from British Columbia at the Colonial and Indian Exhibition, revealed but few differences, and nothing more than might be expected between that of a partially developed and of a mature tree.

Taking into consideration the quantity and quality of wood produced by *A. grandis*, as also its highly ornamental appearance and undoubted hardihood, we place it in the front rank for economic planting in the British Isles. The soil best suited for it is an open rich loam, where it will not suffer either from excess or want of moisture. Introduced from North-West America in 1831.

16. *A. Hookeriana*, named in compliment to the late Sir William Jackson Hooker, is a highly ornamental conifer, and one

that has been found well suited for planting in almost any part of the British Isles, as may also be said of the nearly-allied species *A. Pattoniana.* Both are elegant trees for the lawn or park. The former is a native of California, and was sent to this country in 1854. *A. Pattoniana* occupies the higher regions of the Sierra Nevada, and was introduced in 1851. By most botanists these trees are considered as the same, and should such prove to be the case, the name *Pattoniana* has priority over that of *Hookeriana.*

17. *A. magnifica* (stately Silver Fir).—When seen at its best in this country *A. magnifica* is truly a magnificent tree, but somewhat stiff in form. By some this tree is supposed to be but a form of the better known *A. nobilis;* but such is not our opinion, for, judging from several specimens of fairly large proportions, the differences are very marked. The foliage of *A. magnifica* is at all times of a whitish silvery appearance, as if coated with hoar frost. As an ornamental tree *A. magnifica* is of great value, while its growth is rapid, one specimen of which we have a record having attained the height of 25 feet in twelve years. Little is known regarding its value as a timber producer. Habitat, North California and Oregon. Introduced in 1851.

18. *A. Maresii*, a native of Japan, introduced to this country in 1879, is likely to turn out a very ornamental tree; but too short time has elapsed since its introduction for us to speak with confidence of its value.

19. *A. Menziesii* (Menzies' Fir).—The many good qualities of this conifer, its strong, hardy nature, and its valuable timber, render it pre-eminent among the tribe. The symmetrical outline and vivid bluish-green foliage are its peculiar characteristics, and when in a young state it is one of the handsomest of evergreen trees. The cones are very ornamental; indeed, they are the most distinct and pretty of any produced by the tribe. In cool, damp loam, and where partial shelter from prevailing winds is secured, this spruce does best, but it does not bear crowding. The thick spreading branches point straight outwards, so that in order to have well-grown luxuriant specimens ample room on all sides must be provided. Where the soil is light and dry the foliage is, if we may use the term for an evergreen, semi-deciduous and meagre, and the whole tree stunted in appearance; indeed, so changed in general aspect does it become under these circum-

stances, that it is with difficulty recognised. The colour of foliage varies considerably in different plants, some being of a lighter and others a darker green, approaching to blue, this latter colour being by far the most ornamental, and only attained by such trees as are favourably placed and more fully developed in the younger stages. Under favourable circumstances the rate of growth of *A. Menziesii* is rapid. It is not uncommon for 2 feet to be annually added to the height for the first twenty-five years. About $1\frac{1}{2}$ cubic feet is the annual increase in the bulk of stem, but this has been surpassed by at least one specimen of which I am aware.

The timber, although somewhat coarse-grained, is tough and strong, and is used for a great variety of purposes, including ship-building. We have cut up and used the timber of home-grown trees of Menzies' fir with satisfactory results; it being of a pleasing colour, easily worked, firm and strong in texture, and, so far as our experiments extend, very lasting whether employed in or out of doors. A comparison of home-grown wood with that sent from its native country to the Colonial and Indian Exhibition revealed but slight differences. From our knowledge of this tree, there can be little doubt that as a valuable timber producer and as an ornamental species, it can hold its own with any of its kind that have found their way into this country. A native of North-West America. Introduced in 1831.

20. *A. nigra* (Black Spruce) has little to recommend it to the British arboriculturist, either as an ornamental or commercial tree. At certain stages of growth and when planted in peculiar situations there is a certain beauty about this spruce, but as usually seen in this country it is of meagre appearance and ill-adapted for ornamenting our parks and woodlands. The timber grown in its native country is of great value, but here the tree rarely attains to large dimensions, and the wood is seldom used. Introduced from North America about the year 1700.

21. *A. nobilis* (Noble Fir).—This tree is one of the hardiest and handsomest of the group, and is becoming tolerably common. Amongst the silver firs it is the most conspicuous and beautiful, the deep glaucous foliage, regularly disposed branches, and by no means stiff outline being special recommendations. Few trees are less particular about the quality of soil in which they are planted. It is of rapid growth, the average annual increase in height of several specimens of which I kept a record being 20

inches, for a period of twenty-five years. The production of wood is likewise rapid, and in support of this statement one of many instances which came under my notice may be cited. A tree of this kind was planted in good soil and a sheltered southern situation in 1854, it at that time being a robust growing specimen of 3 feet in height. In 1884, or thirty years afterwards, it had attained to 55 feet, when it was found to contain 61 cubic feet of wood; giving an average annual increase of fully 2 cubic feet.

The home-grown timber of *A. nobilis* is not of first-rate quality, it being, in every instance where I have had the chance of examining it, soft, easily worked, and clean grained. The timber of mature trees will no doubt be of better quality than that of specimens of thirty years' growth. Habitat, about the Columbia River, in Oregon, and southwards to California. Introduced in 1831.

22. *A. Nordmanniana* (Nordmann's Fir).—If *A. nobilis* be the best of the Californian silver firs, this is without doubt the finest and most valuable of the European or Asiatic species. As a lawn tree it can scarcely be surpassed, the handsome and regular outline, rich glossy green foliage, and stately habit rendering it one of the handsomest of conifers for ornamental planting. We expect that at no distant date it will supplant the common silver fir for forest planting; the timber is of excellent quality, the tree more ornamental, and as regards soil it is less exacting. Another advantage it has over the common silver fir is that, owing to starting into growth later in spring, it is less apt to be injured by unseasonable frosts. Few trees are less particular as to soil than Nordmann's fir; it succeeds well in reclaimed peat bog, stiff loam, decomposed vegetable matter, and light gravelly soils. For planting on cold steep declivities in the vicinity of water, it is invaluable, and succeeds well where the common silver fir and even the larch become seared and unsightly. The timber produced in this country is hard, close-grained, very lasting, and susceptible of a fine polish. It is superior to that of the common silver fir, being harder and firmer in texture, and should its durability prove equal to that species it will be one of the most valuable timbers. Introduced in 1848 from the Crimea.

23. *A. orientalis* (Eastern Spruce).—The usually dense habit of this spruce, combined with its deep dark green foliage, which is perfectly distinct from any other conifer, renders it of great

value for contrasting with other trees of a more light and airy appearance. Although of slow growth and doubtful value as a forest tree, still for ornamental planting, particularly for lawns of small extent, or where larger trees would be out of place, this spruce is of particular value, and cannot fail to attract attention and win the admiration of the lovers of trees.

As scarcely half a century has elapsed since its introduction no trees have reached maturity, although specimens of fully 50 feet in height are not uncommon. When grown under favourable circumstances, the Eastern spruce makes an annual upward growth of about 17 inches. A specimen, growing on gravelly loam with a surface coating of decayed vegetable matter and in a sheltered situation, has attained to the height of 47 feet in twenty-nine years, and in that time has produced about 30 feet of timber. The few specimens of wood I have examined were of good quality, the graining and texture resembling closely its near ally, the Norway spruce. As a timber tree it will never rank high with us; but as an ornamental and perfectly hardy tree, it merits greater attention than it has received. The date of introduction is not certain, but it is supposed to have been about 1838. Nearly 300 years before, in 1553, however, it was noticed by Belon, who visited its native country. Habitat, Mount Taurus and the Caucasian region.

24. *A. Pattoniana* (Patton's Fir).—As before stated, this tree and *A. Hookeriana* are usually described by botanists, including Engelmann and Parlatore, as one species. That they are nearly allied in habit and foliage must be admitted by every one who has examined them. It is fair to add that plants differing materially in density as well as colour of foliage are occasionally met with. Whether these two spruces are distinct or not matters little; both are highly ornamental and fast gaining favour amongst British tree-planters. Introduced in 1851. A native of the higher regions of the Sierra Nevada.

25. *A. pectinata* (Common Silver Fir).—As an ornamental tree this is only of secondary importance; but for the value of the timber it produces it is well worthy of attention, although its merits in this particular have been exaggerated. The timber is of fairly good quality, and well fitted for rough outdoor carpentry. The timber is elastic, and the graining irregular, while it is soft, apt to shrink, and soon decays on exposure. For temporary buildings, tool-sheds, cattle-shelters, and many such purposes, we

have used the best quality of silver fir timber produced in this country, and with satisfactory results. It is excellent for use in connection with sluices and dams, or for lining the banks of streams and rivulets. Except the larch, we may say that the silver fir is second to none of the firs that have been introduced for upwards of one hundred years for the value of the timber which it produces. It is a native of Central and Southern Europe, and introduced to this country in the 16th century, but the exact date is unknown.

26. *A. Pinsapo* (Spanish Silver Fir).—The prickly short foliage, extreme density and rigidity, combined with compact growth and unique appearance, at once distinguish this from all other silver firs. In favourable circumstances few trees are more ornamental and effective; but to see it in its beauty it must be planted singly or sufficiently far apart from others so that the branches may have sufficient room for full development. It is most attractive during late spring or early summer, for then the young growths contrast finely with the older foliage, the glaucous and remarkably stiff leaves forming a regular compact cone of the finest colour. Regarding the quality of timber produced in this country I can say little; it closely resembles, both in colour and texture, that of the silver fir; but the examples which came into our hands were not sufficiently matured for a decided statement to be given. The average rate of growth of *Abies Pinsapo* under favourable conditions is 14 inches annually, while in one instance at least we have known it to produce 30 feet of timber in an equal number of years. A native of Spain. Introduced in 1839.

27. *A. polita.*—Introduced in 1861 from Japan. This is one of the handsomest and hardiest of the Japanese conifers, and one that is in great demand for ornamental planting, but its slow growth will debar it from ranking as a profitable timber tree. The foliage is of a pale green colour, which forms a striking contrast in early spring with the reddish-brown globose-shaped buds.

28. *A. Smithiana* (Himalayan Fir) is one of the most distinct and beautiful of the genus. Its graceful pyramidal habit is rendered strikingly beautiful by the slender terminal and lateral branchlets being pendulous to a greater extent, perhaps, than those of any other conifer, not excepting the Deodar. Since its introduction it has been widely spread over the country as an ornamental tree, proving hardy in most districts, although, in

common with many conifers, it commences to grow before spring frosts are past. It forms a remarkably handsome lawn or park specimen of neat conical habit, well furnished with bright green drooping branchlets. The timber, in its native country, is little thought of, being extremely soft, clean and easily worked, but perishable. Sir J. D. Hooker, in his "Himalayan Journals," says that this spruce "has white wood, employed for posts and beams." The quality of wood grown in Britain can hardly be superior to that produced in its native country, yet my observations on wood grown at Penrhyn Castle, in North Wales, lead me to believe it is equal to wood of the common spruce, but weightier and firmer, in trees of an equal age. Whatever the quality of timber produced by the Himalayan Fir may yet turn out when that of mature trees is tried, we know not; but certainly as an ornamental conifer it is one of the most valuable ever introduced. A native of the Himalaya Mountains, and introduced into Scotland in 1818.

29. *A. tsuga* (Japanese Hemlock Fir).—This is a distinct and highly ornamental conifer, and one well suited for planting where space is limited. It is somewhat pyramidal in outline, but by no means stiff and harsh, with foliage resembling that of the American hemlock spruce, but pleasanter in appearance. Being hardy, this conifer is sure to attract much attention when better known. There is a dwarf form called *A. tsuga nana*, which has been used with good effect in rock gardening. A native of Japan, and introduced in 1853.

30. *A. Veitchii* (Veitch's Fir).—Introduced from Japan in 1879. It is a beautiful conifer, and found to be perfectly hardy. The leaves are thickly arranged, short, of a deep almost yew-green, but more glossy, and with two distinct silvery lines on the under side. Little can yet be said as to the timber value of this fir, but the young specimens are highly ornamental.

31. *A. Webbiana* (Captain Webb's Fir).—This is one of the handsomest denizens of the Himalayas, but unfortunately it is not well suited for general planting in this country, being what is usually termed "spring tender." By a careful choice of soil and situation many fine specimens have been reared in almost every part of the British Isles, amply rewarding the trouble taken to grow them by their stately grandeur and distinct appearance. The leaves are of a deep glossy green above, with two broad silvery bands beneath, more intense in colour than

in any other conifer with which I am acquainted. When planted in suitable soil—we have found a light vegetable loam most conducive to growth—this fir is of fairly rapid increase both in height and girth of trunk. A specimen growing in rich alluvial deposit, and sheltered from hard-blowing winds, attained to a height of 58 feet in thirty-two years, while the stem contained 37 feet of wood. We have more than once examined home-grown timber, and found it of fairly good quality, though somewhat soft. It is easily worked, and exceedingly durable when the non-maturity of twenty-three years' growth is taken into account. *A. Webbiana* is a native of the Himalayas, from Bhotan to Cashmere, and was introduced in 1822.

32. *Araucaria imbricata* (Chili Pine).—Though the *Araucaria* is of stiff outline, there is something remarkably pleasing and distinct about a well-grown and well-furnished specimen. The drooping sweep of the branches in old and healthy trees serves to a great extent to soften the rigidity of the foliage. When suitably placed with regard to its surroundings, it imparts to our lawns and grounds a distinctly foreign aspect, and associates well with such trees as the Deodar, the Weymouth pine, and the weeping spruce. Perhaps no other tree has been for the past quarter of a century more sought after for ornamental planting than the Chili pine, while there is no more ill-used and wrongly-placed subject amongst the whole of our forest trees. Nearly every cottager must have his "araucaria," be the soil and space suitable or not, while the town garden is in many instances adorned with this tree, which is unable to withstand for any length of time the deleterious effects of an impure atmosphere. The araucaria is often crowded amongst evergreens, and the lower branches being deprived of light and air, die off prematurely. It is often planted in cottage gardens where a fair-sized specimen of the common Laurustinus could not, for want of space, become perfectly developed. It is found in damp, low-lying situations beneath the shade and drip of other trees; and in soils where even the hardy privet fails to grow properly. To produce stately, well-furnished, and green-foliaged specimens of the araucaria, plenty of room must be allowed for its perfect development. It cannot bear being closely hemmed in by other trees, or where the drip from taller plants falls upon it, and these peculiarities will, to a great extent, prevent its being used as a forest tree in this country. The timber as produced

here is of excellent quality, and of a beautiful yellow colour, not unlike that of box-wood. It is remarkably fine and close-grained, works easily, and takes a good polish. I believe it would be useful in the manufacture of fancy work, furniture, and wherever a clean-grained and prettily-marked wood is in request. We have found it ill adapted for withstanding damp; whereas some fancy articles manufactured from it, and kept constantly in the dry warm air of a room, have stood the test for eleven years in a satisfactory manner. After becoming established, the rate of growth of the Chili pine is rapid in favourable circumstances; that of several specimens observed being 19 inches annually. When a height of 50 feet is attained, the bulk of the trunk increases at the expense of the upward growth. As a distinct and ornamental conifer the Chili pine is of great value, but we hardly think that as a timber tree it will ever attract much attention in Britain. A native of Chili, on the western slopes of the Andes. Introduced in 1796.

33. *Athrotaxis selaginoides* (Tasmanian Cypress).—This interesting little conifer seems to be perfectly hardy, and when planted on the lawn attracts considerable attention, adding contrast and variety to the grounds. The leaves are of a glossy green colour, and closely appressed to the branchlets. With us it has attained to the height of fully 11 feet in fifteen years, and has never suffered from either cutting winds or wintry frosts. A native of Tasmania. Introduced about 1850.

34. *Biota orientalis* (Chinese Arbor-Vitæ) is, perhaps, one of our commonest garden shrubs, or rather small trees, for it frequently attains a height of 25 feet. The leaves are of a pleasing green colour during summer, but usually, and particularly when the plant is grown in an exposed situation, turn of a brown hue in winter. As an elegantly symmetrical conifer, it has long held a prominent position in our lawns and grounds, and rightly so, for its peculiarly distinct form and warmth of foliage are decided attractions. Loudon says it was introduced in 1752; but a letter from the Duke of Richmond to Mr Collinson, dated February 1st, 1743, proves that it had been introduced previous to that date. A native of China and Japan. A considerable number of sports have sprung from this conifer. Of these the following are worthy of attention as ornamental, small-growing plants:—*B. orientalis argentea*, with creamy-white, and *B. orientalis aurea*, with golden foliage, are two of the most distinct and ornamental forms, and

are perhaps more popular for garden decoration than any of the others. *B. orientalis aureo-variegata* is another distinct and pretty form with piebald foliage, or one-half green and the other a rich yellow. *B. orientalis elegantissima* is of rigid upright growth, and with changeable foliage, usually of a pale yellow colour. *B. orientalis falcata* is a distinct but not an ornamental plant, while *B. orientalis japonica* is of good form, and valuable for planting in masses, where its pleasing globular form is best displayed. *B. orientalis pendula* is, as its name denotes, of a weeping habit, and when well grown and placed to advantage is second to none of its relatives as a distinct and handsome shrub. *B. orientalis semper-aurescens* is a counterpart of the golden form in habit, but it is of a different shade of yellow. These are the principal varieties in cultivation, and where small and bright foliaged plants are in request they are very useful.

35. *Cedrus atlantica* (Mount Atlas or African Cedar) is, particularly in a young state, hardly distinguishable from the more commonly cultivated *C. Libani*, although, after a few years' growth, its erect habit and rigid branches are sufficient means of identification. As an ornamental tree it cannot compare with the cedar of Lebanon, although as a forest tree it is in every way preferable, producing more valuable timber, and having less inclination to ramify into unwieldy branches. For the latter reason alone it is valuable, for while the branches of the cedar of Lebanon suffer severely during stormy weather, and are often torn clean off, those of *C. atlantica* remain unharmed, their less length and weight freeing them from injury. In exposed situations, and where the soil is naturally cold, the Mount Atlas cedar makes a sturdy growth, and for this reason it is now much sought after for planting on bleak hill-sides. Little is yet known regarding the value of its timber produced in this country, as too short time has elapsed since its introduction for it to approach maturity. That it is superior to the wood of the cedar of Lebanon in trees of equal age, we are, however, convinced, and there can be little doubt that in after years, when maturity has been attained, it will be found of great value for many constructive purposes in these isles. It is a native of Mount Atlas in Northern Africa, and was introduced into Europe in 1841, and afterwards into England.

36. *C. Deodar* (Indian Cedar).—This tree is almost unrivalled in the grandeur of its lithe and beautifully pendulous branches;

indeed we question much whether a more graceful, ornamental, and hardy tree has yet found its way into the British Isles. Few conifers are more accommodating as to soil. We have found it to be quite at home and to grow with the greatest freedom in soil of the most opposite descriptions. The timber, as produced in its native country, is of very superior quality; but a comparison with that grown in England has rather surprised us, the home-grown timber being rather soft, fine-grained, and not very lasting. It is, however, but fair to add that the specimens of wood with which we experimented were immature, so that the lasting properties were materially lessened. As compared with that of the cedar of Lebanon of equal age, it is of better quality. A native of the Himalaya Mountains. Introduced in 1831.

37. *C. Libani* (Cedar of Lebanon), with its massive and well-clothed trunk, far-spreading and ponderous branches, and deep glaucous green foliage, is beyond doubt one of the most distinct and easily recognised of all trees. For planting amongst the general run of forest trees, this cedar is not well adapted. It requires plenty of room for spread of both root and branch, else it soon puts on a miserable appearance, the leaves becoming scant and yellowish green, the growth short, stunted, and prone to die off prematurely, thus imparting to the tree a half-starved look that is anything but desirable where a healthy state of the woods is of first importance. Hardly a year passes that we have not, on a large English estate where soil and situation are unusually well suited for the growth of exotic conifers, to remove one or two specimens of the cedar of Lebanon owing to ill-health, but how caused is a puzzle that has baffled our most careful investigation. Low lying damp ground is not the cause, for others lying high and dry are similarly affected, and if soil be the cause, then that of every description almost must be at fault, for on rough sand, heavy loam, vegetable refuse, shale rock with light sandy loam at top, chalky soils in which the tree usually grows with great vigour, as well as carefully-prepared peat bog, they have gradually become unhealthy, and ultimately died out altogether. I am not now referring wholly to woodland trees, but rather to those grown as single specimens for lawn and park decoration. Seldom does the disease, or premature death from other causes, attack trees of less than about twenty years' growth. The first indication of decay is want of foliage, which becomes scant and of an unhealthy colour, and in less than four years the

tree dies off. When the tree grows in a conspicuous position, and gets in this condition, the axe is usually laid to its roots after the second year.

The timber of the cedar of Lebanon as produced in this country is of no great value, being liable to snap across under strain, and owing to this many of our fine old English specimens are disfigured from time to time by storms. We have had ample opportunity of testing the quality of the wood, and that of unusually large-sized specimens, but invariably found it wanting in durable properties, though fine-grained, hard, and beautifully coloured. When kept constantly dry, it, however, lasts for a very long time, and is thus of value for the purposes of the cabinetmaker, and is rendered additionally so by the delicious fragrance which it emits. For firewood the wood of this cedar is not to be recommended, as, although it burns clear and emits great heat, it sparks freely, and is thus highly dangerous.

38. *Cephalotaxus drupacea* (Plum-fruited Cephalotaxus).—This is a distinct, interesting, and beautiful coniferous shrub, and one that has been found hardy in almost every part of Britain. When grown in a cool, shady situation, it is a very ornamental plant, the dark, yellowish, green leaves rendering it of value for contrast.

39. *C. Fortunei* (Fortune's Cephalotaxus) is a more ornamental plant than the last, the foliage being less sparsely arranged and of a deeper and more glossy green. We have grown it to best advantage in peaty soil, and where, from the close proximity of the surrounding trees, partial shelter and shade were secured. It is worthy of a place in any collection, be it ever so choice. Both this and the previous species were introduced from China in 1849.

40. *C. pedunculata* (Lord Harrington's Yew), and 41. *C. pedunculata fastigiata*, the latter in particular, are very desirable conifers, and where soil and situation are found suitable, they may be grown with good effect in the embellishment of lawns and parks. As a compact growing shrub or small tree, the latter is worthy of attention, and being hardy and of free growth, may be freely planted, particularly where a cool, loamy soil and warm sheltered corner can be supplied. *C. pedunculata* is a native of Japan, and was introduced in 1837; the other variety, also a native of Japan, was not introduced till 1861.

42. *Cryptomeria elegans* ranks as one of our most beautiful

and distinct coniferous trees. It is perfectly hardy, of free growth, and not exacting as to the soil in which it is planted. No other conifer with which we are acquainted is possessed of the gorgeous foliage tints which are so marked a characteristic of this pretty tree. In winter it glows with a reddish coppery hue, which colour is again changed to a cheerful green in the early spring months. When associated with our darkest evergreens, the bright coppery hue is considerably enhanced; but to show it to perfection it must be planted at a considerable distance from these, and with green as a background. The feathery growth of the tree is elegant in the extreme, while the foliage is easy of arrangement. It is more hardy than *C. japonica*, and has stood unharmed throughout the worst winters we have experienced since its introduction. It is one of the most ornamental and useful of conifers. Introduced from Japan in 1861.

43. *C. japonica* (Japanese Cedar).—This distinct and beautiful conifer is found to be perfectly hardy, sound in constitution, of rapid growth when once established, and not fastidious as to soil or situation, provided the former be naturally sweet and healthy, or artificially made so. The branches spread horizontally, are slightly drooping with up-curved tips, the lateral ones dividing into numerous frondose branchlets, thickly covered with bright, glossy-green foliage. Delighting and thriving luxuriantly in cool, moist soils, the humid atmosphere of Great Britain is peculiarly suited for the successful cultivation of this handsome conifer. Better, indeed, than the generality of coniferous trees, the Japanese cedar seems to thrive in the dense still-air of mid-woodland, and is not at all fastidious about the juxtaposition of surrounding trees, if their extending branches do not actually commingle with its own. The timber of this tree is light but lasting, and employed for room-panelling, for furniture, and in the making of light packing-cases. It is white, soft, and easily worked, with a pleasant perfume, which makes its adoption for panelling or room furniture particularly desirable. We may add that the wood produced in Britain differs but little from foreign timber.

44. *Cunninghamia sinensis* (Chinese Fir).—This tree is of too tender a constitution for the climate of Britain generally, still in certain favoured localities, particularly within the influence of the sea, it does fairly well, and forms a handsome specimen, which, for distinct appearance and beauty of foliage, has few equals among hardy conifers. In no other conifer with which I am

acquainted is there so diverse an appearance of foliage, the pleasant light-green of the younger leaves offering a rich contrast to that of the older foliage. As an ornamental tree of distinct appearance the *Cunninghamia* should find a well-chosen spot in every collection, for, although somewhat tender in unfavourable districts, particularly when the soil and situation have not been attended to at the time of planting, yet in many places it has stood unharmed through our most severe winters, when some of our so-called hardy conifers were badly cut up. It wants a light and rich soil, plenty of room for development, and a partially sheltered southern situation. The rate of growth is not slow, one specimen of which I kept a record having attained the height of 45 feet in thirty-seven years, while the increase in girth at a yard from the ground was 7 inches in six years. The timber produced in this country is clean and firm, of a mahogany colour, and takes a good polish; but as the specimens were rather immature, these qualities would be much enhanced in full-grown and well-ripened wood. So far as we have ascertained, the timber is lasting, particularly when used for indoor purposes. It is as an ornamental tree that it is likely to attract most attention. Introduced from Southern China in 1804.

45. *Cupressus funebris* (Funereal Cypress) is, unfortunately, a conifer that cannot, in point of hardihood, be wholly relied upon for planting in these isles. It is an ornamental tree, with gracefully pendulous branchlets, thickly covered with yellowish-green foliage. A native of China. Introduced in 1846.

46. *C. Goveniana* (Gowen's Cypress).—When seen at its best this is one of the prettiest and most interesting of conifers, particularly during early spring, when loaded with pollen. It is of unusually dense habit, somewhat massive in appearance, with a plentiful supply of the brightest and freshest of foliage. It ranks with *C. funebris* as an ornamental species. Introduced in 1846 from California.

47. *C. Knightiana* (Knight's Cypress).—If only for its graceful habit and conspicuous foliage, which is of a bluish-green shade, this cypress is well worthy of attention. It is not a common plant, but it is certainly the handsomest and hardiest of the Mexican cypresses. We found it to thrive best when planted in a mixture of loam and peat, and in a position where it was not subjected to cold or cutting winds. Once established, the growth is fairly rapid. A native of the Mexican Mountains, and introduced about 1840.

48. *C. Lawsoniana* (Lawson's Cypress).—No tree is more hardy than this cypress—none more easily managed or more readily suited with soil; while few others combine in a higher degree the useful with the ornamental. It has been planted largely in almost every British county, and in soils and situations widely different; yet it is rare to see an ill-grown, stunted, or browned specimen, even when they are growing under very unfavourable conditions. I have tried it in reclaimed peat bog; in gravelly soil; even amongst the *débris* of a disused gravel pit; in plastic loam almost bordering on clay; free sandy loam and alluvial deposit; and in all these it has proved itself to be at home, as the beautiful weeping spray of the most vivid green and the rapidity of growth bore clear testimony. When grown under suitable conditions the tree soon assumes that lively bluish-green tint which pertains to a healthy specimen. This pleasing tint of foliage is not equalled by that of any other tree that I know. As an ornamental tree it is, perhaps, superfluous to say one word in favour of this cypress, its qualities in this particular being well known and appreciated. I may, however, refer to its cheerful and desirable shade of green, and to the gracefully recurved and feather-like foliage, neither of which is surpassed by any other conifer. It is of columnar habit, but not formal in outline, as it is relieved by the drooping spray and elastic leading shoot, the latter being sufficiently tilted to one side to impart a pleasing finish to the tree. The timber is of no great value, but from the appearance of specimens cut from home-grown trees it would seem to be of good quality, and well worthy of a trial in household carpentry at least. It is of a pleasing light-yellow colour, remarkably close-grained, and takes on a good polish. The rate of growth is somewhat rapid, several specimens of which I have a record having attained the height of 43 feet in twenty-seven years. Amongst the varieties there are several distinct and desirable kinds; and these, in the majority of cases, retain their distinctive characteristics under cultivation, such as the following varieties.

49. *C. Lawsoniana alba spica* has the branch tips of a creamy white colour, and—in contradistinction to *C. Lawsoniana alba-variegata*, which has green foliage blotched with white—is of tall spreading nature, and soon attains to goodly proportions. *C. Lawsoniana argentea* is a distinct and pretty form, with silvery foliage. *C. Lawsoniana erecta viridis* is one of the best and most useful, and where a fastigiate-habited tree is wanted, and one of

a lively tint of green, this cypress should find a place, for it is the most valuable of all tapering trees. *C. Lawsoniana filiformis*, with its long and graceful branchlets, is worthy of extended culture; while *C. Lawsoniana intertexta* has beautifully glaucous foliage and a branching habit. *C. Lawsoniana nana* is valuable for rock-work embellishment.

C. Lawsoniana is a native of Northern California, on the Shasta Mountains, and was introduced into this country in 1854.

50. *C. Macnabiana* (MacNab's Cypress), although a very beautiful and distinct species, has never found much favour with British arboriculturists. This is certainly to be regretted, as its compact habit and deep bluish-green foliage render it a distinct and desirable species. Habitat, Northern California. Introduced in 1852.

51. *C. macrocarpa* (Large-fruited Cypress).—The heavy, massive branches, of an unchanging bright green colour, give to this fine cypress an air of stately grandeur that contrasts favourably with the weeping foliage of such trees as the Indian cedar and Lawson's cypress, and renders it one of the most distinct and beautiful of ornamental evergreens. As an adjunct to our limited list of sea-side trees, it is of undoubted value, thriving better near the sea than inland, as has been proved in numerous places along our coasts. The timber, as regards graining, is the most beautiful of any wood grown in this country that I have seen—at least if a large-sized plank now before me is a fair representation. In appearance it resembles the wood of the American walnut (except in colour, which is of a beautiful Barberry yellow), the gnarled graining being equal to that timber. Trunk sections from trees I have had cut up are, towards the centre, of a deep reddish hue, and the colour passes into a deep yellow outwards. Being close-grained, and remarkably hard, it works smoothly under the plane, and is susceptible of a fine polish, these qualities rendering it of great value for many of the finer works in which wood is employed. For in-door carpentry it is likely to be much used, and will no doubt, when more readily procured, be largely used for constructive purposes. *C. macrocarpa,* when suitably placed, is a tree of rapid growth. In one instance under my notice, it has attained to a height of 59 feet in thirty years. A native of California. Introduced in 1838.

52. *C. nutkaënsis* (Nootka Sound Cypress).—This is a fine spreading tree, with a great exterior resemblance to Lawson's

cypress, but, we think, inferior to that well-known species in ornamental appearance. It is more formal in outline, and wanting to a great extent in the long weeping branchlets so characteristic of well-grown specimens of *C. Lawsoniana*. The timber is of excellent quality, remarkably light, close-grained, susceptible of a high polish, and has a pleasant fragrance, not unlike that of sandal-wood, which it retains for many years. Regarding the lasting properties of the wood of the Nootka Sound cypress grown in this country, it would be hazardous as yet to advance an opinion. It, however, promises well, and has stood the test of several years without any appearance of decay. At the Colonial and Indian Exhibition one of the largest and most conspicuous samples of wood was a clean and well-polished specimen, which clearly displayed the beautiful graining, as well as large size to which it attains in its native wilds. It was 18 feet in length, 4 feet in width, and 2 inches thick, clean, smooth, knotless as a piece of yellow pine, prettily grained and of desirable colour. Boats and canoes are made of the timber, and have proved lasting and strong; while oars, paddles, furniture, fencing materials, waggons, and household utensils are but a few of the many uses to which it is applied. Trees of twenty years' growth are usually about 19 feet in height, and in the nursery four-year-old plants are a yard in height. A native of Vancouver Island and British Columbia. Introduced about 1850.

53. *C. sempervirens* (Upright Roman Cypress).—This beautiful upright cypress is among evergreen shrubs what the Lombardy poplar is among timber trees—a fine contrast to the more spreading and round-headed forms. The deep evergreen branches and leaves render it a desirable tree for planting in graveyards and cemeteries, and owing to its fastigiate habit it forms a suitable tree for planting near buildings where the prevailing architectural lines are horizontal. When judiciously placed along the margins of plantations, or among other conifers of a more spreading habit, its effect is strikingly beautiful. As an ornamental tree this cypress is of great value, but as a timber producer, in this country at least, it is not likely to attract much attention. A native of the Mediterranean region, and eastward to the Himalaya. The date of introduction is uncertain, but prior to 1548.

54. *C. thyoides* (White Cedar), and its variegated form *C. thyoides variegata*, are two first-class ornamental trees, particularly when planted in a cool dampish soil. In their cultiva-

tion we have been most successful by using peat largely in the composition in which they are planted. As ornamental trees, these, particularly the variegated form, are worthy of extended culture. Introduced from the United States in 1736.

55. *C. torulosa* (Tufted Cypress).—Few trees are better adapted for planting where space is rather confined than this, and being in every sense highly ornamental, it is of great value for lawn or garden decoration; indeed, in the whole group of cypresses there is none more beautiful—the easy columnar habit, slender branchlets, and bright glaucous foliage being perhaps not so nicely blended in any other member of the family. This cypress is usually classed as a semi-hardy tree, and although a few specimens did succumb to the intense frost of the winters of 1860-61 and 1866-67, yet many remained uninjured. In nearly every instance where trees were killed outright, the cause might be traced to the unsuitable positions in which they were placed, low-lying and well-sheltered places being chosen in which to plant this lover of high and dry ground, and a cool breezy situation. The branches, which are thickly produced, have a decided upward tendency, but tufted branchlets, with their graceful foliage, deprive it entirely of the fastigiate appearance that characterises not a few of our conifers. It is a tree of fairly rapid growth,—one specimen, which with great reluctance we had to remove recently, had attained a height of 43 feet in thirty-five years. The timber of this specimen, which we had cut up and converted into boarding, was hard, close-grained, and fibrous, of a purplish-yellow colour, and fragrant. It is a native of the North-Western Himalayas, and was introduced to this country in 1824.

56. *Fitzroya patagonica* (Patagonian Cypress).—This tree has a decidedly ornamental appearance, the branches, which are irregularly placed and rather slender, being bent downwards at the tips, which is, however, more decided in healthy, fast-growing specimens than in those unfavourably placed and unhealthy. Contrary to the usually expressed opinion regarding the tender nature of this interesting tree, we feel justified, from the results of experiments both in England and Ireland, in recommending it as a valuable addition to the pinetum, more particularly in the warmer maritime portions of southern and western Britain. As an ornamental conifer, the Patagonian cypress is well worthy of culture wherever a suitable situation can be provided. It is a native of Western Patagonia, and was introduced in 1849.

57. *Ginkgo biloba* (Maiden-Hair Tree).—The glossy-green, fan-shaped leaves, cut up like some of the species of *Adiantum* fern, give to this plant a distinct and remarkable appearance. The light and open aspect, peculiar foliage, and stately dimensions, combine to render it one of the most valuable landscape trees that have yet found their way into this country. The timber is said to be of excellent quality as produced in its native country, but whether that grown in the British Isles will prove equally valuable is still a matter of conjecture. A native of Northern China, and introduced about 1754.

58. *Juniperus chinensis* (Chinese Juniper).—This is certainly the most ornamental of the genus; indeed, in this respect it is perhaps not excelled by any evergreen shrub in cultivation. During winter or in early spring, when covered with its golden male flowers, this juniper is particularly beautiful. It is hardy, and of easy culture. A native of China and Thibet. Introduced in 1804.

59. *J. communis* (Common Juniper), and *J. c. nana* (Dwarf Juniper), are native species, and both are of value wherever neat-growin and bright-foliaged plants are in request.

60. *J. drupacea* (Syrian Juniper), a handsome and distinct conifer, one that is perfectly hardy in this country, and neither fastidious as to soil or situation. Whether planted singly or mixed with other shrubs, this pretty juniper never fails to attract attention and produce the most pleasing results. A native of Syria, and introduced into European gardens in 1854.

61. *J. hibernica,* or, as it is usually styled, *J. communis hibernica* (Irish Juniper), is a most desirable and highly ornamental plant, of inestimable value in landscape gardening generally. The growth is close and compact, as in the Irish Yew, and the foliage of a peculiar silvery-grey tint.

62. *J. recurva* (Weeping Indian Juniper).—When seen at its best and growing in suitable soil, it is certainly a most distinct and elegant species, and one that has been found well suited for culture, under certain conditions, in the British Isles. Planted in cool, moist, shady situations, it soon forms an elegant and distinct specimen, with abundance of recurved, feathery foliage, which is of an unusual, greenish-grey colour, while the contrasting light-green of the young, and the rusty brown of the older foliage is remarkable, and renders the tree as striking as it is beautiful. It is a native of the Himalayas; but the date of introduction is uncertain.

63. *J. Sabina* (Savin), although hardly worthy of special remark as an ornamental plant, is of great value for rockwork decoration, or wherever a small-growing and widely-spreading evergreen shrub is in request. It is a native of Southern Europe, and was introduced to this country prior to 1548.

64. *J. virginiana* (Red Cedar).—This tree is of the easiest culture, and seems to succeed well in almost any situation, but attains greatest perfection when planted near the sea-coast. As an ornamental tree it is well known and much valued for lawn and shrubbery decoration. It is a native of North America, and was introduced in 1664.

65. *Larix europœa* (European or Common Larch).—As a valuable timber-producing tree the common larch is surpassed by no other that has been introduced into this country. The wood is very durable, strong, and easily worked, and largely employed for rural purposes. As an ornamental tree the larch is, we think, not sufficiently appreciated. In the spring months, just when the young leaves are bursting from the bud, few trees have a more decided golden-green tint, or are more enchanting when viewed from a distance. Unfortunately of late years the larch has become subject to a disease which has to some extent lessened the value of the tree for forest planting. It is a native of the Alps and Central Europe. The date of introduction is uncertain, but it must have been prior to 1629, in which year it is mentioned by Parkinson.

66. *L. Kœmpferi* (Golden or Chinese Larch).—This is a highly ornamental tree, the foliage of which in spring is of the most delicate pea-green, and towards autumn assumes a bright or clear golden-yellow. Even when leafless, the beautiful yellowish-green or golden-brown of the young shoots is particularly effective, and as uncommon as it is beautiful. We have found the golden larch to be perfectly hardy, to succeed well, perhaps best, on a free gravelly loam, and to bear stem and branch pruning with impunity. It is the only deciduous golden conifer at present introduced, and is the largest in growth. For its ornamental qualities it is certainly well worthy of extended culture. A native of China, and introduced in 1846.

67. *Libocedrus chilensis* (Chilian Arbor-Vitæ), although not perfectly hardy in all parts of Britain, is well worthy of culture in warm and sheltered situations for its ornamental aspect. The bright glaucous green foliage and neat habit are good recom.

mendations. It is a native of Southern Chili, and was sent to this country in 1847.

68. *L. decurrens* (Californian White Cedar), as seen in this country, is a very distinct and desirable conifer, the bright green foliage, columnar habit, and finely-divided frondose branches being its chief recommendations. A native of North California and Oregon. Introduced in 1853.

69. *Pinus Austriaca* (Austrian Pine).—This tree has of late years attracted considerable attention, not only from its perfect hardihood, but from its ornamental appearance and the shelter it affords to other less hardy kinds. As an ornamental tree it is certainly not behind many of its neighbours, with its wealth of dark, glossy, and shaggy foliage, and pleasing contour. For planting in clumps or masses it is particularly well suited; indeed few pines form a more striking feature in the landscape than this tree does when arranged in irregular clumps. Single specimens, when allowed plenty of room on the greensward, are highly attractive, and produce in a short space of time masses of the richest green foliage, which contrasts well with other conifers of a light or silvery appearance.

As a timber tree it is not without value, and several experiments made with the wood prove that it is very durable, and one of the few kinds that may be used where it is subjected to wet and dry alternately. Seven years ago we cut up two large trees of this pine, and placed the planks side by side with those of the Scots and Spruce firs to hold up the sliding banks of a river, each being marked and noted for future observations, and on examining these a year ago the Austrian pine seemed quite sound but of lighter colour than when placed in position. Sufficient time, however, has not elapsed for us to speak with any amount of assurance as to the superiority of the wood of this tree over that of either the Spruce or Scots firs, but from the present appearance of gates, stiles, and posts manufactured some years ago, there can be little doubt that it will, so far as lasting qualities are concerned, be quite equal to either of the other two. It is remarkably strong, tough, coarse of grain, very resinous, works well, and takes a good polish. A native of Austria, and introduced into Great Britain in 1835.

70. *P. Cembra* (Swiss Stone Pine).—This is a tree that deserves extended cultivation, as, apart from its ornamental appearance, it is extremely hardy and well adapted for planting

on a great variety of soils and situations, from well-drained peat at sea-level to thin, poor soils at great elevations. The timber is soft, fine-grained, easily worked, and susceptible of a nice polish. It is found in the Alps and Carpathian Mountains, as well as in France, Italy, Austria, Hungary, and Syria. For its introduction to this country we are no doubt indebted to the Rev. J. Harte, who, in 1746, published "Essays on Husbandry," in which it was strongly recommended, and we learn that in the same year it was planted by the Duke of Argyll. It was not, however, until 1833 that Messrs Lawson, of Edinburgh, imported the first large supply of seed, although, several years previously, in 1828, Mr Lawson brought from Switzerland a small number of seeds which were distributed amongst his friends, the produce of these being, no doubt, among the oldest trees of this pine in the country.

71. *P. densiflora* (Japanese Pine).—The pleasing bright green tufted foliage of this pine renders it a distinct and desirable species, and one that we can confidently recommend for ornamental planting, but particularly where contrast and variety are of paramount importance. A native of Japan, and introduced into Europe in 1854.

72. *P. excelsa* (Himalayan Pine) is one of great value for ornamental planting, the long and lithe branches, elegant foliage of a glaucous, bluish green, and graceful outline, being all recommendations of the highest order. The wood, in its native country, is highly valued, but, as grown in the less favourable climate of Britain, it is never likely to attract attention in an economic sense. It is a native of the Himalayas, from Bhotan to Afghanistan, and was introduced into England about the year 1827.

73. *P. halepensis* (Aleppo Pine) is well worthy of a greater amount of attention than it has yet received. For planting along the seaside, and where the soil is of the poorest description, it is particularly valuable. The tree has rather a pyramidal habit, with an abundance of long, slender branches, which are somewhat scantily covered with bright silvery grey foliage. The timber produced here is of fairly good quality, and fine examples were shown at the Edinburgh Forestry Exhibition. Under favourable circumstances the growth of the Aleppo Pine is by no means slow, one specimen, the dimensions of which we took recently, having attained to a height of 45 feet in thirty-seven years, while the girth at a yard from the ground was 4 feet

7 inches. It is a native of both Europe and Asia, and was introduced into this country in 1663.

74. *P. inops* (Scrub Pine), although of rather straggling growth, is by no means an inelegant tree when well grown, and associates nicely with others of more formal growth. A native of North America, from New Jersey, southward to Kentucky.

75. *P. insignis* (Remarkable Pine).—This is one of the handsomest pines that have yet been introduced, and it is unfortunate that so desirable a species should not be perfectly hardy. It succeeds fairly well in the southern English counties, and particularly in maritime districts, but where subjected to cold, cutting winds and inland situations, it is not satisfactory. In a suitable position it is a tree of great beauty, the dense, grass-green foliage and neat habit of growth rendering it as distinct as it is ornamental. The timber, as grown in the south of England, is of fairly good quality, being clean, close of grain, and easily worked. A native of California, and introduced in 1833.

76. *P. Lambertiana* (Sugar Pine), with its glaucous-green foliage, beautiful cones, and giant proportions, is a tree that is well worthy of a far greater amount of attention in this country than it has hitherto received. It is quite hardy, although it will not put on its best form on exposed and high-lying situations, grows moderately fast, and is not fastidious as to quality of soil. Young specimens in a thriving condition are usually models of beauty, the short and slender branches well covered with the brightest of bluish-green foliage, and the neat, erect habit of growth, being particularly pleasing and distinct. As a timber tree it has not proved itself to be of great value, the upward growth rarely exceeding 12 inches each year. It is a native of California and Oregon, and was introduced in 1827.

77. *P. Laricio* (Corsican Pine).—There can be little doubt that this is the best all-round conifer that has yet found its way into the British Isles, and we predict that ere long the number of Corsican pines to be found in woods and plantations will far exceed that of any other introduced or native species. It is of very rapid growth, and is well suited for planting, even in the most exposed and wind-swept situations; is not fastidious as to soil, and is perhaps the most valuable timber-producing tree that has ever been brought before the British arboriculturist.

As an ornamental tree it is almost superfluous for me to say one word in its favour, its light, airy appearance being well known to every tree lover. We do not wish it, however, to be inferred that it can in point of ornament compare with several other species, although it will be admitted it is worthy of at least second rank.

From our own experience of home-grown wood of the Corsican Pine, it is, so far as lasting qualities are concerned, second to none of those we have tried. It is strong, tough, elastic, very resinous, and easily worked, and this is speaking of trees of fully fifty years' growth. We have used home-grown *Laricio* wood for many purposes, and always with the most satisfactory results, some of the largest planks being fully 27 inches wide, and cut from trees that girthed nearly 9 feet at a yard from the ground. To-day we examined several planks which were sawn up seven years ago, and find that they are little the worse of the wear and tear to which they have been subjected. In France extensive plantations of this pine have been formed, while the Prussian Government has introduced it into the State forests. A native of Southern Europe, parts of Asia, and several islands of the Mediterranean Sea. Introduced 1759.

78. *P. monticola.*—That such a beautiful and free-growing tree has now, after a fair trial, been found to be well suited for planting in our British woodlands is a matter of the greatest importance, for certainly few members of the pine family combine the useful with the ornamental in so high a degree. *P. monticola* is a very handsome tree, about midway in appearance between *P. Cembra* and *P. Strobus;* indeed, by some authorities it is ranked as a variety of the latter. The contour of a fair-sized specimen may be called pyramidal, not so much, however, as in *P. Cembra*, with an abundance of rather short branches, well clothed with dark rich green foliage. More, perhaps, as an ornamental tree than a valuable timber-producer is this pine known to us; yet in this latter respect it is certainly far from valueless, as the fine samples of its timber exhibited at the Colonial Exhibition, as well as the various uses to which it is applied, clearly pointed out. The timber, of which a plank 18 feet long, 46 inches wide, and 3 inches thick, was exhibited, is well packed and firm, not of too deep a colour, and well adapted for using where strength and lasting qualities are of first importance. The value of the wood, as grown in this country, has not yet been fairly tested. As an ornamental tree it, however, occupies the front rank. Habitat, California, Oregon, and Washington Territory. Introduced into this country in 1831.

79. *P. muricata* (the Bishop's Pine).—This is a very distinct pine, the irregular appearance of its branches and clustered prickly cones being different to those of any other with which I am acquainted. From its rather unusual appearance it is worthy of a corner in the pinetum. It is perfectly hardy, not at all fastidious as to soil or situation, of the easiest culture, and valuable for planting as game shelter, or for the ornamentation of high-lying and breezy situations. A native of California, and introduced in 1846.

80. *P. parviflora.*—Where a tree of dwarf habit, well-furnished, and compact outline, is in request, this pine may be considered as one of the best. It somewhat resembles the Swiss Stone Pine (*P. Cembra*), but with lighter and more enticing foliage, which is of a silvery white. It is quite hardy. A native of Japan, and introduced into this country in 1861.

81. *P. Pinaster* (Cluster, or Maritime Pine).—For shelter-giving purposes long experience has proved this to be a most valuable tree, particularly in maritime districts, though an almost worthless species so far as the value of its timber is concerned. When we look at the great value of *P. Pinaster* for planting as a screen to others of a less hardy nature, and in positions where these could not otherwise survive, this latter quality—timber-producing—can well be dispensed with. For the ornamentation of parks and lawns the *Pinaster* is a fitting tree; its tall, massive, and rugged stem, far-spreading, flatly-rounded head, refreshing light-green foliage, and numerous clusters of terra-cotta-coloured cones, all combine to impart an air of massive grandeur that is hardly surpassed by any member of the family. A native of the Mediterranean countries of Europe. Introduced in 1596.

82. *P. pinea* (Stone Pine).—Being of slow growth and rather tender condition, few specimens of this pine have attained to large dimensions in Great Britain. As a timber tree in this country it is almost valueless, but its extremely picturesque appearance renders it of great value for ornamental planting. It affords a striking contrast, from its stiff and rounded head, to other trees of an open and informal mode of growth. A native of both Europe and Africa. The exact date of introduction is uncertain, but it was prior to 1548.

83. *P. ponderosa* (Heavy-wooded Pine).—As an ornamental tree, there is not much to be said in favour of *P. ponderosa*, its

rather lax, tortuous foliage, and gaunt appearance imparting to it more of the picturesque than the beautiful. From specimens of the timber grown in England it appears to be heavy and full of resin, with a very agreeable smell, and prettily marked; but its economic value will never be great in these isles. Introduced from Oregon in 1827.

84. *P. pyrenaica* (Pyrenean Pine), with its bright green foliage and shapely outline, is of value for planting along the outskirts of woods and plantations, particularly where these are principally composed of hardwood trees. It is of no value for timber purposes. A native of the Pyrenees, and introduced in 1834.

85. *P. rigida* (American Pitch Pine).—The stiff and formal growth which characterises many pines is wanting in this tree, it being of an open habit, and of free growth, even in the poorest soils and bleakest situations. This pine, with foliage like *P. insignis*, is of value in ornamental planting, and as it succeeds well in the vicinity of the sea, it is likely to gain favour with the owners of maritime grounds. It has a wide geographical range in North America, and was introduced into England about the year 1759.

86. *P. Sabiniana* (Nut Pine), when suitably placed, and planted in a light rich loam, is by no means an inelegant tree, the lively tinted bluish-green foliage and easy air being special recommendations. It is not advisable to plant the nut pine in cold and wind-swept districts, for in such it will not succeed in a satisfactory manner. As a timber tree it is of no value in this country. A native of California, and introduced in 1832.

87. *P. Strobus* (Weymouth Pine) is fast coming to the front not only as an ornamental, but as a valuable timber-producing tree; indeed, whether viewed in an economic or ornamental aspect, it must be considered as one of the most valuable pines that have yet been introduced. A comparison of the wood produced by the Weymouth pine in this country and that sent to the Colonial and Indian Exhibition revealed but slight differences, and nothing more than could naturally be expected between a mature and partially-developed tree. The rapidly-approaching extinction of this tree is at present causing much anxiety to those who are interested in the timber supplies of America, and is owing partly to the reckless and improvident felling carried on under the impetus of speculation. With such a state of matters abroad, it is to be regretted that greater numbers of this pine are not

planted in suitable soils and situations in the British Isles, for that there are vast tracts of almost worthless land that is well suited for its culture is beyond a doubt. I do not wish it to be inferred from anything here said that the Weymouth pine is suitable for planting at high altitudes and in exposed situations, for such has been long ago proved to be a fallacy; but that it will grow rapidly and produce useful timber in partially sheltered districts has been proved on various occasions by those who have paid particular attention to the value of exotic conifers as profitable timber producers in this country. The Weymouth pine has much to recommend it to the British arboriculturist, for besides the great quantity of valuable timber it produces, it certainly is the handsomest of the genus that have been found to be perfectly hardy in these isles. Its form is light and elegant, and the silvery glaucous leaves afford a distinct and pleasing contrast with the majority of the cultivated pines. Whether grown as a plantation tree, or singly for purely ornamental purposes, the stem is always straight and clean, and the branches evenly distributed. The Weymouth pine is a tree of very rapid growth, numerous specimens of which I have kept a record having attained to an average height of 57 feet in thirty years. A native of North America, and introduced in 1705.

88. *P. tuberculata* (Monterey Pine), if only for its rich foliage and persistent cones, is well worthy of a chosen spot where such trees are grown. It is fairly hardy in this country, but of slow growth, and succeeds best when planted in a sheltered and warm situation. A native of California, and introduced in 1847.

89. *Podocarpus alpinus* (Alpine Podocarp) is a neat and very distinct conifer, but unfortunately one whose hardihood cannot be relied upon in all parts of this country. It is of rather spreading habit, and with an abundance of short bright-coloured foliage. For planting in a warm corner, and in conjunction with low-growing plants, it is valuable. A native of Tasmania and Victoria.

90. *P. macrophyllus* (Broad-leaved Podocarp) is about as hardy as the last mentioned, of taller growth, and with longer and lighter-coloured foliage. A native of Japan, and introduced in 1804.

91. *Retinospora ericoides* (Heath-like Retinospora).—This is a beautiful shrub, of rarely more than 3 feet to 4 feet in height, and one that is of great value for park or garden ornamentation.

During the growing season the foliage is of a bright green, but towards autumn changes to a lovely brownish-violet. Where a small-growing, neat-habited, and pretty shrubby conifer is in request, this *Retinospora* will be found most useful.

92. *R. filicoides* (Fern-like Retinospora), of much larger growth than the last, with short fern-like branchlets, and an abundance of the richest deep-green foliage. It succeeds well in this country, and is of value for its distinct ornamental qualities.

93. *R. leptoclada* (Slender-branched Retinospora).—Another species, with silvery-tinted foliage, and a pyramidal habit. It is useful for garden purposes, and succeeds best in a dampish loam.

94. *R. obtusa* (Japanese Cypress).—Although of rather stiff habit and sombre hue, still there is something remarkably pleasing and distinct about a nice healthy specimen of this Japanese conifer. It is not a rapid growing tree in this country, as it rarely makes more upward growth than a foot per year; indeed, it is usually seen as a large and round-headed shrub of perhaps 12 feet in height, and nearly as much through. But then its graceful pendent branches form fine masses of deep green foliage, suffused with a purplish hue, and thus render the tree one of the most distinct and ornamental with which we are acquainted. Introduced from Japan in 1850.

95. *R. obtusa aurea* is one of the most striking and remarkable of conifers, when a good-sized specimen is seen in a really healthy state and with a well-balanced head. In this favourite variety, the light fulvous green of the foliage changes into a golden-yellow during the period of growth. For associating with any of the darker-foliaged and semi-weeping conifers this tree is well suited, and as it is of comparatively slow growth it may be planted where space is limited.

96. *R. obtusa compacta* differs little from the normal form save in its more compact and dense habit. It is well worthy of a place in every collection.

97. *R. obtusa nana* has a dwarfed appearance, the branches being much shortened, and is useful for planting on small lawns, or where space is limited.

98. *R. pisifera* (Pea-Fruited Retinospora).—This is a very distinct and desirable species with fern-like bright green foliage, and somewhat irregular habit of growth. It is a Japanese tree, and useful for contrast and variety.

99. *R. plumosa* (Feathery Retinospora), and its varieties

argentea and *aurea*, are better known, and more commonly cultivated as ornamental trees, than any of the other species or varieties. For garden and lawn decoration these conifers are not surpassed, either in point of beauty or ease of culture, by any other with which we are acquainted. They are of Japanese origin, and were introduced into this country in 1861.

100. *Sciadopitys verticillata* (Umbrella Pine).—Planters, generally speaking, have been somewhat tardy in procuring specimens of this tree, and that for two reasons; its supposed inability to withstand a severe winter, and the high price at which a fair-sized plant can be obtained. Fortunately, the first supposition has, after a fair and unprejudiced trial, been found to be without foundation, as some of the finest plants I know of this conifer are growing in northern Scottish counties, and are, in point of health, appearance, and rapidity of growth, little behind those in the warmer parts of the south of England. As to the high price at which a plant of sufficient size for planting can be procured, I am by no means surprised, as the *Sciadopitys* is, perhaps, our rarest conifer, only one very limited habitat having been recorded. The Umbrella Pine is well worthy of a place in every collection; for the deep, glossy-green leaves spreading out like the rays of an umbrella, and decidedly pleasing contour of the plant, render the *Sciadopitys* one of the most distinct and peculiar of hardy conifers. A native of Japan, on a mountain in the Island of Nippon, and introduced in 1853.

101. *Sequoia sempervirens* (Californian Redwood).—For its ornamental appearance the redwood is worthy of extensive culture, but it is well to bear in mind at time of planting, that it only puts on its tree character when placed in good rich soils and in partially sheltered situations. The foliage is of a dark, pleasant green above, and silvery underneath, and to some extent resembles that of the common yew, while the branches are irregularly arranged and usually semi-pendent. By depriving the stem of its branches—that is, in old trees—for say 5 feet from the ground, we consider that the appearance of such trees is vastly improved, the thick, spongy, reddish-brown and deeply furrowed bark, which constitutes one of the peculiarities of the Redwood, being then shown to advantage. As regards the quality of timber produced in this country, it is in every respect fairly satisfactory, judging from specimens of hardly thirty years' growth. At the age of fifty or one hundred years, and

when maturity is arrived at, we may expect much better results. The appearance of the timber in a sample now before me is of a pleasing brick-red colour, close-grained, and free from knots. It is light in proportion to its bulk as compared with most other woods, and takes on a fine, silky polish. Being long-grained it splits more readily than any other British grown timber we know of. For these reasons we anticipate that it will, when grown in quantity, be largely used for fencing purposes, and in the making of packing-cases, boxes, etc., where neither great strength nor long-lasting qualities are of importance. In the making of furniture it would seem to be a most valuable wood, as any one could perceive who had the chance of seeing the several suites sent by the Redwood Company to the Forestry Exhibition at Edinburgh. The Redwood is a tree of very rapid growth when suitably placed, the annual upward rate of growth of several specimens of which we have kept a record being almost 30 inches. It is a native of California. Introduced in 1846.

102. *Taxodium distichum* (Deciduous Cypress) is a tree of great beauty; the soft, feathery foliage, which during summer is of a bright, pleasing green, slowly changing as autumn advances to a dark red, rendering it distinct from any other conifer in cultivation. Even during winter, when leafless, this tree is very attractive, for the highly-coloured twigs and branches are resplendent in the evening sun, and appear at a short distance off as if all aglow. Why this tree should have been so neglected of late years is a mystery difficult to solve, for, whether regarded as an ornamental tree or one of the easiest culture, it can well hold its own. It is specially adapted for planting in quagmires, where few other trees succeed, thriving under such conditions in a manner that is quite surprising. As a timber tree in the British Isles, the Deciduous Cypress is, however, not likely to attract much attention, for the simple reason that our summers are too short and cold for its perfect development. A native of North America, principally the South-eastern States, and introduced about 1640.

103. *T. Mexicanum* (Mexican Deciduous Cypress) is a pretty but little-known tree, which we have found to be perfectly hardy in the warmer portions of these islands. I know of no other conifer so delicately beautiful, none that in autumn changes to such a lovely golden red its light, fresh, green foliage of the summer, and none that is better fitted for adorning a shady, well-

chosen spot on the lawn of some maritime garden. It may be described as a refined deciduous cypress, the foliage being finer, of a bright pea-green, and the whole tree more graceful in appearance. To recommend this tree for planting in any but the warmer parts of England and Ireland would perhaps be out of place, but I must say that, judging from several specimens which have come under my notice, and have never suffered from the effects of frost, I am convinced that the tree is not so tender as it is described. A native of Mexico.

104. *Taxus brevifolia* (Californian Yew).—This is rather an ornamental yew, with short, yellowish-green foliage, and a spreading habit of growth. A native of California, and introduced in 1854.

105. *T. canadensis* (Canadian Yew), and its variegated form *T. canadensis variegata*, are, but particularly the latter, highly ornamental and desirable evergreen plants. During the growing season the leaves of the variegated form are margined with yellowish white, which imparts to the whole plant a most distinct and attractive appearance. *T. canadensis* is a native of Canada and several of the North-eastern States. Introduced about the year 1800.

106. *Thuia gigantea* (Giant Arbor-Vitæ).—As an ornamental conifer, this holds a high place, its compact outline, easy appearance, and beautiful vivid green foliage being all points of special recommendation. To produce the best effect, however, we might recommend the planting of this tree in irregular-shaped clumps, of say five or seven trees in each, on the greensward, and not in too close contiguity to such stiff-growing and sombre-foliaged subjects as are some of the pines and other trees.

As a British timber tree the giant arbor-vitæ is fast coming to the front, and has already, at the hands of certain far-seeing planters, received a fair amount of attention, but, in our opinion, not one-half of what its merits deserve. The quality of the timber produced in this country warrants us in speaking highly of it, being yellow, fine-grained, easily worked, remarkably durable, and light in proportion to its bulk, and this refers to timber of thirty years' growth, and consequently immature. In its native country the wood is highly valued, and used extensively for cabinet-making and the construction of boats and ships. The giant arbor-vitæ is a tree of very rapid growth, it having, in several instances we know of, reached a height of 56 feet in thirty years. There can be no question that in the giant arbor-vitæ we have, whether for utility or ornament, a most valuable addition to our forest trees, and it is the opinion of most practical arboriculturists that it will be one of the trees of the future in Britain. A native of North-West America. Introduced in 1851.

107. *T. occidentalis* (American Arbor-Vitæ).—This is a tree well adapted for planting in any part of the British Isles, being quite hardy and not fastidious as regards soil or situation. As an ornamental tree it is not of much value, neither is it for the quality of its timber. The foliage is of a brownish-green colour, which changes to a brownish-purple in winter, and again resumes its green or normal tint during the growing season. A native of Canada. Introduced prior to 1597.

108. *T. occidentalis Ellwangeriana* is a distinct and pretty variety, and one that has been used with good effect in ornamental gardening. It is of dense, rather formal growth, and dwarf in habit.

109. *T. occidentalis Vervæneana*, which we may well describe as the handsomest and most distinct of all the varieties, is of easy habit, with an abundance of golden-green foliage, which, during autumn, changes to a light brownish-yellow.

110. *T. plicata* (Siberian Arbor-Vitæ).—In this we have a neat-growing and compact ornamental tree, with short branches, and an abundance of brownish-green foliage. Being hardy and of distinct appearance, it is useful for shrubbery decoration. Introduced from North-West America in 1796.

111. *T. Wareana* (Ware's Arbor-Vitæ) is a very useful ornamental conifer, with deep-green foliage, and a rather neat, bushy habit of growth. For screening any unsightly object its dense habit renders it of great value, while the bright green foliage-tint makes it of interest, and a valuable acquisition for lawn or park planting. It is said to have originated some years ago in the nursery of Mr Ware, at Coventry.

112. *Thuiopsis dolabrata* (Hatchet-Leaved Thuiopsis).—As an ornamental tree this ranks high, and deservedly so, for perhaps in no other conifer is the tinted green of the upper and silvery hue of the under sides of the leaves more prominently revealed. For lawn purposes, and especially where space is limited, I know of no conifer to equal it, and being hardy and of the easiest culture, it is well suited for any part of the United Kingdom. In well-grown specimens the contour is usually pyramidal, with

branches that are somewhat drooping and vertical towards the points. The leaves are hatchet-shaped (hence the name), loosely imbricated, and of a beautiful shining green above and silvery beneath. The main branches are few, but the branchlets are numerous and compressed, and certainly constitute the most striking feature of the tree. Planted in a rather moist coal loam, and a semi-shady position, this tree seems to thrive best; and though the upward rate of growth is slow for the first dozen years, yet, when fairly established, a change for the better takes place, and occasionally an average yearly increase of half-a-foot is attained. There are two varieties of this tree—*T. d. variegata*, with irregularly variegated leaves of an indistinct yellow; and *T. d. nana*, in which the original is dwarfed into a neat, erect, dense bush of 4 feet to 5 feet in height. *Thuiopsis dolabrata* is well worthy of greatly extended culture, for it is undoubtedly one of the handsomest and hardiest of conifers. A native of Japan, and introduced in 1853.

113. *Wellingtonia gigantea* (Mammoth Tree).—Although of a somewhat stiff and formal appearance, yet the *Wellingtonia*, from its massive proportions and bright green foliage, must ever hold its own as an ornamental tree. It associates well with such free-habited and lighter-leaved conifers as the Deodar, the weeping spruce, and many others; while it has, in the formation of avenues and drives, been made, by judicious planting, to contrast well with *Araucaria imbricata* and *Abies Nordmanniana*.

As a rapid timber producer, the *Wellingtonia* is surpassed by no other tree, the growth of which in this country we have kept a record of, save the Douglas fir, although the Californian redwood (*Sequoia sempervirens*) produces under similar circumstances an almost equal quantity of timber, and likewise attains to a much greater height in the same space of time. Two specimens of which I kept records produced 120 feet and 115 feet of wood respectively in thirty years, or at the rate of about 4 feet per year. One of these specimens was planted in 1857, and when measured in 1887 contained exactly 115 feet of wood. The upward growth of the *Wellingtonia* per year for a period of thirty years is, in numerous specimens of which measurements have been taken, about 26 inches, but even this is far exceeded in special instances which I have not considered it fair to record. Not long ago I had a very large tree cut into boarding, used in the construction of a hut for charcoal burners, and I was surprised with both the appearance and texture of the wood, it being beautifully marked with red lines lengthwise, while the groundwork is of a desirable yellow. Though light in proportion to its bulk, as compared with the generality of timber, it was firm and free from knots, worked readily, and polished with ease. Had I not been conversant with the somewhat valueless nature of the timber of the *Wellingtonia*, and its brittle, spongy quality, as set forth by the numerous specimens exhibited in this country of late years, both in a manufactured and unmanufactured state, I would have been apt to speak in fairly high terms of its qualities, at least so far as could be judged by appearance, without actual experiment as to strength and durability. Although hardy in any part of the British Isles, yet repeated experiments have proved that, unless in sheltered districts, the *Wellingtonia* cannot be relied upon as a tree for forest planting. This is much to be regretted, for, whether looked at in an ornamental or commercial sense, this tree must be considered as an acquisition, being one of the brightest ornaments of our lawns, as well as one of the most rapid timber-producers. A native of California on the Sierra Nevada Mountains, and introduced in 1853.

XIII. *Plan and Specification for the Erection of a Forester's Cottage.* By R. B. Keay, Forester, Redcastle, Ross-shire. [Plate VI.]

General Conditions and Stipulations.

Execution of Works.—The whole of the works required for the perfect completion of the Forester's Cottage must be constructed and finished in a sound and substantial manner, agreeably to the particulars contained in the following specification, and in conformity with the drawings now furnished.

Plan and Specification.—Every effort has been made to include, in making out the plan and specification, all that is usual and necessary for the perfect completion of the works; therefore, contractors shall be held bound to finish the whole in a sound and proper manner, even although a mistake or omission may appear in the plan or specification.

Dimensions.—All dimensions marked on the plan, or described in the specification, must be worked to; and any descriptions or particulars written on the plan are to be equally binding, as if contained in the specification.

Materials, Tools, etc.—Contractors must provide all materials and cartage of same; also all tools, scaffolding, and everything necessary to complete the works herein referred to, or shown on the accompanying plan.

Quality of Materials.—The whole of the works are to be executed with the best materials of their respective kinds, all of which shall be subject to the approval of the architect, who will have full power and liberty to inspect the materials at all times and places during their progress.

Defective Materials or Work.—If at any time during the progress of the works any imperfections shall appear, through the introduction of unsound materials or by defective workmanship, the contractor shall, upon written notice being served upon him by the architect, be bound to take down, rebuild, or reconstruct and make good the same at his own expense.

Alterations.—The architect reserves power to make such alterations during the progress of the work as he may deem advisable; but no deviation from the plan or specification shall be made without his express consent. The cost of any alteration that may be made, whether as a deduction or addition, to be ascertained according to the usual mode of measuring, and regulated by the prices contained in the detailed estimate. Where the estimate does not apply, the price shall be determined by the architect.

Contracts.—The architect does not bind himself to accept the lowest, or any tender for the work; and reserves full power to increase, lessen, and omit any portion of the work which he thinks proper.

Payments.—Payments shall be made on account of the contract, equal to 75 per cent. upon the certified value of the work executed; and the balance within a period not exceeding three calendar months after the buildings have been completed, and the work has been certified by the architect to have been duly performed according to the contract. Part of the payment of the slater's estimate will be retained until twelve months after all the works are completed.

Time of Completion.—The works to be commenced immediately on signing the contract, and carried on with business-like diligence; and the whole must be completed to the entire satisfaction of the architect, or whoever he may appoint to inspect the work, on or before the 1st day of November 1888.

Mason Work.

Excavations.—The contractor will remove the surface soil from off the whole area of the buildings, and make the necessary excavations for walls, space under floors, drains, etc., and the materials thus removed will be laid down by him in a place to be pointed out. The tracks for the walls to be sunk to whatever depth is required to secure a proper foundation on the solid subsoil, without respect to the depth shown on the sections, but none to be less than two feet below the finished ground outside. The ground under wooden floors to be sunk to a depth of 15 inches below the underside of the sleeper joists. The entire area of the back wing will be taken out to a depth of 18 inches below the surface of finished floors, and will be again filled in to a depth of 12 inches with broken stones well rammed down.

Materials.—The window sills, lintels, rybats, corners, jambs, hearths, and chimney heads will be of good freestone, carefully selected, and perfectly free from defects.

Lime Mortar.—The lime to be of the best quality Scotch lime shells, properly slacked, and the mortar prepared in the proportion of two measures of clean sharp sand to one of lime, thoroughly beaten up before being used.

Foundations.—The foundation courses will be laid with large flat bedded stones, averaging 6 feet in area, and 7 to 9 inches thick, bedded and packed with stone chips and lime mortar, and forming scarcements on each side of the walls as shown, the inside scarcements being carried up to bear the ends of sleeper joists where required.

Walls.—The whole of the walls will be built of the best description of rubble work, to the forms and dimensions shown on the plan, having band-stones in every foot in height, extending two-thirds of the thickness of the walls, built from the outside and inside alternately, and not more than 5 feet apart. All walls to be thoroughly packed and hearted with stone chips and lime mortar, and to be levelled at every 20 inches in height for bond-timber, and also at height shown on plan for joists and roof timbers, and to be filled close up to the sarking after the roof is put on. All to be close harl-pointed inside, and the outside harling will be clean-jointed and cut off. Foundation walls will be built under wooden partitions, and sleeper walls will be built under centre of sleeper joists in parlour and sitting-room. These walls to be carefully built and levelled for wall-plates.

Dressed Work.—All rybats, scuntions, and corners will be 9 inches on the heads, 22 inches long, not less than 7 inches or more than 14 inches high. Door and window rybats will be checked, the former $2\frac{1}{2}$ inches and the latter 3 inches, built out-and-in band, and to have 5-inch droved heads and 3-inch margins, with stop chamfers $1\frac{1}{2}$ inches broad. Lintels will be checked and dressed to correspond with rybats, and window-sills droved and weathered. Mullions of parlour and sitting-room will be in single stones, 6 inches broad on face, 5 inches deep, droved and chamfered as described. Upstarts of dormer windows will be in single stones, 8 inches broad on face, 22 inches deep, checked, droved, and chamfered. Chimney heads and corners to have $1\frac{1}{2}$-inch droved margins. Coping of chimney-tops to be formed of two stones 9 inches thick, droved, and cramped together with iron bats run in with lead, and pointed in mastic. All chimneys, except kitchen, to have polished freestone jambs and lintels. All jambs to be 20 inches deep; those in parlour and sitting-room to be 6 inches, and in office and bedrooms to be $4\frac{1}{2}$ inches on face, to project 3 inches beyond plaster. Fireplaces in "office" and bedrooms to be 2 feet 9 inches wide by 3 feet high; parlour and sitting-room fireplaces to be 3 feet by 3 feet, all inside measure. Kitchen fireplace to have droved jambs and lintel; jambs to be 4 feet 4 inches by 1 foot 8 inches by 6 inches; lintel, 5 feet by 9 inches by 6 inches. All hearths to be of polished freestone, corresponding in length to outside of jambs; to be 2 feet broad, and not less than 2 inches thick, with proper back hearths complete. All hearths on the ground-floor to be laid on strong rubble foundations, and bedded in lime mortar.

Chimney Vents.—The vents to be carried up with easy turns, and lined with fire-clay vent linings 10 inches diameter, carefully jointed and close packed round with stone chips and lime mortar, to be carried 6 inches above the chimney tops and finished with a bead or roll; lining of kitchen vent to be 12 inches diameter.

Door Steps.—Flags will be placed at the outer doors, that for the front door to be 5 feet 9 inches by 2 feet 6 inches by 2 inches, and for the back 3 feet 9 inches by 2 feet by 2 inches, bedded in cement. Upper steps in doorways to be 12 inches by 7 inches by the length required to fit neatly in between rybats; the upper step at front door to have a bottle and fillet nosing. Steps and flags to be of polished freestone.

Ventilation.—Four ventilating openings, 9 inches by 6 inches, will be built in base of walls where shown, the stones for opening on face of wall to be 18 inches by 18 inches by 7 inches droved and splayed, and to have galvanised iron plates 9 inches by 6 inches (Cameron, Roberton, & Co.'s No. 40), securely fixed in.

Drains.—The main drain, the line of which will be pointed out by the architect, will be cut to an average depth of 2 feet, and laid with 6-inch hard-burned glazed fireclay spigot and faucet pipes, provided with all necessary bends, firmly bedded and carefully jointed with Portland cement, and having a fall of 1 inch to the yard. Build brick eye "where pointed out," for stop cock of supply pipe from reservoir. Fill in drain after all connections of piping are finished. Excavation to be made for cesspool "where pointed out" 8 feet 6 inches under surface of ground, to be built with wall 18 inches thick of good rubble without lime, covered over with strong covers 6 inches thick, having 9-inch wall hold; inside size of cesspool, 7 feet 6 inches by 4 feet by 6 feet. Overflows to be formed from cesspool with 4-inch agricultural drain pipes $2\frac{1}{2}$ feet deep. The total length of main drain will be about 60 lineal yards, that of overflow drain about 15 lineal yards.

Traps.—Provide 7 fireclay gully traps with fireclay covers for foot of rain water-pipes, and connect drain pipes carefully with same.

Provide and set in drain, outside of scullery window, a fireclay grease trap 12 inches by 12 inches by 12 inches, with cast-iron grating, and connect drain pipe to same.

A 6-inch Buchan trap with ventilating horn, and furnished with cast-iron grating, to be placed outside wall of W.-C.

Syphon trap, with cast-iron grating, to be placed at junction of drain pipes, as shown on plan.

Miscellaneous.—Build in kitchen range and all other grates, providing fire and other bricks, lime, etc.

Cut raggles for all lead flashings, cut all bat and dook holes, and all openings for water or soil pipes, and build round the same after the pipes are in.

Clear away all unused material and rubbish from the place when finished.

Joiner Work.

Materials.—The whole of the timber required must be of the best quality, free from sapwood, shakes, large or loose knots, thoroughly seasoned, and all battens or other timbers must be square up on the edges from end to end. The whole of the joisting, lintels, bondwood, stairs, outside doors, and posts, windows, and projections of roofs, to be of the best quality of Baltic redwood. Sleepers, standards, rafters, wall plates, wall straps, flooring, furnishing of servant's bedroom and closet, wall presses, finishing of kitchen and scullery, and shelving, to be of best quality of Baltic whitewood. Furnishings of parlour, sitting-room, office, lobby, W.-C., and bedrooms, to be of best quality American yellow pine, *perfectly free from knots.*

Bond Timber.—Bond timbers 4 inches by 1 inch to be built into the walls at 20 inches apart.

Safe-Lintels.—Safe-lintels for all voids to be $1\frac{1}{4}$ inches thick for every foot of span, and not less than 10 inches wide, with back closers, and to have 9 inches of wall hold at each end.

Sleepers.—The sleeper joists under wood floors to be $6\frac{1}{2}$ inches by $2\frac{1}{2}$ inches, and placed 16 inches apart on wall plates of $6\frac{1}{2}$ inches by $1\frac{1}{8}$ inches.

Joists.—Floor joists will be 8 inches by $2\frac{1}{2}$ inches, placed at 16 inches apart on wall plates of $6\frac{1}{2}$ inches by $1\frac{1}{8}$ inches, dwanged at

7 feet apart with pieces 8 inches by $1\frac{1}{4}$ inches, driven up and firmly nailed. Joists to be bridled for stairs, and hearths where shown. Bridling joists will be 8 inches by $3\frac{1}{2}$ inches. The space between joists will be prepared for deafening with boards $\frac{5}{8}$ inch thick, 3 inches broad, laid on fillets 1 inch by 1 inch, firmly nailed to joists.

Roofs.—The roofs will be constructed as shown on plan, with rafters $6\frac{1}{2}$ inches by $2\frac{1}{2}$ inches, placed at 18-inch centres. Piend rafters will be 9 inches by 2 inches. The lower end of rafters will be dressed and moulded, and will project from the walls as shown. Cantilevers for gables will be 5 inches by $2\frac{1}{2}$ inches clean dressed at outer ends, and extending through walls and firmly nailed to first rafter. Roofs of dormer windows will be formed as shown, with rafters, ties, and uprights at sides. Rafters to be $5\frac{1}{2}$ inches by $2\frac{1}{4}$ inches, uprights 4 inches by 2 inches. The whole of the roofs will be covered with $\frac{5}{8}$-inch sarking, close jointed and securely nailed. Ridge-rolls will be $1\frac{3}{4}$ inches diameter, firmly fixed down at alternate rafters with iron spikes. Provide the roof with all necessary tilting fillets. Fit on roof-lights, which the plumber provides, and place $\frac{5}{8}$-inch beaded facings inside the same.

Projections.—Projections of roofs will be covered with $1\frac{1}{8}$-inch red-wood flooring, dressed on under side, tongued and grooved and properly jointed; the rafters being checked down to suit the different thickness of flooring and sarking. Rolls for projections of roofs will be $2\frac{1}{4}$ inches by $1\frac{1}{4}$-inches, rounded on upper edge, checked and firmly nailed to sarking. Fret-board and moulding will be fitted up on projections as shown.

Straps and Lath.—The interior surface of all external walls to have straps $1\frac{1}{2}$ inches by $\frac{7}{8}$ inch, placed at 14 inches apart, securely fixed to bond-timbers, opposite flues to be fixed with holdfasts, and to be all covered with best St Petersburg lath-wood $\frac{1}{4}$ inch thick, placed $\frac{3}{8}$ inch apart, double nailed at joinings, but not overlapped, and to have band broken every 2 feet.

Partitions.—Partition standards will be 4 inches by 2 inches, placed at 14 inches from centre to centre, top and bottom runners to be 4 inches by 2 inches. Dwangs 4 inches by $1\frac{1}{2}$ inches to be placed opposite door-lintel, and gradually lowered to mid-way between top and bottom runners, firmly driven up and nailed. The whole of the partitions to be covered on both sides with lath as above described.

Ceilings.—The whole ceilings throughout the building will be lathed in the same manner.

Door Posts.—Outside door-posts will be 6 inches by $2\frac{1}{2}$ inches, properly batted to the stone-work. Door-frame standards in partitions will be 6 inches by $2\frac{1}{2}$ inches, checked 1 inch on back for receiving lath and plaster.

Grounds.—Window grounds will be $2\frac{1}{2}$ inches by 2 inches, checked. Foot-base grounds will be $2\frac{1}{2}$ inches by 1 inch. All external angles will have $\frac{7}{8}$-inch corner beads.

Floors.—The whole of the joisting and sleepers throughout the building will be covered with best quality of white-wood flooring 4 inches broad, $1\frac{1}{8}$ inches thick, tongued, grooved, and nailed on feathers, thoroughly stove-dried before being laid, and properly cleaned off after being laid. The hearths to have mitred borders put round them.

Windows.—The windows to be framed as shown with 1-inch pulley stiles, $1\frac{1}{4}$-inch lintels, $\frac{7}{8}$-inch inside and $\frac{5}{8}$-inch outside facings, 4-inch checked, weathered, and moulded sills; inner edges of sills and lintels to be grooved for finishings, and pulley stiles checked for batten-rods. Sash wood to be 2 inches by 2 inches; counterchecks $1\frac{3}{8}$ inches, properly checked together. All the windows, except window of W.-C., to be glazed with the best quality of 21-oz. sheet-glass. W.-C. windows to be glazed with 21-oz. obscured sheet-glass. Pulley stiles to have $1\frac{3}{4}$-inch brass-faced iron axle pulleys. Sashes to be hung with patent woven sash line and cast-iron weights. All the windows, except those in parlour, to have brass fasteners and lifts, value 2s. per set. The windows in parlour and sitting-room to have bound finishing framing, $3\frac{1}{2}$ inches by $1\frac{3}{8}$ inches. Shutters to be hung with 3-inch D.J. iron edge hinges, to have back closers with cross heads, hung with 2-inch edge hinges, and having hook-and-eye fasteners. One shutter only of the end windows to be hung, and to have back closers with hook-and-eye fasteners. The panels of finishing in parlour to have fine raised planted mouldings, those in sitting-room to have fine sunk mouldings. Bedrooms and office windows to have bound shutters $3\frac{1}{2}$ inches by $1\frac{3}{8}$ inches, with fine sunk mouldings, and to have back closers with hook-and-eye fasteners. Breasts and elbows to be lined with 3-inch by $\frac{5}{8}$-inch tongued, grooved, and properly jointed linings. Kitchen and servant's bedroom windows to have plain shutters formed of 3-inch by $\frac{5}{8}$-inch tongued, grooved, and V-jointed linings, with chamfered bars on back, to be hung with 3-inch D.J. iron edge hinges, and to have closers with hook-and-eye fasteners. Breasts and elbows to be lined as specified for bedroom and office windows. Scullery and W.-C. windows to be furnished with corner beads.

Fanlights, 2 inches thick, will be placed in front and back doors, and in front lobby door, to be glazed with 21-oz. sheet-glass.

Doors.—The parlour, sitting-room, and front lobby door to be bound and framed in four panels, $1\frac{3}{4}$ inches thick, and to have fine raised planted moulding, inner side of sitting-room door to have fine sunk mouldings. Doors of office and bedrooms to be bound and framed in four panels $1\frac{5}{8}$ inches thick, with fine sunk planted mouldings. All these doors to be hung with 6-inch D.J. iron edge hinges. Parlour and lobby doors to have 6-inch mortice locks, with boxwood furniture, value 7s. 6d. Parlour windows to have furniture to match door. Sitting-room door to have 6-inch rim lock, with boxwood furniture outside and brass inside, value 4s. 6d. All shutters throughout the house, except parlour, to have brass knobs. Office and bedroom doors to have 6-inch rim locks, with brass furniture, value 3s. 6d. Door of W.-C. to be bound and framed in four panels $1\frac{1}{2}$ inches thick with sunk mouldings on face, to be hung with 5-inch D.J. iron edge hinges, to have spring latch with brass furniture, and 3-inch brass slip bolt inside. All the other doors throughout the house to be formed of 3 inches by $1\frac{1}{8}$ inches tongued, grooved, and V-jointed lining, with chamfered bars on back, to be hung with 14-inch Tee hinges, and provided with thumb latching. The front door will be bound and framed in four panels $2\frac{1}{4}$ inches thick, the panels to be of 3 inches by $1\frac{1}{8}$ inches, tongued, grooved, and V-jointed; lining placed diagonally as shown on plan, hung with three 7-inch D.J. iron edge hinges, and having a 7-inch strong rim lock, with box furniture inside and bronze outside, value 6s. Transom will be 5 inches by 3 inches moulded, facings $\frac{3}{4}$ inch thick, with O.G. moulding. The back door will be bound and framed $2\frac{1}{8}$ inches thick, with 3-inch by $1\frac{1}{8}$-inch tongued, grooved, and V-jointed lining, hung with three 6-inch D.J. iron edge hinges, with 7-inch rim lock and brass furniture, value 4s. 6d. Transom will be 5 inches by 3 inches, with beaded facing; facings of door to be $\frac{3}{4}$ inch thick and beaded. Press door in sitting-room will be bound and framed in four panels $1\frac{1}{2}$ inches thick, with fine sunk mouldings on face, hung with 5-inch D.J. iron edge hinges, and having press lock with brass furniture, value 1s. 6d. Lobby doors and parlour windows to have single faced architraves set on blocks. Foot base in parlour and lobby will be 8 inches deep, $\frac{5}{8}$ inch thick, with moulding $2\frac{1}{4}$ inches by

$1\frac{1}{4}$ inches. Facings in sitting-room will be 7 inches by $\frac{5}{8}$ inch moulded. Foot base will be 8 inches by $\frac{3}{4}$ inch moulded. Foot base in office and bedroom will be 7 inches by $\frac{5}{8}$ inch moulded, facings 5 inches by $\frac{5}{8}$ inch moulded. All other facing will be $4\frac{1}{2}$ inches by $\frac{5}{8}$ inch beaded. Foot bases to be neatly mitred into back of facings. All door stops to be $\frac{1}{2}$ inch thick.

Stairs.—The front stair will be constructed of pitch pine, with inside stringer 9 inches by $1\frac{1}{4}$ inches, and outside stringer 9 inches by $1\frac{3}{4}$ inches; treads, 9 inches by $1\frac{1}{4}$ inches, with rounded nosings and cavetto underneath; risers, 7 inches by 1 inch. The balustrade will be formed with cast-iron balusters of approved pattern, value 1s. each; two for each tread. Two main balusters of approved pattern to be provided for ends. The lower step will be rounded off, as shown on plan. Hand-rail to be 4 inches by $3\frac{1}{2}$ inches, of pitch pine, moulded, with terminal scrolls. Back stair to be of Baltic redwood, with stringers, 9 inches by $1\frac{1}{4}$ inches; treads, 9 inches by $1\frac{1}{8}$ inches; risers, 7 inches by 1 inch; to have wooden balusters 1 inch by 1 inch morticed into floor and hand-rail. The newel post will be carried up to form main baluster. Hand-rail to be $3\frac{1}{2}$ inches by $2\frac{1}{2}$ inches, moulded, and securely fixed to wooden partition.

Water Closet.—Two bearers, 5 inches by 3 inches, of Baltic redwood to be put into W.-C. at height required for supporting cistern; the ends next wall to be laid on 6 inches by 1 inch wall plate, and ends next wooden partition to be supported on cross-bar 4 inches by 2 inches, all firmly nailed together. Inch bearers to be put in before walls are lathed. Under side of bearers and front of cistern to be lined with 3 inches by $\frac{5}{8}$ inch tongued, grooved, and V-jointed yellow pine lining; part of lining of front to be fixed on with screw nails. Movable seat for closet to be of yellow pine $1\frac{1}{4}$ inches thick with flush beaded panels; lid of seat to be hinged with 3-inch brass edge hinges. Moulded skirting, 6 inches by $\frac{5}{8}$ inch, to be carried round top and down face of seat, and neatly mitred into foot-base. Grounds, $1\frac{3}{4}$ inches by $1\frac{3}{4}$ inches, to be put up where required by plumber to form space for pipes, to have $\frac{5}{8}$-inch yellow pine cover fixed with screw nails.

Sink.—The scullery sink will be fitted up on strong bearers, and lined on front with 3 inches by $\frac{3}{8}$ inch tongued, grooved, and V-jointed lining, part of which will be movable and fixed with screw nails. Coping of sink to be of hardwood, 1 inch thick.

Mantelpieces.—The mantelpieces will be formed in the usual way.

Parlour mantelpiece to have 8-inch pilasters, 10-inch friezes, heavy neck moulding, and moulded base; shelf, 8 inches by $1\frac{3}{4}$ inches. Sitting-room mantelpiece to have 8-inch pilasters, $9\frac{1}{2}$-inch friezes, with neck moulding, and shelf 8 inches by $1\frac{1}{2}$ inches, and plain base. Office and bedroom mantelpieces to have 7-inch pilasters, 9-inch friezes, neck mouldings, and plain bases, and shelves 8 inches by $1\frac{1}{4}$ inches. Kitchen fireplace to have shelf only, 8 inches by $1\frac{1}{2}$ inches.

Shelving.—Fit up wall press in sitting-room with back, sides, and top $\frac{5}{8}$ inch thick, and four shelves 1 inch thick. Fit up press in recess in kitchen with four shelves 1 inch thick, supported with fillets nailed to partitions "to be fitted up before partitions are plastered." Fit up 24 superficial feet of 1-inch shelving on framed brackets and fillets in scullery and kitchen. Fit up 20 lineal feet of utensil plate 5 inches by $\frac{5}{8}$ inch, moulded on edge, placed mostly underneath shelves. Space beneath back stair to be lined with $\frac{5}{8}$-inch whitewood lining.

Miscellaneous.—Fit up board in kitchen, 8 feet by 12 inches by $\frac{3}{4}$ inch, moulded on edge, for carrying bells.

Gable boards, 8 inches by $1\frac{1}{4}$ inches, to be formed to detail drawing, neatly mitred at top, and securely nailed to ends of cantilevers

The framing of outside doors to be put together with white lead, and the joints of lining of same to receive one coat of brown paint before being put in. Prime all windows with best lead and oil priming, before being glazed.

Do all jobbing usually required by other tradesmen.

Plumber Work.

The eave gutters to be half round, cast-iron, $4\frac{1}{2}$ inches diameter (similar to M'Farlane's No. 2), hung on japanned iron hooks, 1 inch by $\frac{1}{4}$ inch, placed 3 feet apart, and firmly fixed to sarking. The gutters to have all necessary stop ends, angles, and drop pipes, complete; the whole being put together with red lead and screw bolts. Conductors to be of cast-iron, 3 inches diameter, fixed with wrought-iron holdfasts, to have galvanized iron gratings at top, and cast-iron shoes at bottom, to discharge on fireclay basins.

Ridges to be covered with No. 14 V. M. zinc, 14 inches wide, held down with galvanized iron straps placed at 2 feet 6 inches apart.

Flanks of same zinc, 12 inches wide; caps of $4\frac{1}{2}$-lb. lead, 18 inches by 18 inches, to be put on at intersection of ridges and flanks.

The flashings at sides of dormers, roof of porch, and intersection of back wing, to be 5-lb. lead, 10 inches wide. Flashings of chimneys to be of $4\frac{1}{2}$-lb. lead, 9 inches wide; but those for haunches of chimneys, 12 inches wide, all batted into the raggles.

Projection rolls to be covered with 5-lb. lead, 8 inches wide, with bead formed under slates; neatly finished off with lower edge of chamfer on face of roll, and securely fixed with copper nails.

Cast-iron opening roof lights to have 4-lb. lead soles, and to be glazed with $\frac{3}{16}$-inch rough plate glass.

Front gable to have cast-iron finial (M'Dowell's No. 53), arms four ways, and 2 feet 6 inches high. Dormers and porch to have cast-iron finials (M'Dowell's No. 11), arms four ways, $14\frac{1}{2}$ inches high. Bases of finials to be covered with 4-lb. lead. Cast-metal gutter to be provided for roof of porch, properly cast to pitch of roof, with bead on edge under slates, and flange on perpendicular side, $\frac{1}{2}$ inch wide, to fit with raggle in wall.

Provide fireclay sink for scullery, pale yellow enamel, 2 feet 3 inches by 1 foot 5 inches by 9 inches, with overflow brass grating and chain, to have a 3-inch cesspool of 7-lb. lead, with brass trap, screw, and waste-pipe out through wall, 3 inches diameter, of 7-lb. lead, and connected to grease trap. Fit up in closet under front stair a combination sanitary closet, with 3-gallon cistern, with brackets, handle, and pull complete. Dig track from reservoir and lay 40 yards $\frac{1}{2}$-inch lead pipe, 5-lbs. per yard, to be connected with cistern in W.-C., having brass stop, and cleansing cock to be put on at brick eye. Supply-pipe to be $1\frac{1}{2}$ inches diameter, of 6-lb. lead.

A 3-inch cast-metal pipe to be taken off horn at the Buchan trap outside wall of W.-C. and carried up side of wall to eave of roof, and furnished on top with wire cone. Pipe to be fixed to wall with holdfasts.

Supply-pipe to sink to be $\frac{1}{2}$-inch lead 6 lb., and to have $\frac{1}{2}$-inch screw-down gun-metal cock at sink (Guest & Chrime's). Track from reservoir to be filled in after pipes are laid. All supply-piping above ground to be wrapped in hair felt, tied with small twine.

Slater Work.

The whole of the roofs will be covered with the very best quality of Port Dinorwick slates, 16 inches by 8 inches, properly shouldered with hair lime mortar, and securely double-nailed with galvanized iron nails, weighing 13 lbs. per M., and to have 3 inches of cover at the eaves, gradually diminishing to $1\frac{1}{2}$ inches at ridges.

The slates on sides of dormers to be close jointed to stone upstarts, and pointed with cement.

The raggles of lead flashings, and gutter of porch, to be pointed with mastic. The whole of the rhones to be left properly cleaned at the completion of the work.

The contractor to maintain and uphold the whole roofs perfect and water-tight for twelve months after the works are completed.

Plaster Work.

Materials.—The lime to be of the best quality of Scotch lime-shells, all run and mixed in proper proportions with clean, sharp, river sand, fresh well-beaten hair, and pure water. All to be thoroughly worked up and used throughout the works in the proportion of 20 cwts. of limeshells to every 100 yards of 3-coat plaster.

Cement to be the best Portland.

Bed all the window-cases with plaster lime, and point them outside with mastic. Deafen the whole of the upper floors with 3 inches of dry engine ashes, laid between two thick coats of well-haired lime plaster, and all cracks in the upper coat to be filled in and repaired before the floors are laid.

The whole of the walls, partitions, and ceilings throughout the house will be covered with the best 3-coat plaster, finished perfectly straight, all thoroughly hand-floated and left free from cracks, blisters, or other flaws.

The parlour, sitting-room, and front lobby will have a moulded cornice girthing about 15 inches; the cornice in lobby to be returned at stair bridling and corner of back lobby.

The floor of kitchen, scullery, passage at kitchen door, and floor under back stair, will be laid with best Portland cement concrete, composed of five parts clean washed gravel to one part of cement, 5 inches thick, all hard rammed down; finished on top with a coat 1 inch thick, composed of equal parts of fine washed river sand and Portland cement; all to be left perfectly smooth and level, and finished off with the hand-float. Point outside of back door posts with cement. Relieve all corner beads, and repair all breakages after the other tradesmen are finished.

Bellhanger Work.

The bells to be of the best bell-metal, averaging 14 oz. weight, with spring carriages complete.

The wires to be of the best copper, No. 16 B. W. G., conveyed behind lath in zinc tubes. All cranks to be of the best description, and made to work with freedom and ease.

Parlour to have pair of pulls, value 9s.; sitting-room to have pair of pulls, value 7s. 6d.; bed-rooms and office to have single pulls, value 3s. 6d., and all to match door-furniture. Front-door to have 4-inch octagon bronze pull set in door-rybat.

Painter Work.

Painting.—All outside wood-work to receive three coats of good oil paint of approved tint. Outside doors to be grained "oak," and to receive two coats of varnish.

The whole of the finishings in parlour, sitting-room, office, lobby, staircase, stair-landing, front bedrooms, and W.-C., to be thoroughly cleaned of all stains, and all nail-holes to be filled with putty, tinted to correspond with wood, and to receive three coats of best pale oak varnish.

The finishings of kitchen, scullery, servant's bedroom, and closet, to receive three coats of good oil paint of approved tint.

Paperhanging.—The parlour, sitting-room, office, porch, lobby, front staircase, and bedrooms, to be hung with selected papers at the following prices per roll of 12 yards:—parlour, 2s. 6d.; sitting-room, 1s. 6d.; porch, lobby, and staircase, 1s.; front bedrooms, 10d.; back bedroom, 8d.; ceiling in parlour and sitting-room, 1s. All paper on walls to be hung plumb, neatly matched, free from creases, and left perfectly clean when finished. The office and bedrooms to have borders to match the papers.

XIV. *Old and Remarkable Trees on Holwood Estate, Kent.* By A. D. Webster, Holwood, Kent.

Holwood Park, including Keston and Hollydale, the property of Earl Derby, is situated in the north-western portion of the county of Kent, and is distant from London about twelve miles. This estate is of particular interest, both historically and for the many old and remarkable trees growing upon it; and, previous to enumerating the latter, we will give a brief description of the estate generally, including its geological features and history, in so far at least as these bear directly upon arboriculture.

History and Antiquities.—In 1767 Holwood was purchased by Mr Robert Burrow, who converted considerable woodlands into beautiful pastures and sheets of water, and planted ornamental shrubberies; and, after being owned by an eminent ship-builder, Mr Randall, was sold in 1785 to the Right Hon. William Pitt, second son of the great Earl of Chatham, who made it his country residence. To the energy and good taste of Mr Pitt, Holwood owes much of its present beauty. He planted extensively, formed new roads and drives, levelled many surface inequalities, and otherwise improved the park during the short space of sixteen years; for we find that in 1801 the property again changed hands. On the west side of Holwood Hill is the ancient Roman Camp, near which the river Ravensbourne takes its rise, the ramparts of which were planted in a most artistic manner by Mr Pitt. The remains of the Camp consist of a large and strong fortification of an oblong form, commanding an extensive view on every side, the area whereof is for the greater part inclosed with ramparts and double ditches of a vast height and depth, especially on the south and west sides. It contains an area of about one hundred acres of ground, and is nearly two miles in compass, the measurement of one side of the innermost *vallum* from the brow of the hill towards Holwood House being fully seven hundred yards in length. Judging from the quantity of Roman bricks, tiles, ancient foundations, and other remains which have been discovered at various times, there can be little doubt that the Camp is of Roman origin. Some persons believe that this was the Camp which Julius Cæsar made, when the Britons gave him the last battle with their united forces, just before he passed the Thames in pursuit of Cassivelaun; while others suppose it to be the remains of the Noviomagus, the first Roman station from London towards Dover; others again believing it, and with great probability, to have been the place where Aulus Plautius, the prætor, after his fourth action with the Britons, encamped with his forces, whilst he waited the arrival of the Emperor Claudius, as mentioned by Dion. Its gigantic dimensions, strength, and nearness to the Thames are strong inducements to think that it could hardly have been made for any other purpose.

The trees used by Mr Pitt for the ornamentation of the fortifications are principally the Scots and Cluster pines, and the Cedar of Lebanon; indeed, in judging from the numbers of these dotted about, usually in formal shaped clumps of from seven to a dozen trees in each, they would appear to have been his favourite conifers.

Surface and Geology.—The soil may be divided into three distinct classes—chalk, gravel, and clay; the first two forming the main ingredients of the hilly grounds, while the valleys and flat land are almost wholly composed of the latter. The chalk range runs through the estate from west to east. In some instances the chalk crops through the surface, while in others, notably to the north of Holwood House, it is overlaid with a small quantity of clay or loam, varying in depth from a few inches to several feet. South from this the greensand occurs, this being immediately followed, particularly in the lower grounds, by a stiff, retentive Weald clay, alternating with a rich but dampish loam. On the chalk, thinly covered with soil, few trees grow satisfactorily, and this may also be said of the gravel or sand; but where the clay, gravel, and chalk mix in due proportions, an extremely fertile loam is produced, in which the majority of forest trees grow with great rapidity, and attain to large dimensions.

Old and Remarkable Trees.—As might be expected from the historic associations connected with the estate, and the remains of the ancient Kentish forests still in existence, the old and remarkable trees are very numerous, and many of them are of large dimensions, particularly of the oak, beech, and elm.

No. 1. Oak.—This tree is more abundant than any other; indeed, throughout the whole county it predominates, thus showing that at one time Kent must have been covered with vast primeval forests of oak. On the sloping ground to the north-west of Holwood House, and onwards into the vale of Keston, are many fine specimens, the giant proportions and venerable appearance of which at once indicate that they are the remnants of one of the ancient forests for which Southern England was at one time so remarkable.

One of the largest stands alongside the public path that leads through the park on the north-western side of Holwood. This is supposed to be the tree under which Pitt and Wilberforce were seated when the latter resolved to bring forward a bill for the abolition of slavery. The following note in reference to this episode is extracted from Mr Wilberforce's diary of the year 1788:—"At length I well remember, after a conversation with Mr Pitt in the open air at the root of an old tree at Holwood, just above the steep descent into the vale of Keston, I resolved to give notice on a fit occasion in the House of Commons of my intention to bring forward the abolition of the slave trade." These words are engraved on a stone chair which Earl Stanhope had set up close to this historic tree in 1862, by the permission of Lord Cranworth who then owned the estate. At 3 feet and 5 feet from the ground the stem of this ancient oak girths 18 feet 1 inch and 18 feet 3 inches respectively, the total height being 42 feet, and the spread of branches 51 feet in diameter. At 6½ feet from the ground this tree divides into two (formerly four, two having been broken off) massive limbs, the girth of each at the point of junction being 11 feet 4 inches and 10 feet 3 inches. The centre is hollow, and forms an open space 4½ feet feet in diameter, while the roots extend, on the lower side particularly, for 11 feet in length above ground, thus affording a convenient seat for the weary traveller or hard-worked politician.

Another oak growing near the Five Island Pond, and within two hundred yards of the latter, girths 21 feet 11 inches at a yard from the ground, and has a sheer height of 45 feet. Three large roots, or rather portions of the stem, extend outward on the eastern side for 11 feet in length, and growing close together they form a solid mass 12 feet in width, which projects above ground for in most parts fully 18 inches. The centre of this gigantic tree is also hollow, while, as is usual with these old oaks, the stem at 8 feet from the ground divides into numerous large limbs, and at which part it is buttressed to an enormous extent. Several other old oaks stand close to this one, but as they are mere shells, and much contorted in the stem, no reliable measurements can be given. Although in nearly every instance these forest Patriarchs are hollow-stemmed, yet they are otherwise in perfect health, and annually produce fine umbrageous heads of the richest-coloured foliage. Not far distant from the same pond is another interesting specimen of the oak, the curiously contorted stem of which gives it a peculiarly weird appearance, and the many stout props with which the unwieldy branches are upheld clearly show that this primeval oak is carefully tended by its worthy owner. At 3 feet from the ground the partially hollow stem is 16 feet 10 inches in girth, while at 5 feet it ramifies into three ponderous limbs, one of which bends backwards from the main stem in an abrupt manner, and runs nearly parallel with the ground for 15 feet. Here it abruptly stops, and sends upwards for nearly 30 feet several large and almost perfectly straight branches. The girth of this limb at a yard from the main stem is 8 feet 7 inches.

Another curiously irregular oak, growing nearer to the pond, girths, at 3 feet from the ground, 17 feet 8 inches. At $4\frac{1}{2}$ feet up the bole terminates, and there sends out several tree-like branches, one of which bends right backwards from the main stem and enters the ground at $5\frac{1}{4}$ feet therefrom. This branch is 9 feet 11 inches in girth near the point where it diverges from the bole, and curiously enough a large root, fully 20 inches in diameter, runs along the surface of the ground and comes in contact with the branch at a distance of 6 feet 9 inches from where the former is emitted by the stem.

"Pitt's Oak" (*Quercus Robur pedunculata*).—This eminently historic oak, which stands within a stone-throw of Holwood House, and without the garden wall, is in a very healthy and thriving condition, and will, should accident not befall it, live for many years to perpetuate the memory of the great statesman. It was Mr Pitt's habit to sit and read beneath the spreading branches of this stately oak. The tree stands upon a conical mound, part of the old encampments, and within a short distance of two magnificent though half-hidden cedars of Lebanon. The dimensions are as follows:—At a yard from the ground level the stem girths 20 feet 1 inch, and at 8 feet it divides into four massive limbs, the two largest of which girth 9 feet 6 inches and 9 feet 4 inches at 2 feet from point of juncture with the main stem. The branch-spread is wide in proportion to the tree's height, covering as it does a space of 57 feet in diameter, while the total height is only about 36 feet.

The stem is hollow from 4 feet upwards to the point where the branches begin to ramify, but the tree is otherwise in a very healthy condition, as is clearly demonstrated by the rich abundance of glaucous green foliage, as well as by the numerous strong shoots that are annually emitted by the stem and larger branches.

Both this and the "Wilberforce Oak," already described, are the variety known as *Quercus Robur pedunculata.*

That Mr Pitt was fond of trees and planting Holwood Park plainly shows, for not only were the ramparts of the Roman Camp planted by him, but likewise many of the shrubberies around the mansion. With what ardour Pitt applied himself to planting will be seen in a letter addressed from Downing Street to his mother, dated November 13th, 1786, in which he says—"To-morrow I hope to get to Holwood, where I am impatient to look at my works. I must carry there, however, only my passion for planting, and leave that of cutting entirely to Burton." It is said that when night drew on the work of planting was frequently not interrupted, but completed by lantern light.

Mr Wilberforce, who was exceedingly fond of visiting his friend at Holwood, says in his Diary—"Walked about after breakfast with Pitt and Grenville. We sallied forth, armed with bill-hooks, cutting new walks from one large tree to another through the thickets of Holwood copses."

The "Bee Oak" is another curiously contorted tree, which stands on an eminence commanding a beautiful view of the vale of Keston. A hive of bees have for many years taken up their abode in its partially hollow stem.

The above are descriptions and measurements of a few of the many fine old oaks at Holwood, but particularly such as are remarkable for their great age and size. In all cases the girths have been taken so as to avoid recording exaggerated dimensions. Many of the trunks at 1 foot and 5 feet, owing to buttresses or excrescences, are nearly double of the size at 3 feet. The cubic contents cannot be given with any approach to accuracy, as in most instances the trunks are hollow, and terminate at from 8 feet to 10 feet from the ground, after which they ramify into wide-spreading branchy heads. As to the age of these trees, it would be hazardous to advance an opinion; but that they are remnants of the primeval forests with which Kent at one time abounded is beyond dispute. Not, however, until the end of the fifteenth and beginning of the sixteenth centuries, or previous to the introduction of hops into England, did the vast Kentish forests suffer from the ruthless hand of the woodman; but after that date it was found that the cultivation of coppice for hop poles was far more remunerative than even the best quality of oak wood, and so these natural forests were either clean swept away or severely thinned out, to make room for the planting of the Spanish chestnut, ash, and alder.

Interspersed with the old oaks referred to are numerous other oaks of about one hundred years' growth, all straight, clean-stemmed, and perfectly sound trees, containing on an average 60 feet of timber each. How to account for the present rather unsatisfactory state of the old oaks—their short, hollow stems and contorted appearance—is, perhaps, easy enough, for by most persons this would at once be attributed to their great age and consequent natural decay. This is, no doubt, so far true; but the wind, combined with injuries inflicted by both man and beast, perhaps centuries ago, have likewise been powerful agents in the work of destruction. When a limb was broken by the wind, it was allowed to lie where it fell, for pruning was then but seldom thought of, while the wound caused by wrenching the branch from the stem formed in the majority of instances a lodgment for water, and thus conducted moisture, ending in decay and rot, into the very core of the tree.

No. 2. Beech.—This tree luxuriates on the chalk formation, and is, next to the oak, perhaps more plentiful in Kent than any other. One of the largest and most remarkable on this estate is growing in the Lake wood on the left side of the drive entering from the top or Holwood side. At 3 feet from the ground this giant tree is 20 feet 6 inches in girth, above which it divides into ten massive limbs, two of the largest girthing 5 feet 3 inches and 5 feet 4 inches at a yard from the fork, the whole tree containing 235 feet of timber. The head is beautifully rounded, and amply furnished with branches, the diameter of the latter being fully 78 feet. As a picturesque tree this noble beech occupies the front rank, and, standing on the greensward at a considerable distance from any other tree, it has a very striking appearance. The soil is a strong loam, resting on gravel.

Growing within twenty-five yards of the last, and on the southern bank of the lake, is another beech tree of noble proportions, the stem at a yard up girthing 17 feet 1 inch, and having a height of fully 60 feet. At 4 feet up the stem divides into thirteen limbs, and the average girth of each at 3 feet from the fork is 3 feet 7 inches. These branches are very uniform in size, and rise perfectly straight for a considerable length before ramifying into the top branchlets. Between the lower lake and the public footpath to the north of it are numerous fine examples of the beech, with clean and straight stems, 70 to 80 feet in height. The following are measurements of six of the largest, which are growing in a space of about 100 yards square :—

BEECH.

	Feet.	Inches.
No. 1—Height,	87	0
Girth of stem at 3 feet,	9	7
Do. do. 5 feet,	9	5
Cubic contents,	127	0
No. 2—Height,	85	0
Girth of stem at 3 feet,	9	5
Do. do. 5 feet,	9	3
Cubic contents,	113	0
No. 3—Height,	87	0
Girth of stem at 3 feet,	9	5
Do. do. 5 feet,	9	4
Cubic contents,	129	0
No. 4—Height,	78	0
Girth of stem at 3 feet,	10	0
Do. do. 5 feet,	9	0
Cubic contents,	98	0
No. 5—Height,	73	0
Girth of stem at 3 feet,	8	0
Do. do. 5 feet,	8	9
Cubic contents,	87	0
No. 6—Height,	83	0
Girth of stem at 3 feet,	9	0
Do. do. 5 feet,	8	9
Cubic contents,	113	0

These trees are in perfect health, and having been allowed plenty of room, their heads are well developed, and average about 50 feet in diameter. The soil is a strong peaty loam, the surface being largely composed of decayed vegetable matter for several inches in depth. Near to Holwood Farm, between it and Keston Church, are numerous large and healthy specimens of the beech, the stems being clean and well-grown, and girth on an average about 10 feet at a yard up.

No. 3. Cedar of Lebanon.—This tree is the pride of Holwood, and it is questionable whether any other estate in Britain of equal extent contains either so many or so large specimens. Growing on the lawn at Holwood House are several stately well-branched trees, the largest of which is 62 feet in height, girths 14 feet 4 inches at 3 feet from the ground, and 12 feet 7 inches at 5 feet up, the diameter of branches being 72 feet. At 48 feet from this tree is another fine specimen, the girths of which, at 3 feet and 5 feet from the ground, are 10 feet 10 inches and 9 feet 7 inches, the branches being 57 feet in diameter, and the height of the tree being 72 feet. This latter tree is in a very healthy condition, more so than the former, which has a somewhat rusty appearance, particularly during winter and early spring. The branches of both are long and lithe, and sweeping the greensward. Their stems are straight and clean, and contain, the former 137 feet, and the latter 127 feet of timber. Another large and well-branched specimen stands opposite to Holwood House, the bole of which girths 12 feet at a yard from the ground, and 11 feet 11 inches at 5 feet up. The height is 67 feet, and the branches cover a diameter of 66 feet. This stately cedar is in perfect health, and is worthy of the conspicuous position which it so nobly fills on the well-kept lawn.

On the sloping ground between Holwood House and the farm are several large and highly-ornamental Cedars of Lebanon, planted almost in the form of a semicircle. The following are the dimensions of these, beginning at the left in advancing from Holwood House:—No. 1, height 57 feet; girths of stem at 3 feet and 5 feet, 10 feet 10 inches and 10 feet 4 inches; diameter of branches, 60 feet. No. 2 is 56 feet in height, with a girth at 3 feet and 5 feet of 9 feet 3 inches and 8 feet 3 inches, and a spread of branches covering a diameter of 51 feet. No. 3 has a height of 55 feet, spread of branches 60 feet in diameter, and a stem girthing 9 feet and 8 feet 9 inches at 3 feet and 5 feet up. No. 4, height 54 feet, spread of branches 52 feet, girths of stem at 3 feet and 5 feet up 6 feet 7 inches and 6 feet 6 inches. No. 4, along with Nos. 5 and 6, form a clump of imposing grandeur, the two latter having large and well-formed trunks, with girths at 3 feet and 5 feet up of 8 feet 8 inches and 8 feet 6 inches, and 7 feet 5 inches and 7 feet 3 inches respectively. No. 7 has a spread of branches 63 feet in diameter, a bole 61 feet in height, and girthing 10 feet 5 inches and 10 feet 2 inches at 3 feet and 5 feet up. No. 8, height 63 feet, girths of stem at 3 feet and 5 feet up 8 feet 8 inches and 8 feet 7 inches. No. 9 has a stem which girths at 3 feet and 5 feet from the ground 12 feet 2 inches and 12 feet, a total height of 65 feet, and a spread of branches 66 feet in diameter. This fine tree contains 190 feet of timber, the stem at 6 feet up dividing into three massive limbs, which rise clean and branchless for fully 20 feet. The soil on which these nine specimens of the Cedar of Lebanon are growing is a stiffish, rich, clayey loam, resting at no great depth on chalk. Around Holwood House there are many splendid specimens of the Cedar of Lebanon, while on the ramparts of the Roman Camp are not a few whose size and rich glossy appearance betoken perfect health and rapid growth.

Two specimens of this Cedar in the grounds at Keston are worthy of record; the largest, which stands close to the stables, has a girth of 12 feet 5 inches at 3 feet up, after which it divides into two limbs, which girth 7 feet 9 inches and 7 feet 10 inches at 3 feet from the fork. The height is 68 feet, and the spread of branches 61 feet. The other is in a secluded spot by the lake, and is 73 feet in height, with a stem girthing 11 feet 3 inches at 3 feet, and 10 feet 10 inches at 5 feet up. The spread of branches is 69 feet, and the bole contains 157 feet of wood. Numerous seedling plants have appeared beneath this noble tree, some of which are now robust specimens of 5 feet in height. This is interesting as showing that the Cedar of Lebanon reproduces itself naturally in this country.

At Hollydale is another picturesque cedar, with an umbrageous head, 72 feet in diameter. The stem girths 11 feet 2 inches at 3 feet, and 11 feet 2 inches at 5 feet up, the height being 61 feet. The soil is a rich stiff loam, resting on gravel.

No. 4. Evergreen Oak.—This tree thrives with great luxuriance at Holwood. To the south-west of the mansion are several large specimens, two of which, growing within a few yards of each other, measure as follows:—No. 1, height 49 feet, girths of stem at 3 feet and 5 feet from the ground 7 feet 10 inches and 7 feet 9 inches, spread of branches 48 feet, and total contents of tree 69 feet. No. 2 is 11 feet 10 inches in girth of stem at 2 feet up, after which it ramifies into eight large stems, which form a well-rounded head of about 50 feet in diameter. Another large tree is growing on the lower side of the public path that leads through Holwood park. At 3 feet and 5 feet from the ground it measures 9 feet 7 inches and 8 feet 11 inches in girth of stem, the height being 54 feet, and the spread of branches 37 feet in diameter.

No. 5. The Cork Oak (*Quercus Suber*).—Seldom indeed is it that finer specimens of this tree are to be seen than those at Holwood. Two of the largest occupy conspicuous positions on the lawn, one of which is 44 feet in height, the girth at 2 feet from the ground being 7 feet 5 inches, and the spread of branches 42 feet in diameter. The other is 28 feet in height, girths at 3 feet and 5 feet up 6 feet 4 inches and 6 feet, and has a spread of branches of 33 feet in diameter. Both these trees are highly ornamental. The bark is another striking feature of these trees, the cork in some instances being $3\frac{1}{2}$ inches thick, deeply furrowed, and of a pleasant light buff colour.

No. 6. Lime.—Forming a triangle on the lawn in front of Holwood House are three unusually large specimens of this tree, all in perfect health, as is evident by their well-developed heads. Their dimensions are as follows:—No. 1—Girth of stem at 3 feet and 5 feet up 9 feet 5 inches and 8 feet 9 inches, and containing 140 feet of timber. No. 2 is 10 feet 6 inches in girth at 3 feet, and 9 feet 7 inches at 5 feet up, and contains 218 feet of timber. No. 3 is 8 feet 8 inches and 8 feet 3 inches in girth of stem at 3 feet and 5 feet from the ground, and contains 110 feet of timber. The three specimens are of an equal height—87 feet—the combined spread of branches being 87 feet in diameter. These trees form a well-matched trio, and are, when in full leaf, objects of much interest. Another excellent example of the lime is growing close to the path from Hollydale House to the lake. At 3 feet and 5 feet up the well-rounded stem girths 11 feet 4 inches and 10 feet 3 inches, the spread of branches covering a space of 61 feet in diameter. The stem at 11 feet up divides into a number of limbs, and these shooting upwards to a height of 81 feet, as well as ramifying in all directions, form a head of great beauty. The soil is of good quality, being a strong clayey loam, with a subsoil of gravel. All over the estate the lime grows with the greatest luxuriance, and produces clean timber of large size. At Keston Lodge there is a path lined on one side with limes, while at Hollydale one of the drives runs along an avenue of this tree, and, during the heat of summer, is a deliciously cool retreat.

No. 7. Elm.—The largest and most beautiful specimen of the English Elm on this estate is growing close to the drive, and within 150 yards of the front door of Holwood House. At 3 feet up this fine tree girths 12 feet 6 inches, and at 5 feet 11 feet 10 inches, and contains 157 feet of timber. The height is 83 feet, and the spread of branches 69 feet. As regards the quality of soil on which this gigantic tree is growing, little can be said in its favour, it being for the greater part a poor gravel, overlaid with a small quantity of loam. Another grand elm stands without the garden wall at Hollydale, and close to the little gate leading to the lake. This specimen girths 12 feet at 3 feet up, and 10 feet 11 inches at 5 feet, the cubic contents being 213 feet. The height of the tree is 89 feet, and the branches extend over a space 81 feet in diameter.

The stem of this tree has but little taper, the girth at 12 feet being scarcely less than at 5 feet, while the ponderous limbs into which it divides at 30 feet up would of themselves form good-sized trees. The soil is loamy clay, resting at no great depth on gravel. On the chalk formation the elm does remarkably well, growing to a great size, and producing a large quantity of clean and valuable timber. At Holwood Farm are numerous stately elms, some of which grow where only a few inches of soil overlies the chalk.

No. 8. Thorn.—By the side of the drive from Holwood House past the Roman Camp are numerous large and healthy specimens of the Thorn, which, judging from their present dimensions, must be of considerable antiquity. One of these is 6 feet 5 inches in girth of stem at a yard from the ground, and has a spread of branches 39 feet in diameter. Others ranging from 5 feet to 6 feet in girth of stem at a yard from the ground, are not uncommon. Another perhaps unique specimen is growing in the park, and within a few yards of the public path where it joins the road at Holwood Farm. At 3 feet from the ground the stem girths 14 feet 6 inches, after which it divides into six limbs, the girth of each, at a yard from the fork, being as follows:—No. 1—4 feet 2 inches. 2—4 feet. 3—5 feet 8 inches. 4—2 feet 8 inches. 5—4 feet 4 inches. 6—3 feet 5 inches. The height is 42 feet, with a spread of branches 63 feet in diameter. This gigantic specimen of the thorn is in perfect health, branched to the ground in most parts, and grows in strong clayey loam. At twenty-five yards distant is another thorn worthy of note. At a yard from the ground the stem is 8 feet 11 inches in circumference, while the branches have a spread of 33 feet.

No. 9. Spanish Chestnut.—The largest tree of this kind is growing in the grounds at Keston Lodge, and close to the green walk running alongside the pond. At 3 feet and 5 feet from the ground the stem girths 14 feet 3 inches and 13 feet 1 inch, the branches having a diameter of 78 feet. At 7 feet up the stem divides into two large limbs, which rise perfectly straight and parallel with each other for almost their entire length. This tree is 78 feet in height, and is in perfect health and forming wood rapidly. Not far from this tree, but in Holwood bounds, and growing close to Lake No. 2, is another noteworthy Spanish chestnut, the stem of which, at 3 feet and 5 feet from the ground, measures 11 feet 2 inches and 10 feet 3 inches. So little taper has the stem, that at 8 feet up the girth is 10 feet. Sixteen feet in length of the butt contains exactly 100 cubic feet. The height is 67 feet, and the spread of branches is 60 feet in diameter. Soil, a strong clayey loam, on gravel.

No. 10. Locust-Tree (*Robinia Pseud-Acacia*).—This tree would seem, from the numerous fine specimens growing on this estate, to be well suited for Kent. Two of the largest are growing at Hollydale, close to the public road from Farnborough to Keston. The largest has a stem girth of 14 feet 10 inches at a yard from the ground, the height being 78 feet, and the diameter of branches 54 feet. The other girths, at 3 feet and 5 feet up, 11 feet 8 inches and 11 feet 7 inches, and contains 110 feet of wood. One of the largest limbs, which girthed 8 feet, was broken off this tree some years ago, but it is otherwise perfect. The height is 78 feet, and the diameter of branches 54 feet.

No. 11. Plane-Tree (*Platanus orientalis*).—On the lawn at Hollydale there is growing a large and well-furnished oriental plane. The height is 78 feet, diameter of branches 75 feet, girth of stem at 3 feet and 5 feet from the ground 11 feet 5 inches and 9 feet 10 inches, cubic contents 118 feet. This tree is growing in plastic loam, resting on roughish gravel, and exposed on all sides. There are many other specimens in various parts of the ground, but the one just mentioned is, perhaps, the largest, oldest, and most ornamental of any on the property. There are several varieties of plane, but *P. acerifolia* is the best and most distinct.

No. 12. Ash.—Of this tree there are very few remarkable specimens, the largest being, at 3 feet and 5 feet from the ground, 17 feet 11 inches and 18 feet 7 inches in girth of stem. The height is 68 feet, and the diameter of branches 66 feet. It is growing south-west from Holwood House, and close to the public path which leads through the park to the farm. The centre is hollow for some distance up, but the stem is of perfect shape for the first 7 feet, after which it branches, and at 8 feet girths nearly double what it does at 3 feet.

No. 13. Larch.—The largest Larch on the Holwood property is growing by the side of "My Lady's" path, a green drive leading from Keston Lodge past the lake. It is not an ornamental tree, but is indeed a great curiosity, the stem being bent in a peculiar manner, although it is otherwise well shaped. At 3 feet and 5 feet from the ground, the stem girths 11 feet 10 inches and 10 feet 6 inches, and contains 123 feet of timber. The height is 72 feet, and the diameter of branches is 66 feet. This fine tree is in excellent health, and forming wood rapidly, the soil on which it is growing being a stiff but rich loam.

No. 14. Yew.—Standing alone in the South Park to the north-east of Holwood is a noble specimen of the Yew, rendered conspicuous by its densely-branched and wide-spreading head, clothed with the healthiest of foliage. At 2 feet from the ground the stem has a girth of 20 feet 5 inches, and at 5 feet of 14 feet 1 inch while the branches cover a space 57 feet in diameter. Around this handsome tree is a neat iron fence, with a small gate leading to a rustic seat, which, during the heat of summer, forms a deliciously cool retreat. The soil is not of the best quality, it being a gravelly and clayey loam. Another noteworthy yew is growing on the south side of the Five Island Pond, its roots reaching the water. At 3 feet and 5 feet up the stem girths 13 feet 1 inch and 13 feet, the height being 42 feet, and the diameter of branches 42 feet. This is a very picturesque tree, the curiously gnarled stem giving it an aged and weird appearance.

Not far from this tree is one of the most peculiar cases of the junction of the stems of two trees—an oak and a yew—that has ever come under my notice. The combined stem of the yew and oak, which is of a perfectly normal shape throughout its entire length, is 7 feet 11 inches in girth at a yard from the ground, and 7 feet 10 inches at 5 feet up. The yew rises to 15 feet in height, and has a branch-spread of 36 feet; while the oak, whose height is 35 feet, has a diameter of branches of 54 feet. Both stems are so amalgamated into one, that were it not for the difference in colour of the barks, the point of junction could hardly be detected. For fully 5 feet up, at which point two large limbs are sent out by the oak, the yew takes up from 2 feet 2 inches to 2 feet 5 inches of the total girth of the stem, but how far the wood of the yew extends inwards has not been ascertained. At 2 feet from the main stem the two large limbs sent out by the oak girth respectively 4 feet 7 inches and 4 feet 9 inches, and as they grow on opposite sides—north and south—of the trunk, have an appearance that is very peculiar. The yew stem almost encircles the northern limb, and with it is completely amalgamated, the barks being quite level at their points of junction. When viewed from the public path, from which it is 11 yards distant, these combined trees present a curious appearance, particularly when the oak is destitute of leaves, the commingled deciduous and evergreen branches being then most noticeable. How this union of the two trees, but particularly an evergreen conifer and a deciduous hardwood, could have been brought about it is difficult to determine, but as both the oak and yew are of about equal age, in all probability they had been planted intentionally closely together when seedlings, and so grown into one stem owing to their close contiguity. Tying of the two stems together may likewise have been resorted to; indeed, owing to their nearness to the public path, this is quite likely.

No. 15. Cluster Pine (*Pinus Pinaster*).—The numerous large specimens of this pine which are growing on the Holwood estate, particularly at Keston, clearly prove that the climate and soil of certain parts of Kent are well adapted for the perfect development of this tree. On the right side of the drive from Keston Lodge to the gardens are a number of unusually large specimens, which have evidently been planted at the same time as the Scots firs with which they are associated. The following are measurements of six of the largest:—

		Feet.	Inches.
No. 1—	Height,	76	0
	Girth of stem at 3 feet,	8	6
	Do. do. 5 feet,	8	4
	Cubic contents,	92	0
	Diameter of spread of branches,	48	0
No. 2—	Height,	85	0
	Girth of stem at 3 feet,	8	8
	Do. do. 5 feet,	8	7
	Cubic contents,	112	0
	Diameter of spread of branches,	45	0
No. 3—	Height,	79	0
	Girth of stem at 3 feet,	8	4
	Do. do. 5 feet,	8	2
	Cubic contents,	97	0
	Diameter of spread of branches,	51	0
No. 4—	Height,	73	0
	Girth of stem at 3 feet,	8	4
	Do. do. 5 feet,	8	1
	Cubic contents,	93	0
	Diameter of spread of branches,	33	0
No. 5—	Girth of stem at 3 feet,	7	10
	Do. do. 5 feet,	7	9
	Cubic contents,	78	0
	Diameter of spread of branches,	51	0
No. 6—	Height,	60	0
	Girth of stem at 3 feet,	8	1
	Do. do. 5 feet,	8	0
	Cubic contents,	76	0
	Diameter of spread of branches,	48	0

These trees are generally destitute of branches to 40 or 50 feet up. In nearly every case the stems are perfectly straight, and with a very gradual taper, this being due to growing in close contact with other pines, and not allowed room to develop side branches. The bark on the stems is rough and rugged, and being of a pleasant light-brown colour, is readily distinguishable from that of any other tree. The soil is sandy, or rather gravelly, with a small admixture of peat, to a depth of a few inches.

On the Roman Camp are many specimens of the cluster pine, probably of the same age as the Scots firs among which they grow, and if so, were, in all probability, planted by Pitt when he owned the estate. One of the largest has a stem which girths 7 feet 10 inches and 7 feet 6 inches at 3 feet and 5 feet from the ground, is 67 feet in height, and contains 78 feet of wood. The Scots firs are not nearly so large as the cluster pines, and thus show that the *Pinaster* is by far the most rapid timber-producing tree. The soil of which the camp is composed is principally a rough gravel.

Growing on the lawn in front of Holwood House is another old and weather-beaten cluster pine, which, with its mop head and branchless stem, affords a striking contrast to the well-clothed and wide-spreading Cedars of Lebanon and evergreen oaks near which it stands.

No. 16. Holly.—This tree is everywhere abundant, but particularly at Hollydale. The largest, however, is one growing in the grounds at Keston Lodge. At 3 feet and 5 feet from the ground the stem of this giant holly measures 9 feet 4 inches and 9 feet 2 inches in circumference, and the branches cover a space 33 feet in diameter. The stem is enveloped in ivy, and the tree has suffered severely from the effects of the wind, the top being completely broken off, as well as many of the larger side branches. The height is 32 feet, and the tree is perfectly healthy, and will no doubt survive in its present shattered condition for many years. It stands close to the gravel path leading from Hayward's Lodge to Keston Lake. At Hollydale a part of an old oak wood is almost all hollies, many of them being from 40 feet to 50 feet in height, and girthing fully 5 feet at a yard from the ground. The holly is quite naturalised at Holwood, seedlings springing up with the greatest freedom in all directions.

No. 17. Birch.—The birch does not attain a large size at Holwood, the finest trees, with one or two exceptions, being at the Roman Camp and alongside the lakes. Immediately to the right of the green drive, where it crosses the Roman Camp, is a good example of this tree, and which, at 3 feet and 5 feet from the ground, girths 12 feet 2 inches and 12 feet 1 inch. At a few feet from the ground the stem divides into three limbs, whose girths at 3 feet from the fork are 5 feet 8 inches, 4 feet 1 inch, and 3 feet 7 inches. The branches have a spread of 57 feet in diameter, and the height is 62 feet.

No. 18. Scots Fir.—Many of these trees were planted about one hundred years ago, particularly those on the Roman Camp, when Pitt owned the Holwood property. The planting of the Camp has been executed in an admirable manner, great skill being displayed in the arrangement of the various clumps, so that they present quite a natural appearance, especially when viewed from the centre of the area enclosed by the rampions. The trees have been arranged generally in clumps of fives, sevens, and nines, but occasionally in twos and threes; and single trees have also been used with telling effect in adorning these grounds. Immediately to the right of the remains of the old road from Cæsar's Well to the Camp is a clump of Scots firs, seven in number, and planted in an oval. These trees are about an equal height, 68 feet, and the largest girths, at 3 feet and 5 feet from the ground, 6 feet 10 inches and 6 feet 7 inches, while the distance apart at which they stand is 9 feet. Further along, towards Holwood House, another clump of seven trees, planted in circular form, is to be seen, the individual trees standing at only 5 feet apart. The largest tree of this clump girths 7 feet 3 inches and 6 feet 7 inches at 3 feet and 5 feet from the ground. Many other instances might be given of the formal planting of Scots firs on the Roman Camp, but those already given are enough to show the peculiar way in which these historic remains were rendered beautiful by tree-planting.

Growing in the shrubbery at Holwood are several large Scots firs, two of which measure as follows:—

	Feet.	Inches.
No. 1—Height,	82	0
Girth of stem at 3 feet,	10	6
Do. do. 5 feet,	9	10
Diameter of branches,	35	0
No. 2—Height,	80	0
Girth of stem at 3 feet,	8	8
Do. do. 5 feet,	8	6
Diameter of branches,	33	0

Growing on the lawn, and on opposite sides of a walk, are two other Scots firs of picturesque appearance, the measurements of which are as follows:—

		Feet.	Inches.
No. 1—	Height,	78	0
	Girth of stem at 3 feet,	8	9
	Do. do. 5 feet,	8	7
	Diameter of branches,	45	0
No. 2—	Height,	78	0
	Girth of stem at 3 feet,	9	4
	Do. do. 5 feet,	9	3
	Diameter of branches,	57	0

At Hollydale, in the park between the ponds, is an oval-shaped clump of eight Scots firs, planted 9 feet apart. The oval is 30 feet in length by 20 feet in width, and the outline is quite perfect. The largest, that nearest Hollydale House, girths 6 feet 6 inches at 3 feet from the ground, and 6 feet 1 inch at 5 feet up, the height being 52 feet. There is reason to believe that this clump was planted at the instigation of Pitt, who was very fond of imparting his knowledge of tree-planting to the owners of neighbouring estates.

No. 19. White Poplar (*Populus alba*).—Of this handsome and fast-growing tree there are several fair examples in the grounds at Hollydale, where they attain a large size, in a dampish loam overlying a bed of gravel. Growing near one of the lakes is a clean-stemmed specimen of this tree, which is not so remarkable for the girth as for the uniformity of its stem, the girth at 20 feet being very little less than that at a yard from the ground. The following are measurements of two of the cleanest and straightest specimens:—

		Feet.	Inches.
No. 1—	Height,	82	0
	Girth of stem at 3 feet,	8	10
	Do. do. 5 feet,	8	9
	Diameter of branches,	45	0
	Cubic contents,	97	0
No. 2—	Height,	79	0
	Girth of stem at 3 feet,	8	3
	Do. do. 5 feet,	8	2
	Diameter of branches,	57	0
	Cubic contents,	67	0

No. 1 grows in the grounds at Hollydale, by the side of the public road; and No. 2 occupies a prominent position close to the smaller pond at the same place.

No. 20. Weymouth Pine (*Pinus Strobus*).—No tree of this kind on the Holwood property has as yet reached maturity, but several of large size and vigorous growth are to be met with. Growing on the ramps of the Roman Camp are several fine specimens, the largest of which we have measured having a stem girth 3 feet and 5 feet from the ground of 6 feet 8 inches and 6 feet 3 inches respectively. The height is 72 feet, and the greatest spread of branches is 42 feet in diameter. In all probability these trees were planted at the same time as the Scots firs and cluster pines already mentioned, and if so, a fair estimate may be made as to the respective rates of growth of these three species of pines. Soil, a rich gravelly loam.

No. 21. Wych or Scotch Elm.—Of this tree there is a large specimen on the south side of Holwood House, near to the public path. The dimensions are as follows:—Height, 72 feet; diameter of branches, 66 feet; girth at 3 feet and 5 feet, 12 feet and 11 feet; and cubic contents, 162 feet. This fine specimen of a wych elm has a tall, straight, and well-formed stem, from the base of which few suckers are ever emitted.

No. 22. Horse Chestnut.—A fine tree, which is not so remarkable for large dimensions as it is for symmetrical shape and ornamental aspect, stands near the road from Holwood House to Keston Church. Its dimensions are—Height, 54 feet; diameter of branches, 52 feet; girth of stem at 3 and 5 feet, 7 feet 9 inches and 7 feet 2 inches. This is the most remarkable specimen, so far at least as ornament is concerned, of the horse chestnut on the Holwood estate. It is growing in a gravelly soil, on chalk.

No. 23. Silver Fir.—The largest silver fir at Holwood is growing in the old oak wood which extends along the west side of the park, not far distant from the Five Island Pond. Another whose dimensions we also subjoin is growing in the shrubbery at Holwood House. The dimensions of both are as follows:—

	Feet.	Inches.
No. 1—Height,	92	0
Diameter of branches,	57	0
Girth of stem at 3 feet,	9	7
Do. do. 5 feet,	9	3
Cubic contents,	123	0

		Feet	Inches.
No. 2—	Height,	89	0
	Diameter of branches,	49	0
	Girth of stem at 3 feet,	7	2
	Do. do. 5 feet,		11
	Cubic contents,	92	0

No. 24. Spruce Fir.—In a few spots on the estate where the soil is a heavy dampish loam, the spruce fir succeeds fairly well; but where gravel and chalk predominate in the surface soil, the spruce is short-lived, and rarely attains a large size. One of the largest, certainly the most ornamental from its peculiar weeping habit, is growing to the west of Holwood House on a gently sloping bank, and where its characteristic features are brought prominently before the visitor who chances to stray along the beautiful green drives with which this part of the park abounds. This tree measures as follows:—

	Feet.	Inches.
Height,	59	0
Diameter of branches,	27	0
Girth of stem at 3 feet,	7	8
Do. do. 5 feet,	7	6
Greatest length of weeping spray,	16	0

No. 25. Horse Chestnut (two trees) raised from seed brought by the Earl and Countess of Derby from Ferney, Lake of Geneva, March 1873. These trees are growing at the top of the concrete pond at Keston Lodge, and on the margin of the carriage drive. They are both growing rapidly, the largest being 15 feet in height, and with a stem girthing 14 inches at a yard from the ground.

No. 26. Oaks.—A number of trees, raised from acorns planted for Mary, Countess of Derby, by Thomas Carlyle in October 1875. These are not in a flourishing condition, which can hardly be due to the soil, as other oaks growing in close proximity have attained to goodly proportions. The largest of these seedling oaks does not exceed 8 feet in height, and the average is 6 feet.

No. 27. *Quercus sessilis* (*Q. Robur sessiliflora?*).—This was reared in 1873 from an acorn brought from Burwood, Cranborne. It is 6 feet 7 inches in height, in a fairly healthy condition, and grows on the lawn, near the entrance gate to Keston Lodge.

No. 28. Flowering Ash (*Ornus europœus*).—There is a beautiful specimen of this interesting tree in the park in front of Hollydale House, which is a treat to view when in full flower. It is 35 feet in height, girths 4 feet 7 inches and 3 feet 11 inches at 3 feet and 5 feet from the ground, and has a spread of branches 27 feet in diameter.

No. 29. Mulberry (*Morus nigra*).—This tree is growing within fifty yards of the latter, and in an open though partially shaded situation. It is fully 25 feet in height, girths 4 feet 8 inches at 3 feet up, and 4 feet 7 inches at 5 feet from the ground, with a diameter of branches of 39 feet. Judging from the healthy appearance of this tree, it seems to be peculiarly well suited for the soil and climate of this part of Kent.

No. 30. Purple Beech (*Fagus sylvatica purpurea*).—Of this very distinct variety of beech there are numerous examples, some being of a great size, while others exhibit the richest colouring of foliage. The largest occupies a conspicuous position on the sloping ground to the south of Holwood House, and is the best furnished specimen I have ever seen. At 3 feet and 5 feet from the ground the straight and well-rounded stem girths 11 feet and 10 feet 11 inches, while the tree rises to fully 50 feet in height, and has a spread of branches 75 feet in diameter. The head of this tree is very shapely, and having at all times been allowed plenty of room for development the branches are long, lithe, and evenly distributed on the stem. The soil is a free and rich loam, resting on a bed of chalk.

No. 31. Cut-leaved Alder (*Alnus glutinosa laciniata*).—There are two specimens of this tree at Hollydale, both of about equal height and bulk of stem. The largest is growing on the margin of the lake, and almost opposite to Keston Lodge. It is 45 feet in height, is 6 feet and 5 feet 2 inches in girth at 3 feet and 5 feet from the ground, and has a spread of branches 45 feet in diameter. Both trees are objects of great beauty, the plentifully and finely-divided foliage being a source of much attraction. This variety of alder seems to be very partial to water, much more so than the normal form; indeed the finest specimens are always to be found growing with their roots within reach of water.

No. 32. The Catalpa thrives with unusual luxuriance in the grounds at Hollydale. A specimen on the lawn is 40 feet in height, and girths, at 3 feet and 5 feet from the ground, 3 feet 3 inches and 3 feet 2 inches. Owing to being crowded in between a huge beech and a deciduous cypress, the spread of branches is not in proportion to the height, but otherwise it is perfect.

No. 33. The Magnolia (*Magnolia cordata*) is represented by a large well-furnished tree, which seems to be quite at home in "The Garden of England," as Kent is designated. It is growing on the greensward within a few yards of the wall of Hollydale garden, and in a partially sheltered situation. When studded with its deliciously fragrant flowers, this tree is an object of much admiration. The height is 52 feet; girth at 3 feet and 5 feet from the ground 5 feet 11 inches and 5 feet 9 inches; diameter of branches 45 feet.

No. 34. The Umbrella Magnolia (*Magnolia tripetala*).—The leaves of this curious and handsome species are unusually large, and of a pleasing light green above, paler beneath, while the flowers are white, and produced about midsummer. About 14 inches is the average length of the leaves, while they are fully 5 inches in breadth. The largest plant of this magnolia is growing within half-a-dozen yards of the *M. cordata* above described.

No. 35. The Mexican Deciduous Cypress (*Taxodium Mexicanum*) is not a tree that may be relied upon as perfectly hardy in this country. At Hollydale, growing on the lawn, there is a fairly good tree, straight as an arrow, and fully 35 feet in height, with a stem girthing 3 feet 3 inches at a yard from the ground. During early summer this is a tree of great beauty, the light fulvous green foliage being pleasing almost beyond description. In autumn again it turns of a lovely pinky hue, and associates well with the majority of our forest trees whose foliage at that season is of a waning yellow.

No. 36. The Tree Box (*Buxus sempervirens arborescens*) has, in the grounds at Keston Lodge, attained to a height of fully 30 feet, and with a spread of branches 18 feet in diameter. The position in which it is planted is well sheltered, while the soil is a dampish loam incumbent on gravel.

XV. *Landscape and Economic Planting.* By CHARLES S. FRANCE, Bridge of Dee, Aberdeen.

Every one who travels and exercises those common attributes with which man is endowed—namely, the natural emotions of likes and dislikes in the objects which are always surrounding them, must be affected either pleasingly or otherwise by the profusion and variety with which nature has adorned the landscape; it may be by the rolling undulations of a comparatively flat country, by the sterile waste of the bleak muir or bare sandy down, or by the wild mountain range and precipitous crag. In these natural scenes the picture is invariably modified so as to relieve it of monotony and sameness by the sylvan beauties of our valleys, the distribution of larger tracts of woodland and forest on the more elevated reaches, or, it may be, by small isolated clumps, here and there, either announcing where more trees have existed, or indicating where trees ought to grow. These, and many other features, are all calculated to evoke feelings of interest and admiration in proportion as they strike the eye from given points, and produce pleasing emotions, or otherwise by association, in the mind of the observer.

Nature has thus provided many rich treats to the eye of the intelligent and thinking mind. These beautiful gradations of "wood and fell," of "light and shade," are calculated not only to touch the heart with the most gentle feelings, but are also intended to elevate and inspire the mind with high and holy emotions of reverence and awe, and

> "To trace in Nature's most minute design,
> The signature and stamp of Power Divine."

We must, then, admit that nothing approaches perfection in general beauty more than Nature if viewed aright. Still, even Nature has been subject to change, arising from many causes. Nothing on earth has escaped accident to its normal condition, nor has that which we call Nature had immunity from accidents and their influences. What we would call accidents to Nature have been brought about by many causes. It may have been the ruthless hand of the invader, the force of worldly circumstances, the uneducated work of man, or the convulsions of Nature herself. These and many other influences may have interfered with the normal condition of Nature; hence the necessity of human taste and skill being applied, in order to replace if possible what an abnormal state of things has brought about. This, then, in so far as it relates to our subject, is the work of the planter; and we will endeavour in the course of this paper to lay down a few general principles by which this may be accomplished. We admit the utter impossibility in the compass of a single essay to do anything but merely "tap the subject;" but we trust sufficient may be said to engender a desire for further and more minute study.

Planting for landscape effect may, however, have other objects than merely replacing what the accidents of Nature have deranged. Special circumstances may demand, on given and limited areas, the production of a distinct and complete effect. In such a case, in order to produce beauty in accordance with true principles, it may be found necessary to act in opposition to the teachings of Nature in its widest meaning. Permit me to explain this. We admit the natural distribution of trees in the landscape, both as an index to climate, soil, etc., to be economically the best guide. We further admit that in the distribution of colour, light, and shade, Nature is the best preceptor; but we must also recollect that Nature is far reaching. We do not see the whole picture. It is beautiful and complete as a whole, but the eye of man can only see a part. That part is obviously imperfect, as its proportions only bear a relation to the whole. For example, if we take a beautiful picture and divide it into several parts; looking at these parts separately, we will at once see grave inequalities both in colouring and relative proportion. The incongruities of the parts could only be harmonised by seeing it as a whole, as all the details bear a relation to the whole, not to a part. The part inspected separately is a meaningless daub—the whole is an exquisite work of art. In like manner also it is with Nature; we only see a part of the picture, and consequently we imagine we see certain incongruities. We then introduce art to elaborate on a small scale what Nature has done on a large. While it is right, therefore, to keep the laws of Nature in the forefront as the basis of beauty, it is not expedient to follow her in every detail, because wild Nature is not always and under all circumstances pleasing to the cultivated eye.

We consequently introduce art, based upon Nature, but refined to the circumstances, to satisfy the demands of educated taste. In order that this may be attained, certain general rules, or first principles, must be carefully studied, and not only so, but the operator must be, by natural intuition and experience, able to apply these principles in a careful and discriminating manner, so as to produce the desired result. With the view, therefore, of assisting in this inquiry, we would as briefly as possible notice a few of the points which we deem necessary in order to arrive at an approximation of the truth on this subject.

The first matter of study is the principles of Taste, as leading to the production of the Beautiful; and, while it cannot be expected that we can go into an exhaustive discussion on the different opinions that have been held on this subject, we may be permitted to draw the attention of the reader to what we consider are the more important points which seem to be germane to the matter, and which may be useful to the student.

The nature and the principles of taste are subjects which have been very fully treated by the following writers,—viz., Price, Knight, Burke, Allison, and Repton, and, as showing the complex nature of the inquiry, it is a remarkable fact that no two of these great men have absolutely agreed. Loudon, again, has condensed the views of all the foregoing, and we would recommend his works, along with those of Price, Repton, and Gilpin, as the best calculated to assist the student in the present inquiry, because they treat of the subject from a purely landscape point of view, while most of the other writers have made it the subject of philosophical or rather psychological study.

Price devotes his inquiry to the definition of the picturesque; Burke endeavours (and has, perhaps, done more than any other) to illustrate what is "the Sublime and Beautiful;" and Knight in many respects controverts the views of both, as well as some of those of the more practical Repton. Allison, on the other hand, while clearly laying down lines of his own, summarising the truth, and casting aside errors, has, in his admirable "Dissertation on the Nature and Principles of Taste," to a certain extent finished the discussion, by carefully eliminating the doctrines of each from their fallacies, and bringing into clear relief what is really the definition of true taste. This has been expressively and succinctly given in a summary, which, for the benefit of the reader, I will shortly recapitulate in as near as possible the words of the author. The two primary objects of inquiry which he lays down are—*First*, "The investigation of these qualities that produce the emotions of taste;" *Secondly*, "The nature of the faculty by which these emotions are received."

It will be obvious that the two qualities or objects should be considered together, for he says, "We can never ascertain what is beauty without having clear notions of the state of mind which it produces, and in its power of producing which its essence consists; and it is utterly impossible to ascertain what is the nature of the effect produced by beauty on the mind, till we can decide what are the common properties that are found in all the objects that produce it."

It would therefore appear that the view Allison held was, that the feelings which actuate our minds from the contemplation of beauty are not engendered by any physical or absolute quality in the objects we contemplate, but by the association in our imaginations of them with other objects which are interesting or affecting, such as love, pity, fear, veneration, or some other common or lively emotion of the mind.

The fundamental principle of this theory is, that all objects are beautiful or tasteful, or even sublime, which suggest to our minds some simple emotion, such as love, pity, terror, or any other social or self affection of our nature, and that the beauty we ascribe to them consists in the power they have by association, or otherwise, of reminding us of the proper objects of these familiar affections, or of some other similar emotion which we have felt on a former occasion when identical feelings of the heart and mind were evoked. We are by no means prepared to give this theory an unqualified assent, because there are various arguments that may be advanced against it in its bare and skeleton form; but as a safe basis from which to start, we think it may with certain qualifications be generally admitted.

It may be said now, however, what has this to do with the main object of this paper? the doctrine is so speculative that it may be deemed as quite inapplicable. We will endeavour to show how it is completely germane, and thoroughly in keeping with our present object. There can be no doubt that in creating beautiful objects in the landscape, or in making the objects around us pleasing to the eye, all the qualities enumerated above must be understood and, if possible, so arranged as to evoke the emotions necessary to to constitute beauty or good taste. At one time smoothness and regularity may draw forth a feeling of pleasure, at another time ruggedness and irregularity may have the same effect; but these are relative either to objects immediately in association with them, or as bearing affinity to some other similar object created by past experience or recollection. We will take an instance or two so as to illustrate our meaning. For example, see yon old ruin, the stones of which are gradually crumbling into decay, the green ivy clinging around it to shield it, as it were, from the damaging influence of the atmosphere. Examine it closely; is it beautiful in itself? are those crumbling stones and lime inherently beautiful? No; but the contemplation of that old structure is beautiful to the eye, because it carries the mind back to years long gone by. It may be the only remains of some departed glory in either Church or State, or it may be the link which ties the present with the memory of some great man, or some epoch in history which draws forth feelings of interest and respect, veneration, love, or pity; or long ago within those walls may have been enacted some terrible tragedy, which even now produces a sense of horror in beholding the spot. See again, that old gnarled tree, it may be an oak, with twisted branches, hollow stem, and apparently existing only by a miracle in nature. In itself it is ugly, no symmetry, partially decayed, struggling for an existence, or perhaps dead altogether. Can there be beauty in it? Yes; there is beauty to the mind that can be affected with past associations. That tree may have withstood the blasts and convulsions of hundreds of years; beneath its ample shade deeds may have been done which thrill the heart; or among its spreading boughs it may have hid one whose name is associated with historical events which interest and draw forth the tenderest or most patriotic emotions of the heart: consequently it is beautiful. Now, true taste is the creation or arrangement of existing objects of this or a kindred description, so as to produce in the mind true beauty.

Let us now endeavour to apply this in the further and more particular consideration of our subject, and in order that this may be done as perspicuously as possible, it is necessary that we should define the objects of ornamental planting. This we will shortly put under three heads—

First. Planting around a country residence, or in the home park for ornamental purposes.

Second. The general distribution of trees over a large area of country with the view to landscape effect and general utility.

Third. Hints on the distribution of different varieties of trees with a view to the picturesque and beautiful.

1. *The Ornamental Planting of the Grounds around a Country Residence, or in the Home Park.*

As this is a branch of the subject which may be more particularly defined under the name of "Landscape Gardening," the sphere of operation is necessarily circumscribed, and has consequently to be dealt with as distinct from the larger question.

The object of the distribution of woods, plantations, etc., in a home park may be said to be of a purely decorative or ornamental description, and while the principles of general utility must always be kept in view, they do not form so large a consideration as the question of creating a beautiful picture which shall be pleasing from various points of observation.

The difficulties which present themselves to the landscape gardener in the carrying out of this are sometimes very great. While he is an artist supposed to execute a natural picture in accordance with the principles of good taste, he has at the same time often to create a picture, pleasing to a certain individual, his employer, who may not agree with him as to what is good taste. As already pretty fully adverted to, however, taste is an emotional quality of the mind, and therefore subject to many different alterations, in proportion (1.) to the constitution of the mental condition at given times; and (2.) to the various circumstances which from time to time may affect it; and consequently it is obvious that while there are certain very distinct lines by which the successful operator must be guided, he in many cases must make these subservient to the necessary variations of each particular case.

It would be trespassing too much on the patience of the reader to go into details on this point, beyond merely adverting to it in passing. Moreover, our chief object is shortly to give some practical hints for general application, rather than to go into the theoretical phases of the subject, and delineate, as near as we can, the lines upon which the planter ought to proceed in adorning a home park.

The first consideration is the nature and extent of the ground which has to be treated, and the situation of the mansion-house, or main object from which the different views of the effect are to be observed. This, therefore, being the point of greatest importance, it should be the centre from which the main body of the plantations should radiate, and while these need not be continuous, they should have the appearance, at any distant point, of forming a principal feature of the park. The objects in this arrangement are various. It gives shelter and the appearance of warmth to the mansion, and can be utilised for covering up any necessary outbuildings which may interfere with its appearance; at the same time, it can be made effective in closing up from the mansion any object not pleasing to the view in its immediate vicinity, such as stables or other buildings necessary to the establishment. From this main body or mass must then diverge all the lesser plantations, strips, or individual trees—in other words, the further distribution of trees in the park, which must, however, in all instances be relative to this initial point.

In laying out this central body care should be taken to preserve all far-stretching views from the mansion, either by vistas through the mass, or by larger openings, such as glades or partially enclosed spaces of grass, in order that from several points at the mansion, or in the private grounds, pleasing views of distant objects may be preserved, as well as views of the farther woods in the park, or beyond its limits.

In forming the more distant plantations, the shape which they are to take must be settled very much in accordance with the general nature of the ground, as well as their relation to the main body. If the general surface of the ground is level, as in many parks in the midlands of England, straight avenues and individual trees are quite admissible, or even groups to give breadth at certain points; and an informal mass on any point which will not obstruct a view may be introduced with good effect. The ground being level, the natural consequence is, that any given area looks much less than the same extent would do if it was hilly or rolling, and the introduction of properly distributed individual trees, groups, avenues, or, it may be, larger masses, gives an idea of extent, or lengthens the distance, which is here so much required.

Should the ground be hilly or rolling, the treatment is different. Avenues should be avoided as much as possible—in fact, avenues on uneven surfaces are, as a rule, not in good taste, being too formal. The hills or rising ground should be planted in irregular masses, and the lower ground left free from trees, because planting the hills always increases the effect, while planting the valleys, and leaving the hills bare, diminishes the idea of extent. These masses should be so distributed as to permit of views of the intervening glades being seen at a distance. The planting of belts is, and has been, very common in home parks, and no doubt there are cases in which they are essential; but as a rule they should be avoided for several reasons—(1.) because they are unprofitable; (2.) they are too formal; (3.) they are liable to convey the idea of being closed in; and (4.) they in many cases obstruct views of distant objects of interest which always ought to be conserved. Except therefore it may be for shelter, or to shut out or cover up some unsightly object, belts should not be adopted in park planting.

This is a very cursory outline of a few of the different points to be observed in laying out plantations in a demesne or home park. There are, however, many other little details which naturally reveal themselves in order to satisfy taste and local circumstances, but which could only be fully described on a given subject being presented to view, accompanied with a series of detailed drawings to illustrate the case. Our end being to lay down general principles rather than elaborated details, we allow each individual case to be treated as may be found necessary in accordance with these principles.

2. *The distribution of Trees over a large area of country, with the view to Landscape Effect and General Utility.*

We now approach the second head, and assume that the question is—the planting, or distribution of plantations, in a wide district, with the view to improve the landscape, as well as for general utility.

It may be said that Nature is here the true preceptor to follow, because the object being more general and less of an artificial character, the adoption of Nature as the sole guide is the proper course. Now we are by no means prepared to admit this without a considerable qualification. In laying out a district for such a purpose as indicated, we must always bear in mind that, extended though the area may be as compared with the ornamenting of a demesne or home park, even here it is circumscribed as compared to Nature in its widest acceptation—in other words, we wish to make a complete picture of what is necessarily only a portion of the one great picture. Again, we must rectify and rearrange the accidents before referred to, with the view of bringing out true beauty. To achieve this it may be necessary to depart in a great measure from those arbitrary rules which a study of Nature would inculcate, because here as well as under the former head, local circumstances, general utility, and the physical aspect of the ground, must all exercise an influence on the course which it is necessary to adopt. In proceeding practically to the carrying out of these ideas, it is necessary to consider and settle the quantity of ground to be planted, bearing in mind always only to plant the least valuable land, and also to consider and arrange the forms those plantations should take, and their relationship to each other, so as to produce, as much as possible, a proper balance in the landscape, while at the same time having them so distributed as to render not only mutual shelter, but also shelter to the cultivated land around them.

In planting a large extent of country, the primary object is not so much landscape effect, although that ought to be very prominently kept in view, as the profitable covering of the less fertile land, the sheltering of neighbouring arable land, and, in short, devoting the ground as a whole to the most useful and profitable purposes.

Having fixed the locality and extent of the different plantations, the next step is to arrange definitely the form or boundaries of each. We may here premise that anything opposed to utility is bad taste, because otherwise the main object would be sacrificed to the less. While irregular boundaries in a state of wild nature are generally the rule in a waste and uncultivable country, it would be eminently bad taste alongside of good arable land, where such an arrangement would entail much extra expense in the working and cultivation of the soil. In this case, therefore, straight boundaries along cultivated fields are by no means ugly or out of taste. Small groups or individual trees ought also to be avoided on such ground, as tending to incommode profitable cultivation, besides producing unprofitable timber. The ground selected for planting should generally be the least valuable; but even at the sacrifice of a portion of the more fertile the plantations should be in good large masses, so distributed as to produce a pleasing effect, while at the same time laid out with the view to produce the best timber. Nature generally plants the valley, and leaves the hill tops bare. We would, however, reverse this so far by planting the hills and leaving all the valleys or lowlands fit for cultivation bare of trees, while at the same time any sheltered glens that are too narrow, or whose banks may be too steep for profitable cultivation, ought to be planted. In planting hillsides, it is always well to make the upper outline as irregular as possible, if it is impossible from the altitude to carry the plantation over or up to the top of the hill. In this case the irregular outline is better than a straight line. It is here we again apply the teaching of nature—first, because there is no economic object to be attained by a straight line, and it is here that rugged nature ought to be shown, as it conveys the idea that altitude or climatic influences have prevented the plantation from naturally existing higher. So much for the planting of a hilly or rolling country.

On a level country, again, the treatment must be different. Large masses are not so essential, except, it may be, on a flat sterile plain too poor for profitable cultivation, in which case large masses are not only quite admissible, but the proper form for the plantations to take; but in a rich and fertile district it would be too great a sacrifice of good ground. Smaller masses may be with advantage introduced, however, and hedgerow trees alongside of roads and lanes, but not in hedges or fences, as they, by their shelter or otherwise, might unduly interfere with the ripening of neighbouring crops. The ornamental object in planting level ground is not so much to create a picture, because the extent open to the vision is very limited, hence form or relative effect is not so apparent as to break the level surface, and in doing so enhance the beauty, by conveying an idea of extent and creating interest in the beholder, while the introduction of plantations breaks the damaging influences of prevailing winds, and shelters the intervening lands both for the production of crops and the pasturage of stock.

Beauty being a purely relative quality dependent on the circumstances under which it is contemplated, and the associations attached to either the object or the mind of the beholder, it is quite possible that as much beauty may be conveyed by the beholding of a comparatively flat or even rolling country, rich in sylvan treasures, as in the wilder and more rugged scenery where woods and jagged crags are the prevailing objects in the landscape. Each has beauties peculiar to itself. It is then the duty of the planter to endeavour to realise what are the conditions necessary to produce their several effects in accordance with the principles of good taste; and it may be said that this consists in the most implicit attention being paid to the following—viz., "Utility, proportion, and unity, or the general harmonising of all the parts and circumstances to the whole."

3. *Hints on the proper Distribution of Trees, with a view to Effect in the Landscape.*

We have hitherto been dealing entirely with those branches of the subject which may be classed under the following heads:—Taste, form, and the proper distribution of plantations in the landscape under two different conditions—viz., in a home park with a view to ornament alone, and over a large area of country, where ornament and utility are each combined.

We now desire to draw attention to the material by which these several objects may be best accomplished.

In the case of the grounds surrounding a residence, be it small or large, the treatment must necessarily depend in some measure on the desire and peculiar taste of the proprietor, and that must be further qualified by the situation, soil, and other local circumstances. In order to make a beautiful or pleasing arrangement of trees and shrubs, the first consideration is, to use such plants as are likely to suit the locality and display their natural characteristics. Again, form must be closely studied so that trees which naturally assume certain distinct forms or shapes are introduced where such forms will be in keeping with the position occupied by them. We may class trees under three heads—Spiral-shaped, such as the spruce; oblong-headed, such as the Lombardy poplar, and some of the cypress tribe; and round-headed, such as the oak, beech, and many other trees. As most plantations, whether they be large masses, groups, or clumps, are seen in profile, it must be obvious that the introduction of spiral-shaped trees as forming the margin of any group, is not good taste, because they are too formal and stiff. Round-headed trees are, therefore, much more in keeping, because there is greater variety in the form of head and distribution of the branches, while as regards height they are more likely to form an uneven surface to the eye, and by that means give light and shade to the general picture. We therefore recommend that in producing a pleasing effect by planting groups or clumps, the preponderance ought to be given to round-headed trees. At the same time the introduction of a spiral tree here and there may form a pleasing contrast; but care should be taken that they are only introduced so as to produce this, or it may be colour at given points. On the other hand, if they are planted in small groups, or one or two introduced along the margin of a thicket, or in the bottom of some dingle or sheltered spot where their form will not improperly interfere, the general effect will probably be enhanced. Again, on rocky or uneven surfaces, and among hills, the spiral-shaped trees are in their proper place; indeed, it is their natural habitat. For general ornamental planting, we think that round or irregular headed ought to have the preponderance, with those of an oblong or fastigiate form sparingly introduced among them, as they blend better than the more formal spiral trees.

Another very important point which must be kept in view is the selection of trees likely to attain a certain size and height; and the commingling of those trees, so as to produce effect without conveying the idea of crowding. No doubt in planting it is necessary to plant at first pretty thickly, so as to encourage growth, and thereby enable the trees to assume their natural characteristics; but in laying out mixed plantations for ornament, care should be taken to plant such trees as are intended to form the permanent crop, at such distances that they can be preserved in the subsequent thinnings. Ligneous plants are divided into two classes, viz., trees and shrubs; and each class varies materially in individual magnitude. A proper study therefore of this characteristic is of the first importance.

The next point to be considered is the different kinds of trees most suitable for ornamental planting. As already hinted, this must greatly depend on circumstances—viz., soil, situation, and the object desired. The list from which the planter can select is, we may say, almost inexhaustible.

Among trees which are indigenous to Britain we may enumerate the following: oak, ash, beech, Wych or Scots elm, English elm, sycamore, alder, birch, several species of willow and poplar, and last, though not least, we have the only indigenous member of the fir tribe in our Scottish pine. Among exotic kinds which have been introduced to Britain, none have furnished more choice species than the order of *Coniferæ;* while many of the American maples judiciously distributed form a beautiful contrast of colour when blended with our more stern foliaged trees. In a paper such as this, it is unnecessary to give a list of the many trees and shrubs at the command of the planter, to enable him to produce results satisfactory, not only to good taste, but also to utility. We therefore pass that over, and in the subsequent remarks will advert more to the disposition of varieties in ornamental plantations in relation to form.

We will presume that the outlines of an existing plantation require to be broken, and, to accomplish this, it is necessary to plant a group, or single trees, on the verge of this plantation. In doing this, regard must be had to what the body of the plantation is composed of. The introduced group ought to be the same; by this means harmony and unity are produced, while if trees entirely different were planted, the opposite would be the effect. If, however, in the planting of a protuberance, or group, it is found necessary to make that protuberance more apparent, and show a more decided recess in the outline, one or two distinct trees, not too dissimilar in shape, but possessing greater depth of colour, may be introduced with advantage, without in any way detracting from the harmony.

In general planting for ornament, it is held by some that mixed plantations furnish the greatest amount of beauty. Now this is a matter that is by no means clear, and cannot in our opinion be held as an arbitrary axiom. On the contrary it is subject to very great objection. By mixing up all varieties in general planting, there is no real variety, as the eye is always seeing the same thing, and, as Repton says, "Variety is destroyed by the excess of variety." But by grouping certain kinds by themselves this is not the case, because the eye passes from one group to the other, and hence receives, as it were, a fresh impression. We are therefore inclined to think that, as a general rule, the promiscuous mingling of varieties in a plantation is a mistake, and we would under all circumstances prefer the planting of each separate species in groups. These may be large or small as the circumstances may admit, but done in such a way as to prevent them from palling on our sense of beauty, by conveying an idea of sameness.

Another point which we would refer to here is, what we would call the associations of trees. Different varieties of trees have attached to them certain attributes by association, either arising from historical connection, peculiarity to certain soils or localities, or in connection with their generally-applied uses; and, as the creation of objects of interest is one of the first considerations of the landscape gardener or planter, it is well that this should not be overlooked. The oak and yew convey an idea of permanency, strength, and antiquity; the cypress and the weeping willow an impression of veneration, the lime and sycamore of luxuriance, the alder and the mountain ash of poverty or sterility, and so on. It is well therefore that these qualities should be borne in mind, so that they may be either introduced where an impression in accordance with their distinctive associations is necessary, or calculated to produce interest; or, on the other hand, avoided where such an association would be incongruous.

We have endeavoured to condense in as short a space as possible what we consider the most important points on this head of the subject, but obviously much more could be said in order to make all points clear. Space, however, will not permit of our going more minutely into the subject, but we trust sufficient has been said to convey to the reader a fairly correct idea of the general principles prescribed.

It is now necessary to advert very shortly to the distribution of different varieties ornamentally, where the plantations are on a more extended scale, and where the main object is the profitable adorning of the landscape. Under this head it must be understood that the principle object is utility, and that, in regard to the ground plan, it has been already pretty fully gone into. The chief matter now to be considered is, How to combine the greatest profit with the utmost possible beauty in general effect? We can conceive of no better distribution of trees under these circumstances, than to plant in each situation the trees which are by nature best suited to it; because, the more naturally the trees are distributed, the more will they display their inherent beauties, which we conceive is really true beauty. The promiscuous mixing of many different kinds of trees, some indigenous, some exotic, some evergreen, and some deciduous, without relation to their suitability to the soil and situation, is in our opinion not only devoid of beauty, but is, to say the least, vulgar. We do not in any way find fault with a mixture of different trees all likely to grow well, and produce not only good timber but show variety in foliage; nay, we distinctly say that is perfectly good taste where it can be accomplished; but that all large plantations should be so mixed, simply for variety in foliage or individual form alone, is preposterous. Let there be mixed plantations where they are likely to be profitable, but let there also be plantations of one variety, such as Scots fir, larch, oak, or even of some of our more recently introduced conifers, where they are likely to produce a really profitable crop.

It is in such masses that trees of all kinds, if they are on their proper soil and situation, are most likely to display their true characteristics; hence true beauty. There must be no patching here. Let everything be conceived and done in proportion to the extent of the work. No petty intermingling of patches of colour here and there will either add or detract from the general beauty of the design, if done in the way indicated. Where utility is accomplished, beauty exists; and where proportion of design and harmony of outline and colour form the chief points, then the landscape may be said to be pleasing to the eye, and beautiful to the senses.

XVI. *On the Advantages of forming Belts of Plantations on Hill Pasture Land.* By Thomas Wilkie, Forester, Tyninghame, East Lothian.

As an enormous number of sheep are grazed upon our hill pastures, and a large percentage of them are left there through the winter to find their food, in most cases upon cold bleak exposures, any means that can be adopted to add to their comfort and safety ought to be hailed with satisfaction. During severe storms thousands of them lose their lives, and others become so emaciated that many deaths follow, which means an almost incalculable loss to the owner. The knowledge of this ought to prompt us in our desires and endeavours to prevent suffering to the sheep and danger and anxiety to the shepherd.

During the year 1885, there were stated to be, in the agricultural returns, 6,957,198 sheep in Scotland, and for the year ending 4th June 1886, 6,603,611. It is a well-known fact that sheep have some natural premonition of the coming storm, as I have seen those on the higher elevations coming down six or eight miles on the approach of a storm to seek for shelter from its fury in the lower grounds. If shelter is not naturally provided there, we ought to adopt the best means at our command for forming it.

But serious as is the loss of stock in times of storm, cold wet springs are often as destructive as is the winter's hurricane. Ewes become so weak and lean that they often are so reduced as to be unable to give birth to their young, or if they do, they fail to give the necessary support to them afterwards; and thus we find the number of lambs very much less in severe seasons than in others of a more favourable nature. The past spring (1888) has been one of this severe description, and I have had reports from various quarters stating that it was one of the worst lambing seasons experienced for many years. All my correspondents agree in saying that had shelter been provided, a much less percentage of deaths would have resulted; and several cases have been specially referred to where the death-rate has been much lower, owing to the presence and sheltering influences of plantations.

In laying out belts of plantations on hills for shelter, the experienced owner, or observant shepherd, should be consulted, as they are better acquainted with the peculiar and general wants of the land. It may, however, be unhesitatingly asserted that the plantations should be so laid out that shelter on all sides will be provided, in order that a more comfortable resting-place may be had, as well as the security of the stock provided for, and that irregular or crooked margins following along the base of a ridge running up and down the hill should be the fixed boundary lines. The width of these belts may vary according to the width of the ridge, and may be stated at from 100 to 250 yards, and the highest belt should be made the widest, say from 250 to 500 yards broad, so as to give increased density to resist the storm. In order that freedom be allowed to the stock to roam at pleasure in search of their food, I would suggest that no belt should extend continuously without a break every 1000 or 1500 yards, and the higher and lower extremities of each should terminate in the hollows of the ground. Those lowest down, where it may be necessary to give artificial feeding, should have a broad base, enclosing a square or circular piece of unplanted ground, of such a size as may be necessary for the safe accommodation of the stock, and so formed that it may be easily accessible in any emergency, advantage being always taken of any natural shelter. No belts should be formed near ravines or rivulets, where sheep may congregate and be suffocated under the accumulated depth of snow. Should a belt be required where no prominent ridge occurs, or on a neck of land where contrary currents meet, it must be formed of greater width.

Draining may be necessary where the lower belts are to be formed, but if the ground is considered in a good condition for pasturing, I hold that fir plantations will grow without any more drainage. Better to shorten the length of the plantation than to have large ruts formed near the lower base, in which sheep may be lost or injured; and as I propose setting plants on ridges or "shanks," as they are locally termed, it will be understood that the ground will have a slope on at least three sides, hence stagnant water will seldom if ever be found. Pine timber absorbs a large amount of moisture, and unless where water is stagnant I would not recommend the formation of drains.

Fencing is often one of the most expensive items in connection with the formation of plantations, but in the circumstances under consideration, shelter and not profit from the crop being the main object, the fences ought to be of the best class. Where stones can be had, and the ground is not too steep for the erection of walls or stone dykes, these are the best for adoption; but where too steep for their erection, or stones are absent, galvanised iron and wire fences are the best and most durable. Short sections of stone dykes might, however, be erected in many instances, which would shelter both the newly-formed plantation and the grazing stock at the same time. In erecting the iron and wire fences, care should be taken that the holes in the iron standards are only as large as will allow the wire to be passed through, as, if the holes be larger and the wires have room to play, the constant movement produced by the wind, and consequent friction against the standards, causes the wires to be cut through in six or eight years especially at high altitudes. Both standards and wire should be of a strong description, as the snow may gather in heavy wreaths and destroy the whole at a time when the damage cannot be repaired, and the stock thereby have access to, and might destroy the crop in the plantation.

The best trees for the purpose are the Scots Fir (*Pinus sylvestris*), the Austrian Pine (*P. austriaca*), the Mountain Pine (*P. montana*), the Birch (*Betula alba*), and the Mountain Ash (*Pyrus Aucuparia*), all well-known hardy trees, which, although planted at an altitude of 2000 or 3000 feet, will grow well, and produce the shelter required. At and under 1600 feet elevation the larch and Norway spruce (*Abies excelsa*) may also be used. The pines on the higher and drier portions of the ground should be mixed with the birch and mountain ash, and the lower belts planted on the same principle, but may have the larch set on the less exposed portions, with spruce and birch mixed in the dampest sections along with the Scots fir. The mountain pine need not be planted at elevations under 1200 feet. The plants at high altitudes, or above 800 feet, and those to be set on exposed promontories or bare margins, should be 1 year 1 year plants of the pines, and the birch and mountain ash 6 inches to 9 inches in height. The lower belts, in cases where the herbage is rough, may be planted with 2 year 1 year; or if at elevations of only a few hundred feet, 2 years 2 years pines and larch may be used, and also plants from 9 to 15 inches of birch and mountain ash. Wherever the surface is broken, birch seeds might advantageously be sown, and a few hazels set in the ground. All should be planted at $2\frac{1}{2}$ feet apart, with a view to encourage an early start and produce the desired effect as soon as possible.

Remarks.—From 5 to 10 per cent. of sheep stock would be saved from suffocation in the snow, by the protection afforded to them by the sheltering plantations; and from 10 to 15, or even 20 per cent. of ewes and lambs from death by the evil consequences of a cold wet spring. Then we may safely reckon that a much less percentage of the stock would be attacked by what is known as "trembling," and other diseases arising from cold and exposure, and hence the increased numbers and value of the stock, producing a greater return to the tenant, a larger rental to the proprietor, and cheaper meat and clothing to the people. If such are the approximate results in bad seasons, we may also anticipate a favourable return in ordinary ones; but without doubt we would produce a healthier and heavier stock, and I affirm that the pasture would be materially improved; it would come away sooner in the spring, and remain fresh later in the autumn. We would also be showing a proper feeling of sympathy towards the harmless sufferers from inclement Nature, and confer a boon and draw forth the praise of succeeding generations, as the plantations, if carefully attended to, would afford good shelter for 200 years to come. And let us hope that, before they are cleared, the fallen seeds will germinate and perpetuate the blessing.

XVII. *The Giant Arbor-Vitæ* (Thuja gigantea). By A. D. Webster, Holwood, Kent.

The climate of Great Britain is well suited for the culture of this handsome, fast-growing, and valuable timber-producing tree, as it thrives luxuriantly in a cool moist soil, and although introduced only thirty-six years ago, there are numerous specimens fully 70 feet in height to be met with in various parts of the country.

Perhaps the name of no other tree has been the subject of so much confusion; even the honour and date of its introduction to Britain is a matter of dispute. Veitch's "Manual of Coniferæ" states that it was introduced by them, through their collector, William Lobb, in 1853,—a statement which receives little credence from Edinburgh authorities; for in the "Transactions and Proceedings of the Botanical Society of Edinburgh," 1872, Mr James M'Nab tells us that "a Thuja, raised from seed, and proved to be the true *Thuja gigantea* (Yellow Cypress), is another acquisition first sent by Jeffrey. At first the seedlings resembled *Thuja occidentalis,* and little attention for a time was paid to them."

This statement is rendered all the more probable by specimens taken from three of the trees raised from seed sent home by Jeffrey to the Oregon Association, and now growing in the Botanic Garden at Edinburgh, which were recognised, about three years ago, by some of the Kew authorities as "forms of the true *Thuja gigantea.*" It is also well to remember that both *T. gigantea* and the nearly allied *T. plicata* grow side by side in their native wilds, which, coupled with the fact that two more of Jeffrey's seedlings were recognised by the same authorities as *T. plicata,* goes far to substantiate Mr M'Nab's remarks. When sending the specimens to Kew for examination, the Curator of the Edinburgh Botanic Garden stated they were from plants "raised from seeds sent to Edinburgh by Jeffrey in 1851." This statement, along with the recognition of the specimens by so high an authority as forms of the true *T. gigantea,* gives Jeffrey's claim two years of priority over that of Lobb. The tree under notice has also been named *T. Menziesii,* and *T. Lobbi.* It is, however, the true *T. gigantea* which was first described by Nuttall in his "Plants of the Rocky Mountains," and this is now the recognised name.

Soil, Situation, and Exposure.—Professor Macoun, botanist to the Geological and Natural History Survey of Canada, tells me that he has always found the largest specimens of this tree in damp alluvial deposits; indeed, that it is almost unknown in the dry central plateau, but plentiful along the coast and rivers, as well as in the great mountain valleys. Judging from its growth on an estate in this country where it has been planted by the hundred, and under varying circumstances as regards soil and situation, we should say that a deep and dampish sandy loam best suits the Giant Arbor-Vitæ, although we have seen it doing well and forming timber rapidly on decayed vegetable refuse, rocky slate *débris*, gravelly loam, loam of a plastic clayey nature, and well-drained peat bog. In each case, however, abundance of moisture was present in the soil—not stagnant, but sufficient to keep the soil in a dampish condition, and prevent it becoming dust-dry even in the hottest and driest of summers. We measured recently several specimens of this tree, which were planted twenty-five years ago in a deep, rich, sandy loam resting on gravel, with a deep surface layer of decayed vegetable matter, and found the average annual upward growth to be 2 feet 8 inches; whereas others, planted at the same time on a fairly rich but rather dry gravelly loam, had made hardly 2 feet. Of twenty-four trees measured, the average annual growth was found to be 22 inches; but no special care, either in the planting of the trees or choice of soil, had been bestowed on them. On reclaimed bog the upward growth of the tree is surprising, several specimens having formed a leading shoot of fully 37 inches annually. The bog, previous to draining and reclaiming, was used for peat-making, but at the time of planting a small quantity of soil was added to the pits in which the Thuja was placed. As an experiment, we some years ago formed a small plantation of this tree in a well-sheltered piece of ground near the sea-level, and about two miles inland; but as the soil was of a stiff and cold nature, though perfectly drained, the plants did not at first succeed as well as could have been desired. Now, however, that they have established themselves, growth has become rapid—far more so than temporary trees which were mixed with them, to be removed at an early date. The soil was of a half-clayey and half-boggy nature, which, previous to being drained, cut like cheese, but when exposed to the atmosphere for a length of time, crumbled down, and was then well fitted for plant growth.

Some of the largest specimens of the Giant Arbor-Vitæ that I know of are growing in alluvial matter, which has been deposited by a rapid-flowing English river, this being largely commingled with rocky *débris* carried down from the hills by the stream. One of these, perhaps the largest, was, when I measured it in July 1887, 76 feet in height, with a trunk girthing 4 feet 11 inches at a yard from the ground, and 4 feet 8 inches at 5 feet up; the diameter of branches being 15 feet. Others in the same place ranged from 50 feet in height upwards, with straight, clean, and well-formed stems; the situation was sheltered, and the trees were planted among old specimens of the English oak, elm, and ash, as well as a few Eastern spruces, Douglas firs, and Weymouth pines. At Hafodunos, in North Wales, this tree grows with great luxuriance, and this is all the more remarkable, as the site is in a romantic mountain valley, and fully exposed, at over 900 feet altitude. We were quite surprised to see how well these trees did at that altitude, the growths being long and well-matured, while foliage of the most healthy description was abundantly produced. It is questionable whether any other of the newer conifers, excepting perhaps the Austrian and Corsican pines, would have succeeded so well under similar conditions. In the park at the same place, and at altitudes ranging from 700 feet to nearly 900 feet, this fine tree is everywhere seen in the most luxuriant condition, thus demonstrating its great value for planting in high-lying and breezy situations. The soil here is a rich sandy loam, resting on broken whinstone. In the chalky districts of Kent the Giant Arbor-Vitæ is likewise quite at home, although the annual growth does not approach that on heavier and damper soil.

Sir C. W. Strickland writes to say, that at Hildenley, Malton, Yorkshire, he has this Thuja thriving well in good alluvial soil, and also in that of a very opposite description. "There is a hillside here," says Sir Charles, "with a thin soil upon limestone rock, which I planted two or three times over with larch with very small success—chiefly, I believe, on account of the extreme dryness of the site. The Thuja grows there with great vigour, and I have scarcely lost one of those planted. Among the other merits of this Thuja is the ease with which it can be transplanted, owing to its having bushy fibrous roots, instead of the long tangles which larch and many other conifers have."

There can be little doubt, however, that in this country the Giant Arbor-Vitæ thrives better when planted in rich dampish soil, than in light dry loam or gravel. Even when young in the nursery, we have noticed the preference of this tree for a cool moist soil, seedlings placed in light warm loam succeeding very indifferently. As to situation or exposure to wind, the Giant Arbor-Vitæ is almost totally indifferent, for we have planted it at 750 feet altitude on the hill-side, where almost fully exposed to the south-west wind, and with every prospect of its attaining goodly proportions in years to come.

We cannot, however, expect the Giant Arbor-Vitæ to attain the large dimensions on the wind-swept hill-side which it does in the warm and sheltered valley; yet it is well suited for high-lying and breezy situations in this country. At Benmore, in Argyleshire, it is thriving luxuriantly at high altitudes, and in a few instances, where planted in alluvial soil, it rivals the larch as a rapid grower. *Thuja gigantea* is also one of the few trees which the Prussian Government is introducing as useful additions to the State forests.

Quality of Timber.—The timber of this tree, as produced in its native wilds, is, as every one knows who had the privilege to behold the huge logs and well-dressed planks in the Canadian Court of the late Colonial and Indian Exhibition, of very superior quality, and held in high esteem in its native country for constructive purposes, particularly by the cabinetmaker and boat-builder. Being fine in the grain, of a yellowish-brown colour, easily worked, remarkably durable, and light in proportion to its bulk, it is extensively used in the manufacture of furniture, for shingles, household utensils, fencing purposes, and in the erection of houses and outbuildings. On account of its lasting qualities, but particularly when subjected to dry and damp alternately, it has been used largely for piles, while many of the canoes and boats made on Vancouver Island are formed of this wood. It has been recorded that in the repairing of an old fort in North-West America, the only log found sound after twenty-one years' trial was one of the Giant Arbor-Vitæ.

Professor Macoun told me that the huge log exhibited at the Colonial Exhibition, and which was no less than 21 feet in girth, and taken from a tree 150 feet in height, might be considered as a fair sample of what was produced under favourable circumstances, and that the average dimensions reached by this stately tree are but little less. The largest trees are usually hollow for a short distance up the stem, but even then the outer timber is perfectly sound and well fitted for constructive purposes.

For making large pillars or columns it is peculiarly well suited, being so even of grain, susceptible of a nice polish, and of a most desirable rich colour; qualities which were well set forth in the Exhibition by the large and beautifully carved posts which once ornamented the Indian villages of the Queen Charlotte Islands.

In No. 1 Museum at Kew there are some interesting specimens of the wood, including a stave and several sections, as well as a hat, shawl, and mat made from the fibrous bark. This fibre of the inner bark is largely used by the Indian tribes for making articles of dress, ropes, and mats.

It is premature to speak of the value of the timber of *Thuja gigantea* produced in this country, as sufficient time has not elapsed since the tree was introduced for the timber to become matured. We have, however, used the timber of trees of thirty years' growth, and, on comparing it with that produced in its native habitat, the differences were few indeed; the same yellowish tinge and compact though light nature being quite apparent in the home-grown wood. A friend who cultivated this tree largely on an estate in the north of Ireland, and who has used the wood, tells us that it is "firm and of good quality, quite upholding the published descriptions of foreign-grown timber of the same kind."

Judging by present appearance, and the many uses to which it is applied in its native country, there can be little doubt that the timber grown in the British Isles will be of excellent quality, and when produced in sufficient quantity will be largely used in the arts and manufactures.

The headquarters of this tree, Professor Macoun tells us, may be said to be the north-west coast of the United States. In the Columbia valley it forms vast forests, and in the valley of the Beaver it attains large dimensions, specimens 150 feet in height, with a diameter of 10 feet, being not at all uncommon. At an altitude of 6000 feet, along the line of the Canadian Pacific Railway, it occurs as a mere shrub, but gradually increases in size as it descends the hills, until in the fertile valleys it attains to full dimensions, with beautifully straight and clean stems that are branchless for nearly half their height.

Ornamental Qualities.—As an ornamental tree, *Thuja gigantea* is well worthy of attention, the bright green graceful foliage being pleasing in the extreme, imparting to the tree a contour that is highly desirable among hardy conifers. The stem is well clothed with irregularly-arranged branches, which are short in proportion to the height of the tree, the branch diameter of a specimen 50 feet high rarely exceeding 12 feet, thus giving the tree an easy columnar habit that rarely fails to attract the attention of even the most unobservant.

The branches are placed at right angles to the stem, or nearly so, with the tips curving upwards. They are very flexible, and densely covered with scale-like finely-pointed leaves, which are of a bright glossy green above, and glaucous beneath. The cones are fully half an inch long, clustered near the ends of the branches, and borne in greatest abundance on the top half of the trees. When ripe in October and November, they impart, from their great numbers and light brown colour, a by no means uninteresting feature to the trees. So pliant is the leading shoot, that we have frequently tied it in a knot, and, when released, it sprung back to the original position without the least damage. This pliability of the young wood renders accidents to the tree of rare occurrence. During ten years' residence on an English estate, where the Giant Arbor-Vitæ was planted in great quantities, we never knew an instance of this tree having suffered from the wind. Even during the memorable "Tay Bridge gale," when nearly every other species of tree was more or less maimed, this tree stood unharmed.

As a specimen on the lawn the Giant Arbor-Vitæ will ever hold a high position; but to be shown off to perfection it requires a background of darker-foliaged trees or shrubs, such as the yew, holly, laurel, and others whose foliage is of a darker hue. Placed along the outskirts of plantations, particularly of hardwood, it has a telling effect, more especially where visible from the drives, and where a bit of green in the winter landscape is of importance. Unlike *Thuja occidentalis*, the foliage does not turn to a rusty brown during the autumn and winter, but remains a bright and pleasant green; indeed, this is an unerring point of difference between these two species of Arbor-Vitæ. For filling up gaps where other trees have been uprooted by the wind the Giant Arbor-Vitæ is peculiarly well adapted, by reason of the narrow spread of its branches, this being a matter of much moment in the choice of forest trees for filling up open spaces in woods and plantations. We have used it largely for the purpose, and may say that for planting where space is limited it is one of our most valuable evergreen trees, luxuriating even where interfered with by the branches of neighbouring trees, and where neither light nor air can freely penetrate.

The bark of the Giant Arbor-Vitæ is of a warm and pleasant brown colour, thin and smooth in texture, and where glimpses of it are revealed here and there along the stem it forms a striking contrast to the bright green of the foliage.

Nursery Management.—The cones are collected in October and November, and after being thoroughly dried by exposure to wind and sunshine, are carefully stowed away in shallow boxes in a dry and airy loft, until wanted for sowing in spring. We have found it advisable not to sift the seeds from the husks, because, by allowing the latter to remain, a greater quantity of air permeates the mass, and thus to a great extent damping is prevented. It is, however, well to turn and disturb the whole mass two or three times during the winter, and if this can be accomplished on a dry day in the open air, so much the better.

When wanted for sowing, the seed should be passed through a $\frac{1}{4}$-inch riddle, to clear it of cones and rubbish. In preparing the seed-beds (which should be in a sheltered situation in the open air), let the soil be deeply dug and left exposed to the influence of the weather, especially frost, for a considerable time, as this has a most ameliorating action upon it. Should the soil be ordinary loam, let leaf-soil and silver sand be freely incorporated with it, mixing the whole well together with a digging-fork. The beds may be formed 4 feet wide, of any convenient length, and divided by alleys 1 foot broad. Rake the surface well, to remove hard clods and stones, leaving it in a free open state for the reception of the seeds. Level and smooth the surface with a light roller, taking care that it does not excessively harden the soil. Sow the seed thinly and evenly, either broadcast over the surface or in lines, as may be found most convenient. By sowing in lines a great saving of seed is effected, and greater regularity at the same time secured. The lines are formed 2 inches apart, and hardly $\frac{1}{4}$ inch deep. In covering the seeds great care is necessary, so that they may not be buried too deeply, and to avoid this the soil should be distributed from a finely-meshed riddle. This, in the hands of an experienced man, is used with great freedom, and the soil distributed evenly and not too thickly. The soil used for covering should be of a light sandy nature, free from lumps or stones, and moderately rich. No beating of the surface of the beds with the back of a spade should be permitted, as this causes the soil to bake and become full of cracks, and thus numbers of the seed are lost. Sowing should not take place until April or May, and dry weather must be chosen for this work, as well as for the formation of the beds. Should dry parching weather prevail for any length of time after sowing, watering may be resorted to with great benefit, using a fine-rosed watering-can and rain water if procurable.

When the young plants begin to appear, shading from direct sunshine will be highly beneficial, and this can easily be done by sticking a few spruce branches around the beds, particularly on the southern and western sides. The beds should be kept at all times clean and free from weeds, which is best performed by hand-picking during dripping weather, as at such a time the young plants are less apt to suffer from root disturbance caused by the extraction of the weeds. As the seedlings will have to remain for one winter at least in the beds before they are large enough for planting out, it is probable that numbers of them will be raised up by the frost, and in such cases a quantity of fine sandy soil, evenly sifted amongst them, will soon set matters right. Should the young plants come up too closely, it is wise policy to thin out the smaller for the benefit of the remaining ones.

When they have attained a size sufficient for handling, they should be carefully lifted with a fork, and planted in previously prepared soil—not in too sheltered a portion, but where the wind can have free access to them. The size of the plants will form a guide as to the distance apart at which they should be planted; but seedlings of the second year may be placed at about 4 inches apart in the rows, and 9 inches from line to line. Spread the roots well out in planting, laying them out to their full extent on all sides of the plant. After remaining for two years in this position, the young plants should again be transplanted into well-enriched ground, their individual sizes forming, at this stage of their growth, the best criterion as to the distance apart at which they should be placed.

In planting, however, the method usually adopted of taking out a notch and placing the plant close against the perpendicular side, will not do, as by such a course of treatment the roots are caused to diverge to one side, and when the trees are planted out permanently they usually topple over during the first hard-blowing gale. The best method we know of, and one that we have adopted with success, is to take out a notch on each side of the line, and partly level the ridge under the latter, the centre of the crown of each plant being placed exactly where the line struck, and the roots spread evenly into the notches on each side. By so doing, the roots are trained from infancy in the positions they should occupy, and, forming a whorl round the base of the stem, they are enabled to collect food from all quarters, and the trees are far less liable to be upset during a gale.

Propagation of this Thuja is also effected by cuttings, but these seldom form such well-shaped trees as those produced from seed. However, as on many estates seeds are difficult to procure, and young plants have to be raised from cuttings, the following method may be practised with the best success :—

Early in September take off young shoots of the current season with a small portion of the previous year's wood, and insert these in sandy loam in a border facing north. In choosing the cuttings, those from the south side of the tree where fully exposed to light and air root more freely, and produce better plants, than those from the shady side. Press the soil firmly round the cuttings, and scatter a little sharp sand on the surface, just sufficient to hide the soil. Should severe frost set in during the winter, it may be well to make a temporary erection, and cover over with a few old mats, straw, or any other convenient material, which will to some extent ward off the frost, and thus prevent the cuttings being lifted out of the ground. The two special points to be attended to in raising cuttings of this Thuja are to insert them sufficiently early in the season, so that they may get *callused* before the winter sets in, and to prevent the sun's rays striking them for any length of time until the roots are formed. By the end of the second year the cuttings will be ready for planting into nursery lines, which operation is similar in all respects to that recommended for seedlings. Generally speaking, plants raised from cuttings are difficult to get to start away freely, they having an inclination to form a spreading head, which must be corrected by pruning at an early stage of their growth.

Grafting is another method of propagating the Giant Thuja, and one that is commonly practised on the Continent; and it has this advantage, that larger plants are formed in less time than from either cuttings or seeds. The stock used is *Thuja occidentalis*, a vigorous growing and hardy species, and the operation is performed both in spring and summer, but more satisfactory results have been obtained by grafting in August than at any other time, for the following reasons :—By grafting in August the scion gets hold of the stock in autumn, and although actual growth does not take place during the winter, yet with the protection of glass the union of the scion and stock goes on and is perfected, so that when a start to grow is made in spring the one seldom shows any inclination to get rid of the other, as is not unfrequently the case when the operation has been performed in spring. Spring grafting must be performed in a warm close house, and unless hardening off is practised with a great amount of caution, many of the plants will cast their scions when the sap begins to move quickly. The stocks should be potted up in spring for autumn grafting, as by that time they are established and in the best condition for operating upon.

Recapitulation.—From these observations of the growth, hardihood, and valuable timber-producing qualities of *Thuja gigantea*, there can be little doubt that it is one of the most useful forest trees that have yet found their way into this country; and in point of general utility it is well entitled to rank with such other tried and valuable introductions as the Douglas fir, the Corsican, Austrian, and Weymouth pines, and that desirable silver fir, *Abies Nordmanniana.* Its perfect hardihood in even the coldest portions of the British Isles is now well known; while in Switzerland and Germany, where very few of our best conifers can withstand the too often semi-arctic winter, this tree is highly prized, and is a great favourite with planters. Then, again, it withstands exposure to long-continued and hard, biting winds better than almost any other tree; its lithe branches and supple leading shoot rendering it peculiarly well adapted for exposed positions.

It cannot be said to be particular about soil, for, as has been stated, goodly specimens have been produced in this country on soil of the most opposite descriptions, although, at the same time, that of a rich, moist, and open nature is preferred. The rate of growth is very rapid, surpassing that of most of our cultivated trees, while the timber is of superior quality, and the branch spread narrow in proportion to the tree's height—all valuable qualities in a conifer for general forest purposes.

As an ornamental conifer it ranks high, and has already received a great amount of attention in this way; while the extreme ease with which it may be propagated is another point that is greatly in its favour, and which will, in conjunction with its other good qualities, cause it at no distant date to be largely used for economic planting both at home and abroad.

XVIII. *Tables for the Conversion of Measurements from one Denomination to another.* By Colonel F. Bailey, R.E.

Example to show the manner of using the Tables.

Convert 341·27 Hectares to Acres.

HECT.			(c)	ACRES.				
* 1 =		2	·	4	7	1	0	9
2 =		(d)4	·	9	4	2	1	8
3 =		7	·	4	1(a)	3	2	7
4 =		9	·	8(b)	8	4	3	6
5 =	1	2	·	3	5	5	4	5
6 =	1	4	·	8	2	6	5	4
7 =	(e)1	7	·	2	9	7	6	3
8 =	1	9	·	7	6	8	7	2
9 =	2	2	·	2	3	9	8	1
Decimals	·ii	·i	i	ii	iii	iv	v	vi Whole numbers.

* **1 Hectare is equal to 2·47109 acres ; and so on in all the other Tables.**

3	in the 3d	place of	whole numbers gives. . . .	741·327
4	,, 2d	,,	,, ,, ...	98·843
1	,, 1st	,,	,, ,, ...	2·471
2	,, 1st	,,	decimals gives	·494
7	,, 2d	,,	,, ,, ...	·172
			Answer, . Acres,	843·307

To read off the first of these numbers.—Place the point of a pencil at (*a*), *i.e.*, at the point where the line (3) meets the line (iii). This indicates the position of the decimal point.

To read the second.—Place it at (*b*) where the line (4) meets the line (ii).

To read the other numbers.—Place it successively at (*c*), (*d*), and (*e*). With a little practice this can be done very rapidly. The calculation is made by copying figures and simple addition only. Complete accuracy can be assured to any required number of decimal places by extending the Tables.

The Tables occupy a very small space, and by using them there is less liability to error than if the conversion were effected by multiplication or division.

Metres to Inches (Linear).

MET.	INCHES.									
1 =		3	9	·	3	7	0	4	2	3
2 =		7	8	·	7	4	0	8	4	6
3 =	1	1	8	·	1	1	1	2	6	9
4 =	1	5	7	·	4	8	1	6	9	2
5 =	1	9	6	·	8	5	2	1	1	5
6 =	2	3	6	·	2	2	2	5	3	8
7 =	2	7	5	·	5	9	2	9	6	1
8 =	3	1	4	·	9	6	3	3	8	4
9 =	3	5	4	·	3	3	3	8	0	7

Decimals ·iii ·ii ·i | i ii iii iv v vi vii Whole numbers.

Metres to Feet (Linear).

MET.	FEET.								
1 =		3	·	2	8	0	8	6	9
2 =		6	·	5	6	1	7	3	8
3 =		9	·	8	4	2	6	0	7
4 =	1	3	·	1	2	3	4	7	6
5 =	1	6	·	4	0	4	3	4	5
6 =	1	9	·	6	8	5	2	1	4
7 =	2	2	·	9	6	6	0	8	3
8 =	2	6	·	2	4	6	9	5	2
9 =	2	9	·	5	2	7	8	2	1

Decimals ·ii ·i | i ii iii iv v vi vii Whole numbers.

Kilometres to Miles (Linear).

KILO.	MILES.									
1 =		·	6	2	1	3	7	6	7	6
2 =	1	·	2	4	2	7	5	3	5	2
3 =	1	·	8	6	4	1	3	0	2	8
4 =	2	·	4	8	5	5	0	7	0	4
5 =	3	·	1	0	6	8	8	3	8	0
6 =	3	·	7	2	8	2	6	0	5	6
7 =	4	·	3	4	9	6	3	7	3	2
8 =	4	·	9	7	1	0	1	4	0	8
9 =	5	·	5	9	2	3	9	0	8	4

Decimals ·i | i ii iii iv v vi vii viii ix Whole numbers

Hectares to Acres (Square).

HECT.	ACRES.						
1 =		2	·4	7	1	0	9
2 =		4	·9	4	2	1	8
3 =		7	·4	1	3	2	7
4 =		9	·8	8	4	3	6
5 =	1	2	·3	5	5	4	5
6 =	1	4	·8	2	6	5	4
7 =	1	7	·2	9	7	6	3
8 =	1	9	·7	6	8	7	2
9 =	2	2	·2	3	9	8	1

Decimals ·ii ·i | i ii iii iv v vi Whole numbers.

Hectares to Miles (Square).

HECT.	SQUARE MILES.							
1 =	0	·0	0	3	8	6	1	1
2 =	0	·0	0	7	7	2	2	1
3 =	0	·0	1	1	5	8	3	2
4 =	0	·0	1	5	4	4	4	3
5 =	0	·0	1	9	3	0	5	4
6 =	0	·0	2	3	1	6	6	5
7 =	0	·0	2	7	0	2	7	5
8 =	0	·0	3	0	8	8	8	6
9 =	0	·0	3	4	7	4	9	7

Decimals ·i | i ii iii iv v vi vii viii Whole numbers.

Kilometres to Miles (Square).

KILO.	SQUARE MILES.								
1 =		·3	8	6	1	0	9	0	8
2 =		·7	7	2	2	1	8	1	6
3 =	1	·1	5	8	3	2	7	2	4
4 =	1	·5	4	4	4	3	6	3	2
5 =	1	·9	3	0	5	4	5	4	0
6 =	2	·3	1	6	6	5	4	4	8
7 =	2	·7	0	2	7	6	3	5	6
8 =	3	·0	8	8	8	7	2	6	4
9 =	3	·4	7	4	9	8	1	7	2

Decimals ·i | i ii iii iv v vi vii viii ix Whole numbers.

Metres to Feet (Solid).

MET.	CUBIC FEET.
1 =	35·315617
2 =	70·631234
3 =	105·946851
4 =	141·262468
5 =	176·578085
6 =	211·893702
7 =	247·209319
8 =	282·524936
9 =	317·840553

Decimals ·iii ·ii ·i | i ii iii iv v vi vii Whole numbers.

Metres to Loads of 50 Feet (Solid).

MET.	LOADS.
1 =	·7063123
2 =	1·4126247
3 =	2·1189370
4 =	2·8252493
5 =	3·5315617
6 =	4·2378740
7 =	4·9441864
8 =	5·6504987
9 =	6·3568110

Decimals ·i | i ii iii iv v vi vii viii Whole numbers.

Kilos. to Pounds (Weight).

KILO.	POUNDS.
1 =	2·20462
2 =	4·40924
3 =	6·61386
4 =	8·81848
5 =	11·02310
6 =	13·22772
7 =	15·43234
8 =	17·63696
9 =	19·84158

Decimals ·ii ·i | i ii iii iv v vi Whole numbers.

Kilos. to Tons (Weight).

KILO.	TON.								
1 =	·0	0	0	9	8	4	2	1	
2 =	·0	0	1	9	6	8	4	2	
3 =	·0	0	2	9	5	2	6	3	
4 =	·0	0	3	9	3	6	8	4	
5 =	·0	0	4	9	2	1	0	5	
6 =	·0	0	5	9	0	5	2	6	
7 =	·0	0	6	8	8	9	4	7	
8 =	·0	0	7	8	7	3	6	8	
9 =	·0	0	8	8	5	7	8	9	
	i	ii	iii	iv	v	vi	vii	viii	ix

Whole numbers.

Quintaux of 100 Kilos. to Tons (Weight).

QUI.	TON.						
1 =	·0	9	8	4	2	1	
2 =	·1	9	6	8	4	2	
3 =	·2	9	5	2	6	3	
4 =	·3	9	3	6	8	4	
5 =	·4	9	2	1	0	5	
6 =	·5	9	0	5	2	6	
7 =	·6	8	8	9	4	7	
8 =	7	8	7	3	6	8	
9 =	·8	8	5	7	8	9	
	i	ii	iii	iv	v	vi	vii

Whole numbers.

Maunds ($82\frac{2}{7}$ lbs.) to Cwts.

MA.	HUNDREDWEIGHTS.									
1 =	0	·7	3	2	5	2	6	7	6	
2 =	1	·4	6	5	0	5	3	5	2	
3 =	2	·1	9	7	5	8	0	2	8	
4 =	2	·9	3	0	1	0	7	0	4	
5 =	3	·6	6	2	6	3	3	8	0	
6 =	4	·3	9	5	1	6	0	5	6	
7 =	5	·1	2	7	6	8	7	3	2	
8 =	5	·8	6	0	2	1	4	0	8	
9 =	6	·5	9	2	7	4	0	8	4	
Decimals	·i	i	ii	iii	iv	v	vi	vii	viii	ix

Whole numbers.

XIX. *The Ligneous Plants of Hampshire.* By JOHN SMITH, Romsey, Hants.

An account of the indigenous plants of a county is of interest not only to the Botanist, but also to the practical Forester. Some counties have a flora peculiarly their own, or at least have plants which occur more abundantly than in other counties; and Hampshire being rich in native and naturalised plants, I have been induced to submit this paper on the Ligneous Plants, giving the results of many years of observation.

It seems desirable to localise as much as possible our native flora, and by examining counties separately we are more likely to determine which plants are true natives. Without further remark I proceed to give an account of the native trees and shrubs of Hampshire, adopting the Natural System of classification.

CUPULIFERÆ.—The British Oak (*Quercus Robur pedunculata*).—This is the prevailing tree of the county, and is found in every variety of soil and subsoil. There are many fine old trees, such as the one at Oakley Farm, Mottisfont, girthing 31 feet 6 inches[1]; one at Hurstbourne Park, girthing 21 feet; and many others remarkable for size and beauty.

The "Dur" or Durmast Oak (*Q. Robur sessiliflora*) is a distinct species. 1st, the leaves are on long foot-stalks; 2d, the acorn is on a short foot-stalk. These two characters are exactly the opposite of *Q. Robur*, but this is not the only distinction, for the bark of the young tree is more silvery in appearance than that of the mature tree. The habit of growth is also different; the head is more spreading and umbrella-shaped. Finally, the timber is not of so enduring a quality, and the tree does not attain to such large dimensions as the other species. This species is not widely distributed, but a large wood exists between Hursley and Romsey, where a great many specimens are to be found, and also in Brook-Wood in the northern part of the New Forest.

The Beech (*Fagus sylvatica*).—While the leaf and the acorn of the oak vary much in different trees, the leaf and the mast of the beech are seldom seen to vary. The ancient beech forests were at one time very extensive in the county, but are mostly giving place to oak. It has still, however, a wide range, and such old

[1] For a description of the trees of which the measurements are given in this paper, *see* "Present State and Future Prospects of Arboriculture in Hampshire" (*Trans. Scot. Arbor. Soc.*, vol. xi., page 522, *et seq.*).

clumps as are seen in the Outwood, Hursley, Norman Court on the borders of Wiltshire, and Mark Ash in the New Forest, still show the grandeur of the ancient forests.

The Hazel (*Corylus avellana*).—The nut of the hazel varies greatly in different plants, but not so the leaf. This tree is widely distributed, and in former years it was extensively planted in the hedgerows. Twenty-five to thirty years ago many of these hedgerows were grubbed up, partly for the purpose of enlarging the fields, and partly owing to the depreciation in the value of hazel hoops consequent on the importation of the foreign article; but after a time it was found that imported hoops did not last so long as homegrown, and now hazel "rods" command a good price. The wood is cut at the age of from eight to twelve years, and is the most useful of our small-wood. Here a question presents itself to the agricultural chemist.—Most of these hedgerows have been in existence time out of mind, and have been regularly cut say every ten years. The weight of a crop taken off an acre is estimated at 40 tons. Besides this, there is in the hedgerow a thick carpet of wild hyacinth (*Agraphis nutans*), wood anemone (*Anemone nemorosa*), and the common primrose (*Primula vulgaris*). When grubbed up a rich virgin soil is exposed, in strange contrast to the adjoining arable land, which has been ploughed and manured from the time the hazel was planted. The hedgerow has neither been tilled nor manured, yet not only is the soil richer, but has increased in bulk, and is on a higher level than the arable fields. Compare the weight of produce carried off per acre, and putting the hazel at ten years of age, and taking the weight at 40 tons,—this gives an average weight of 4 tons per acre per annum, while agricultural produce cannot be taken at more than 2 tons per acre per annum. But it may be said that there is a crop of "roots" of say 20 tons to the acre every four years. To balance this, however, the ground receives say 20 tons of manure per acre in every fourth year. Then, without going into the chemical composition of the produce removed, it is obvious that the 4 tons of wood contain a larger proportion of solid matter than the 2 tons of agricultural produce. It is said that the hazel leaves which fall tend to enrich the soil. This is no doubt true, but whence did the leaves obtain their nourishment? Some part may be from the atmosphere, but the agricultural plant has the same chance. It may be said that the roots of the hazel penetrate to a greater depth in the soil. This is true, although the hazel is not a deep-rooting plant. Then, again, what is to be said of the crop of wild hyacinth, etc.? Is, then, the rotation of crops, so much insisted upon, a mistake? I cannot answer, but only point out the fact that a piece of land will produce year after year 4 tons per acre of the same crop, while a similar piece only produces 2 tons of different crops, and the former piece of land remains richer than the latter.

The Sweet or Spanish Chestnut (*Castanea vesca*).—This noble tree is not indigenous. It is, however, plentiful in the county, and is naturalised, reproducing itself freely. While the oak and the beech (especially the former) are attacked by caterpillars, aphis, and different insects, producing galls and other excrescences, the chestnut, so far as I have observed, is exempt from insect pests. This immunity, and the value of the small-wood and timber, while it is one of our fastest-growing deciduous trees (the poplars and willows excepted), all combine to make it one of the most valuable trees for planting. This seems to have been generally appreciated, for it has been extensively planted, and there are now many plantations of useful timber trees and considerable breadths of coppice. The trees are not of large dimensions, the largest being in North Stoneham Park, with a girth of 16 feet 9 inches. There are many girthing from 8 to 10 feet.

The Hornbeam (*Carpinus Betulus*).—This tree is admitted into the British flora, but is not common in Hampshire, and I am not aware that it reproduces itself; for I have not found a single "self-comer," and would therefore pronounce it *not* to be a native.

ULMACEÆ.—The Elms have given rise to considerable discussion amongst botanists as to the several species or varieties found wild in Britain, and in consequence it is difficult to pronounce which are natives, as all the species are trees of semi-cultivation, and occur usually where the soil has been disturbed.

The Common Elm (*Ulmus campestris*), the most majestic of all the species, is common, occurring mostly in hedgerows, clumps, and avenues. For the last it has a fine effect, but it cannot be recommended for the purpose on account of its dangerous peculiarity, that without warning a large bough may snap and fall with serious consequences. Several instances have occurred of persons being killed from this cause. A fine avenue, the glory of Southampton thirty years ago, is now almost gone; only a tree here and there remains to show the ancient grandeur. Various theories have been started as to the cause of this destruction, but no satisfactory cause has been assigned. The Corporation of Southampton, to their credit, have continued to replant young trees in place of the old ones. This species seldom produces fertile seeds, but propagates itself by suckers, which run to a great distance from the parent stem, and have been measured to the length of 60 yards. In 1880, a piece of ground which had been allotted for gardens was laid out for building purposes; but as operations did not commence till 1886, the land meantime lying dormant, on digging it up in that year elm roots were found to have extended 30 yards from the adjoining trees. This gives an average of 5 yards or 15 feet in each year. Now this was not poor, but very rich soil, having 2 feet of vegetable mould, then 6 feet of hazel loam down to the gravel, so it could not be for want of nourishment.

The Wych Elm, Wych Hazel (*U. montana*).—This is more limited than the last, but it occurs at widely distant stations in the county. This species is quite distinct, in that it produces fertile seeds and has no suckers. It is not found of larger girth than 15 feet 7 inches at Tufton, near Whitchurch, while *U. campestris* in Broadlands Park has a girth of 24 feet 7 inches.

OLEACEÆ.—The Common Ash (*Fraxinus excelsior*).—This well-known tree is not so plentiful in a natural state as might be expected, seeing that it produces winged seeds (keys) abundantly. It is the "husbandman's tree," providing him with "plough bote and cart bote," as allowed by the lord of the manor, but has been largely superseded, like the "wooden walls of old England," by iron. The ash is still used for many purposes, and the supply is barely equal to the demand. Many old adages which foretell the weather have fallen into disuse, but I have to record a rather curious fact. On the 25th of May 1887, the buds of the ash had no appearance of life, not even swelled, while the oak was almost in full leafage. This year (1888), at the same date, the ash is nearly in leaf, while the buds of the oak are just beginning to swell. These are the same trees, and the contrast between the two years is certainly remarkable. The old saying is, that if the oak comes out before the ash the summer will be dry, but if the ash is first out then the summer will be wet. 1887 was dry, and we now wait for 1888.

The Common Privet (*Ligustrum vulgare*).—This useful shrub is common everywhere in coppices, hedgebanks, etc. It is of little value, except as cover for game or as a hedge plant, and when kept trimmed it becomes almost an evergreen. The most beautiful hedge of it I have seen is at Shelley farm on the Paultons estate.

TILIACEÆ.—The Common Lime (*Tilia europæa*), and the Small-leaved Lime (*T. parvifolia*).—I do not consider either of these natives of the county, having only found them where planted.

ACERACEÆ.—The Common Maple (*Acer campestris*) is plentiful everywhere, but seldom attains to any size either in girth or height, and is mostly cut as copsewood.

The Sycamore (*A. Pseudo-Platanus*). — The Greater Maple, whether a native or not, is frequently met with, and reproduces itself freely.

BETULACEÆ.—The Common Birch (*Betula alba*) is abundant, and is valued most for its beauty, with its drooping tresses and fragrant perfume. It lays claim to be the "Lady of the Woods," and many specimens are found of rare beauty, which give such a charm to the wild woodland scenes in the New Forest.

The Common Alder (*Alnus glutinosa*) is found by every stream and rivulet, and in boggy places. The small-wood is useful for many purposes; and the tree being a rapid grower, it is valuable.

SALICACEÆ.—The Abele or White Poplar (*Populus alba*) is plentiful in the river valleys, especially in the Test Valley from Mottisfont to Clatford, near Andover. It is very ornamental, and finds a place in the grounds of most suburban villas. I have little hesitation in saying that it is a native of Hants. It supplies the most valuable timber of all the poplars.

The Grey Poplar (*P. canescens*) is occasionally found, but is not plentiful, and is a doubtful native.

The Trembling Poplar or Aspen (*P. tremula*) is comparatively rare, and the specimens I have seen do not appear to have the tremulous motion of the leaves which is characteristic of them in the north. I consider it a doubtful native.

The Black Poplar (*P. nigra*) is plentiful, and is more likely to be a native than the last.

The Lombardy Poplar (*P. fastigiata*) is considered by some to be only a variety of the last; but I have noticed that it puts forth its leaves a fortnight earlier than the black, and they are smaller. Other characteristics would lead to the conclusion that it is distinct. It is in considerable numbers, but as the timber is of no value, it can only be prized as an ornamental tree. Of course it has no claim to be considered a native.

The Willow, Sallow, and Osier (*Salix*).—With reference to this genus of plants, I take the following from Hooker and Arnott's "British Flora:"—"The many important uses rendered by the different species of willow and osier, serve to rank them high in our list of economical plants. The larger kinds, which are the most rapid growers, yield timber and exceed 60 feet in height; whilst the least of them (*S. herbacea*), which grows on the summits of our Highland mountains, can scarcely be said to rise above the surface of the soil in which it vegetates. Many are in great request for baskets, hoops, and crates. Their bark is used by the tanner, and that of one species (*S. fragilis*, var. *Russelliana*) as a substitute for Peruvian bark. A correct knowledge of them is of primary importance; yet there is not in the whole range of the vegetable creation a genus liable to greater variation in properties, foliage, and general appearance, at different periods of growth, in different soils and situations, and under different circumstances; so that the accurate determination of its species, or even what constitutes a species, has baffled the researches of the ablest botanists." Of the economic value of many sorts of willows and osiers there is little doubt, but as to bark for tanning there is no demand where the oak is so plentiful, and less so as a substitute for the Peruvian bark. The principal demand is for basket-making, or rather wicker work, such as chairs, tables, and the many fancy articles now made with osiers, which is a considerable industry in several towns in the county; but the supply is not equal to the demand, considerable quantities coming from Somerset and other counties. Why this should be it is difficult to say, as Hampshire some years ago had many osier beds, as the names still testify. Of late several unsuccessful attempts have been made to re-introduce the cultivation of willows. An instance came under my observation. A piece of apparently suitable ground of about three acres in extent was prepared with great care and planted. It produced fine crops the first and second years; the third year the produce began to fail, as also the fourth year; the fifth year it was not considered worth the cutting, as a great many of the plants had died clean out. I have inquired into the causes of this, and the owner, who is a practical basket-maker, is entirely at a loss for the cause, sometimes blaming one thing, and sometimes another. When the osiers are cut they are tied up in bundles (bolts), which should be 18 inches round at 14 inches from the butt. When not used for black work (that is, with the rind on), they are placed butt downwards in water pits in spring, and when they begin to sprout, the bark is then easily peeled off.

The White Willow (*Salix alba*) is found in many places, and there are some fine trees, but as a rule it is not plentiful.

The Crack or Bedford Willow (*S. fragilis*) is more abundant as a tree than the last, but it does not attain to so large a size.

The Goat Willow (*S. caprea*), or English "Palm Tree," so called from the practice once prevalent of children going in procession to church on Palm Sunday carrying rods of this willow in their hands; and it is seldom that a Palm Sunday passes without its being in bloom—

> "The siller saughs, wi' downy buds
> Adorn the banks"—

proclaiming that

> "Gloomy winter's noo awa',"—

is common, but the tree is of little use for any economic purpose.

The Common Osier (*S. viminalis*), Silky-leaved Osier (*S. Smithiana*), Triandrous Willow (*S. triandra*), Green-leaved Osier (*S. rubra*), Purple Willow (*S. purpurea*), Golden Osier (*S. vitellina*), Grey Sallow (*S. cinerea*), Round-eared Sallow (*S. aurita*), and Dwarf Silky Willow (*S. fusca*), are all more or less plentiful; but in consequence of several of the species being at one time much cultivated, it is doubtful if they all can be classed as natives.

ROSACEÆ.—The Wild Pear (*Pyrus communis*) is found in coppices and hedges in different parts of the county, but seldom allowed to attain tree proportions, being generally cut with the small-wood. Some years ago I measured one with a girth of 4 feet 6 inches, and about 30 feet high. It was covered with fruit, but so hard and dry that a knife could hardly penetrate them.

The Crab Apple (*Pyrus Malus*).—Found in many places, and, unlike the pear, occurs often as a tree, and when in full bloom is very ornamental, and worthy of a place in any park. There is considerable variety among the wild apples, some being almost eatable. A tree in Hursley Park had a girth of 5 feet 9½ inches, and another in Headley Park measured 6 feet 1 inch.

The Wild Service-Tree (*P. torminalis*) is not a native, and is only found in neglected shrubberies.

The Mountain Ash, or Rowan-Tree (*P. Aucuparia*).—Abundant in woods with a moory soil, and freely introduced into pleasure grounds as an ornamental tree.

The White Beam-Tree (*P. aria*).—Plentiful, especially on the chalky downs, where it shows in strange contrast with the sombre yew.

The Hawthorn, Whitethorn, or May (*Cratægus Oxyacantha*).—This well-known plant is found everywhere, and there are many variations in the fruit and leaf. It is esteemed as an ornamental tree, and is *par excellence* the hedge-plant of Britain. In a hedge, I recommend that it should be trimmed on the sides only, especially when required for shelter and ornament, as the plants then blossom freely; and from experience I can say that, treated in this way, it forms as effective a fence.

The Rose (*Rosa*).—This tribe of ornamental plants is fairly well represented in the flora of Hampshire, and comprises the following species:—The Burnet-leaved Rose (*R. spinosissima*), Slightly-scented Briar (*R. inodora*), Small-flowered Briar (*R. micrantha*), Downy-leaved Rose (*R. tomentosa*), Trailing Dog-rose (*R. arvensis*), Common Dog-rose (*R. canina*), True Sweetbriar (*R. rubiginosa*), rare.

The Common Plum, Blackthorn, or Sloe, and Bullace (*Prunus communis, spinosa*, and *institia*), are often classed together as one species, although their characters are widely distinct. The early blossoming of the blackthorn is so abundant as to give the appearance of wreaths of snow; but the quantity of fruit is small in proportion. This may arise from the fact that severe weather often prevails during the flowering season, and the "blackthorn winter" has passed into a common saying.

The Wild Cherry or Gean (*P. avium*) is plentiful, and highly ornamental when in blossom, and produces an abundance of fruit, of which the birds reap the benefit. It is seldom left in the coppices to attain timber size, as the small-wood is useful for hoops, etc. Some of the trees have a girth of from 4 feet to 6 feet, and attain a height of 50 or 60 feet. The Morello Cherry (*P. Cerasus*) is said to be native, and a distinct species, but I have not found it. The Bird Cherry (*P. Padus*), locally called "Black Dogwood," is plentiful, but is not allowed to attain any size, being in demand for the manufacture of gunpowder.

The Raspberry (*Rubus idæus*).—This is occasionally found, but is not common.

The Upright Bramble (*R. suberectus*).—About as common as the raspberry.

The Common Bramble (*R. fruticosus*), Buckthorn-leaved B. (*R. rhamnifolius*), Hornbeam-leaved B. (*R. carpinifolius*), Glandular B. (*R. glandulosus*), Hazel-leaved B. (*R. corylifolius*), and the Dewberry (*R. cæsius*), are all more or less plentiful in different localities, and produce an abundance of fruit.

GROSSULARIACEÆ.—The Common Currant (*Ribes rubrum*).—Found in woods and hedges, where it appears to be truly wild.

The Black Currant (*R. nigrum*).—Found in some places, a doubtful native.

The Gooseberry (*R. Grossularia*).—Plentiful in woods, hedges, and on old walls; but it is difficult to say whether indigenous or not.

RHAMNACEÆ.—The Common Buckthorn (*Rhamnus catharticus*).—Rare; is found in a hedge by side of road from Furze Down to King's Somborne.

Alder Buckthorn (*R. Frangula*).—This is found in the New Forest, but is very rare.

BERBERIDACEÆ.—The Common Barberry (*Berberis vulgaris*).—This shrub is not common, probably arising from the idea prevalent amongst farmers that it produces blight in wheat. Whether this be a mere superstition or not I cannot say.

LEGUMINOSÆ.—The Whin, Furze, or Gorse (*Ulex Europæus*).—Plentiful.

The Dwarf Furze (*U. nanus*).—Plentiful on the heaths in the New Forest, and if any one wishes to see the difference between the two species, he has only to visit the New Forest at the end of August or beginning of September.

The Dyer's Green-weed, Woad-waxen, Dyer's Broom (*Genista tinctoria*).—So named from being used to dye yarn of a yellow colour. It is fairly plentiful, but now of no use.

The Needle Genista, or Petty Whin (*G. Anglica*).—Frequent on moist heaths and moorish ground.

The Common Broom (*Sarothamnus scoparius*).—Frequent, but seldom found on the chalk.

The Rest-harrow (*Ononis arvensis*).—This pretty little shrub, with rose-coloured or white flowers, is common on the borders of fields and neglected pastures on a chalk soil.

VACCINIACEÆ.—The Bilberry, or Whortleberry (*Vaccinium Myrtillus*).—The "blackheart" of the New Forest is abundant in heathy woods, and produces quantities of berries, which are much sought after, being the first of our wild fruits.

The Cranberry (*V. Oxycoccus*) is said to be found in the northern part of the county, but this is doubtful.

SOLANACEÆ.—The Woody Nightshade, or Bitter-Sweet (*Solanum Dulcamara*).—Common in hedges and thickets, climbing amongst the branches. The bright scarlet berries are poisonous, and have frequently been eaten by children with fatal effect.

MYRICACEÆ.—The Sweet Gale, Bog or Dutch Myrtle (*Myrica Gale*).—The "Gold Withy" of the New Forest, where it is plentiful; also in boggy places in different parts of the county. Formerly used as a substitute for hops, but now of no economic use, although perhaps its agreeably pungent smell may assist in correcting the malaria arising from the bogs which it inhabits.

LILIACEÆ.—The Butcher's Broom (*Ruscus aculeatus*) is the "knee-holm" or "knee-holly" of the New Forest, as it seldom rises higher than the knee. Frequent in woods, at the foot of trees, in a gravelly soil. The berry is larger than that of the common holly, and is of a beautiful scarlet.

CORNACEÆ.—The Wild Cornel or Dogwood (*Cornus sanguinea*).—Widely distributed throughout the county, especially on the chalk. It is of little economic value.

CAPRIFOLIACEÆ.—The Common Elder (*Sambucus nigra*).—In hedges everywhere, sometimes with yellow berries.

The Dwarf Elder or Dane-wort (*S. Ebulus*).—Found in waste ground, not plentiful; near Lyndhurst in the New Forest, and in a meadow near the old Priory of Wherwell.

The Wayfaring tree, or "Copse Elder" of Hants (*Viburnum Lantana*), is frequent by roadsides on the chalk.

The Guelder-rose (*V. Opulus*).—Plentiful in coppices and damp moorish pastures.

The Honeysuckle, or Woodbine (*Lonicera Periclymenum*).—This is common in woods and hedges, ascending trees to a considerable height. It has the sweetest scent of all our wild flowering shrubs, and is the only species found in this county.

ARALIACEÆ.—The Ivy (*Hedera Helix*).—Found everywhere in waste places, hedges, coppices; on buildings, and ascending to a great height on trees. On a Lombardy poplar I have seen it attaining a height of 90 feet. There are two charges against the ivy—namely, that it *induces damp* in the walls of houses (this is now admitted *not* to be the case); the other, that it retards, or is destructive of the growth of trees, of which much has been written, but it seems difficult to pronounce either one way or another. Twenty-four years ago, in Queen's Mead Wood, in the New Forest, I measured the stem of an ivy which had ascended a beech to a great height. The stem of the ivy had a diameter of 9 inches, and that of the beech 3 feet. They were thriving and growing on the north side of, and not far from, the Brockenhurst stream. Now, if we suppose that the ivy was as old as the beech, it could not have retarded the growth of the tree very much. I may add that this is the largest single stem of an ivy I ever saw, and it is to be hoped that no over-zealous woodranger has severed it since then. The bronzed leaves of the ivy are much sought after at present for funeral wreaths.

AQUIFOLIACEÆ.—The Holly (*Ilex aquifolium*).—This beautiful and well-known shrub or small tree is plentiful in the woods throughout the county, and especially in the New Forest, where it is to be regretted that the Crown officials are cutting the finest sticks and selling them for whip handles, &c. Abundant as a wilding, yet no pleasure ground can be said to be complete without a specimen tree, and the more fortunate possess a hedge, of which there are many fine ones in the county, especially about Hursley, near Winchester. The custom of decorating the shops, houses, and churches at Christmas time, is telling somewhat on the numbers of the holly, as the demand has raised it into an article of commerce in the larger towns. I have occasionally found a specimen with yellow berries. The variety known as the "Highclere Holly" (*I. a. Altaclerense*) was first discovered in Penwood on the Highclere estate in this county.

CONIFERÆ.—The Juniper (*Juniperus communis*).—Another fine evergreen shrub, abundant on the bare chalky downs, preferring the northern slopes, such as that of Dean Hill and Farley-mount Down. Two varieties, if not species, are to be found. I do not refer to the dwarf *J. nana* of botanists, but to the upright and the spreading varieties—the former rising 4 feet to 6 feet, and in habit like an Irish yew, and the latter covering the ground with a diameter of from 8 feet to 10 feet, with a height of only 2 feet. The habit of the full-grown plants, as well as the seedlings, are here quite distinct. At Old Lodge, in the parish of Nether Wallop, on the borders of Wiltshire, there are several acres of natural juniper forming a dense impenetrable thicket, some of the stems being 3 inches in diameter; but it was being grubbed up when I saw it in 1880. The juniper is now of no economic use.

The Yew (*Taxus baccata*).—This tree abounds all over the county, and there are some splendid specimens, such as that at

Selborne, with a girth of 25 feet 2 inches; one in Lockerley churchyard girths 23 feet 4 inches, and others. One in Twyford churchyard is shaped like a gigantic mushroom, and has a sheer height of 30 feet, with a girth of 12 feet 5 inches. Another near the Forest of Bere is so solid in its branches, from being trimmed time out of mind, that a cricket ball fails to penetrate it, although thrown with considerable force. Many of the yew avenues in the county are of great interest, such as the one at Queenwood, reputed to have been planted by Queen Elizabeth; at any rate, there is one called after her on the same estate, near the manor-house of East Tytherley, where there is one running due east and west. It has a width of 27 feet, the trees standing 15 feet apart in the rows. The largest has a circumference of 6 feet. The boughs meet and intertwine, forming a Tudor arch to an aisle 300 yards long, the effect of which is difficult to describe, as it can neither be called "magnificent" nor "sublime," but it is worthy of the study of every thoughtful mind. In the Candover Valley, at the village of Chilton Candover, is one which is thus described by a writer in a local paper:—"The longest lived of British trees, the yew (which was certainly reverenced by the Druids) flourishes in this valley, and attains to a great size. A long avenue of yews of great age stretches from the village of Chilton Candover (adjoining Preston Candover) up the sides of the Downs towards the east for nearly a mile. These trees are certainly one thousand, and may, some of them, be nearer two thousand years old, or the present trees may have replaced others, for yews may often be seen, hollow and decayed, having a vigorous and younger stem growing inside the hollow tree. In any case, it is a fact that this great avenue does exist, and that a wide grass road runs along it leading on to the downs, but no further now, although in former times it doubtless led to an important height, still known by the Celtic name of 'Bangor' Copse, in which, as we should expect, more Druid sandstones are lying about."

Jonathan Oldbuck, in Scott's "Antiquary," when dilating on his Roman antiquities, was interrupted by Edie Ochiltree saying, "Prætorian here, Prætorian there, I mind the biggin' o' it." I cannot pretend to act the part of Edie, but the true history is—a mansion-house was erected here sometime in the middle of the 16th century as the seat of the Worsley family, which Bishop Gibson describes as a "noted seat." It stood near the church, and its foundations and terraced gardens may still be traced. It was pulled down about the end of last century, but its fine avenue of yew trees, three-quarters of a mile long, still remains.

As to the poisonous qualities of the yew, many accidents have occurred to horses and cattle through eating the leaves. Some time ago I was witness to the death of eighteen fine heifers poisoned through eating the trimmings of a hedge. This was supposed to arise from the twigs having undergone some change in the process of drying, but instances have occurred from eating off the growing tree. The last case that came under my notice was that of two horses—both had browsed off a tree, and one died, but the other apparently felt no bad effects. On further investigation, however, it appeared that the horses had eaten off different trees. This fact points to a conclusion I have for some time entertained, namely, that it is either the male or female tree which is poisonous. The berries are undoubtedly poisonous, which would favour the conclusion that the female is the poison tree. A veterinary surgeon pointed out to me a tree off which a cow partook of a plentiful repast, and he waited the result, expecting every moment to see her sicken and fall, but no bad effect followed. This was a male tree.

The Scots Fir (*Pinus sylvestris*).—It is said to have been first planted in this county at Bramshill by James VI. of Scotland; but an old map of the Hursley estate (in Queen Elizabeth's reign) shows two clumps near Ampfield, the big and little fir clump, as then existing; but whatever was the date, it is admittedly not a native of this county. It has, however, become established by self-sowing on the wastes and moorlands, and may be said to be quite naturalised. A great number have been planted on unprofitable land within the last seventy or eighty years, both on private properties and the Crown lands of the New Forest, so that, next to the oak, it has become one of the most important of the timber products of the county.

RANUNCULACEÆ.—The Traveller's Joy (*Clematis vitalba*) is also called the "Virgin's Bower," and the "Old Man's Beard." This is abundant on the chalk, ascending trees and shrubs 30 feet to 40 feet in length, and covering the face of disused chalk-pits.

APOCYNACEÆ.—The Lesser Periwinkle (*Vinca minor*).—Often occurring in woods and shady places, and spreading to a considerable distance. Flowers blue, but sometimes found with white flowers.

The Greater Periwinkle (*V. major*).—To be found on banks and in hedges in many places. It does not creep along the ground like the last, but grows into bush-like form.

HYPERICACEÆ.—The St John's-Wort, or Tutsan (*Hypericum Androsæmum*).—This is found in several places, but is not common; indeed, the large-flowered St John's-Wort (*H. calycinum*), although not admitted as a native, is nearly as common.

THYMELACEÆ.—The Mezereon (*Daphne Mezereum*).—In Hooker and Arnott's "British Flora," 1860, it is said: "Hampshire (perhaps truly wild)." I have made several journeys to find a truly wild specimen, but have been unsuccessful. The next species was always pointed out as the "Mezereon"; in fact, I have not found it naturalised even, but only as an outcast from gardens, it being plentiful about cottages, and perhaps no doubtful plant has less claim to rank as a native.

The Spurge-Laurel (*D. Laureola*).—To be found in many places, especially on the chalk.

CELASTRACEÆ.—The Spindle Tree (*Euonymus europæus*) is also called "Prick-wood," and "Skewer-wood." This shrub is to be found mostly on the chalk, and is fairly common. It sometimes attains a height of 10 feet. The bark is green and smooth, the leaves glabrous, the flowers small and white, and the fruit rose and orange-coloured and very beautiful. In the older wood the bark is rough and corky. The fruit in autumn has a singularly rich appearance.

MALVACEÆ.—The Tree-Mallow (*Lavatera arborea*) is found on the sea-coast by Hurst Castle on the Solent, but is rare.

COMPOSITÆ.—The Sea Wormwood (*Artemisia maritima*).—Rare, but found on the banks of Southampton Water at Dibdin and at Calshot Castle.

TAMARICACEÆ.—The Tamarisk (*Tamarix anglica*).—This beautiful shrub is found from Hurst Castle to the Lymington Salterus, and in places along the coast to Bournemouth, and on the opposite coast near Yarmouth in the Isle of Wight. Although it is said not to be a native, yet it is perfectly naturalised.

ERICACEÆ.—The Cross-leaved Heath (*Erica tetralix*) is abundant in the New Forest and on moors.

The Fine-leaved Heath (*E. cinerea*) is also abundant.

The Ling (*Calluna vulgaris*) is common along with the last, and is still much used for making brooms.

CISTACEÆ.—The Rock-Rose (*Helianthemum vulgare*).—Frequent throughout the county, especially on the chalk.

LABIATÆ.—The Wild Thyme (*Thymus serpyllum*).—Shakespeare says—

> "I know a bank whereon the wild thyme grows,"

but it would be difficult to find a bank in Hampshire where it does not grow, so plentiful is this small sweet-smelling plant.

LORANTHACEÆ.—The Mistletoe (*Viscum album*).

> "The mistletoe hung in the castle hall,
> The holly branch shone on the old oak wall;
> And the baron's retainers were blythe and gay,
> And keeping their Christmas holiday."

This plant is interesting on account of its being the only true parasite which is a native of England. It is to be found in this county on the apple-tree, hawthorn, maple (*Acer campestre*), lime (*Tilia europæus*), black poplar, white willow (*Salix alba*), and white-beam (*Pyrus aria*). The county also possesses one of the few oaks in England on which the mistletoe grows, namely, that in Hackwood Park, near Basingstoke. A list of these oaks appeared in the "Leisure Hour" in 1873. They numbered in all fifteen, but to the list has to be added an oak in Clarendon Park, near Salisbury, Wilts, making a total of sixteen trees.

The mistletoe has of late years become of such marketable value at Christmas time, that it is very difficult to preserve it from depredators.

XX. *Report upon the rearing of Underwood for Game Coverts in High Forest.* By THOMAS WILKIE, Forester, Tyninghame, East Lothian.

With few exceptions, shrubs will not grow under fir trees, and none will luxuriate under a dense crop of timber trees whatever the variety; hence, if a game covert is desired, the trees should be thinned out to about 30 or more feet apart—that is, if the tops are heavily clothed with foliage, but if they are not, the trees may stand at 24 feet apart, and a very good covert be formed beneath them.

In a plantation of about fifty years of age, where the crop consisted of ash, oak, and sycamore, averaging about 45 feet in height, with fairly well-furnished tops, and growing at 15 to 20 feet apart, I have formed a covert with very fair success. I was not permitted to thin out any of the trees, but had a few of their lower branches shortened. It was next the outside of a plantation, and on the inside an avenue 28 feet in width ran round the interior of the plantation, the distance from this avenue to the outside of the plantation and covert being about 50 yards. I had the refuse carefully burned, and the ground enclosed with 4-feet galvanised wire-netting of $1\frac{1}{4}$-inch mesh, which was sunk about 9 inches deep into the drifted sand of which the soil was composed, and then planted the enclosure with evergreen privet, red and white flowering *Ribes*, barberry, common laurel, hazel, rhododendrons, *Cotoneaster Simonsii*, and a few silver firs. The first five varieties named were from 18 to 24 inches in height, the others $2\frac{1}{2}$ to 4 feet, except the silver firs, which were about 9 inches. The plants were all set in pits 12 to 24 inches in diameter, and planted in patches where the largest openings were above them with connecting links between each clump. The most of the laurels have died down to the ground, but are coming away nicely again from the root-stock. Notwithstanding that the netting stands 3 feet 3 inches above the ground, the rabbits have gained access to the enclosure and done considerable damage to the plants. The mole has uprooted many of the silver firs, and a caterpillar of the "looper" kind has damaged the rhododendrons; but still, though this is only the second year since they were planted, they promise to make an excellent cover, and are already a tolerably good one.

Two other coverts have been planted as experiments, and, being under more favourable circumstances, they are doing remarkably well. One is planted on a small patch of ground where an aged crop of timber had been nearly all blown down; and the other on ground where the trees are not growing very close together. Both are planted with evergreen privet and common rhododendrons in drift-sand. As yet the rabbits have not found admittance to either of them, although the fences are of the same height and material as that already described.

In order that the covert may be made as good as possible, I would recommend that where the underwood or shrubs are growing densely, they should be cut over about 18 inches above the ground; but where they are scant and straggling, they should be laid over, cutting the strong shoots half through, so as to make them easier bent, and securely peg them to the ground, into which they soon root and grow. Thus the covert will be extended, and ultimately it will become as dense as may be desired. As the tree canopy increases in density it ought to be reduced by thinning the over-hanging branches, or by taking out some of the timber trees.

Another wood of about 11 acres, upon which a heavy crop of beech and oak grows at about 40 feet apart, was planted with a few conifers in the larger openings, and the whole area filled with a mixture of hazel and privet. This was done ten years ago, and is now an excellent covert, whilst before it was only a bare piece of ground with scarcely a vestige of herbage upon it. The conifers might now be cut out, being of a size suitable for use, and the hazel and the privet cut over, or pegged down, to thicken and increase the covert.

Instances might be multiplied to any extent; but the chief question is, For what kind of game are the coverts to be formed? If for pheasants, or for fox coverts, a variety of plants may be used, and details of their success can be enumerated; but if hares and rabbits are allowed to become numerous in coverts, I do not know of any class of plants which they will not destroy, except it may be the elder and rhododendron. *Lycesteria formosa* has been named as another shrub which the rabbit will not touch, but they are attacked where I have planted them quite as soon as any other shrub.

In marshy land in mountainous districts, the candleberry myrtle or sweet gale (*Myrica gale*) makes an admirable covert; so also does the hazel on the drier spots. On peaty soil the "Salal" of North-West America, *Gaultheria Shallon*, is also an excellent covert, and bears numerous fleshy purple berries, which pheasants eat readily.

The elder and its varieties are always exempt from the attacks of hares and rabbits, and are possibly the least fastidious as to soil or situation of any shrub. They will grow and thrive anywhere, except on wet marshy ground, or under a dense crop of fir trees. When they become overgrown, they can be cut half through and allowed to fall to the ground, and in a few years they will become very dense, and form a cover of which the pheasant seems particularly fond. I attribute this fact to their preference for covert where they are able to see around them, as until a pheasant is wounded it does not care for too dense a covert.

Fox covers are most economically, and possibly as densely formed, by simply ploughing the land, reducing it to a good mould and sowing whin seed, using about a bushel per acre, and then giving a double course of the harrows. No good covert for the fox is formed in high forest, unless only a very few trees are left per acre, the fox preferring a densely-covered hiding-place where his enemies cannot easily find him. In addition to the privet, the sloe-thorn has often been used successfully for this purpose, but it does not like a deep shade.

The successful planting of coverts gives a pleasing character to the woodlands; and where the ground game is kept within moderate limits, or is well killed down before the winter sets in, the under growth in such cases is much more useful as covert, and of a far more ornamental appearance.

ABSTRACT of ACCOUNTS of ROYAL SCOTTISH ARBORICULTURAL SOCIETY for YEAR 1888.

NOTE.—The Financial Year of the Society now ends at 31st December, and the following Statement shows the intromissions of the Treasurer as from 1st January to 31st December 1888, and not, as formerly, as from July to July of each year.

CHARGE.

Branch		£	s.	d.
	Balance in hand at 1st January 1888,	£10	11	11
I.	Arrears of Subscriptions due,	86	1	6
II.	Subscriptions due for current year 1888,	150	10	6
III.	Sums received for Life Membership,	24	1	8
IV.	Subscriptions due in 1889, paid in 1888,	2	16	6
V.	Dividend on Bank of Scotland Stock,	13	0	0
VI.	Sum received for Advertisements, and Sale of *Transactions*,	10	18	6
VII.	Donations to "Illustration Fund,"	3	1	0
		£301	1	7

DISCHARGE.

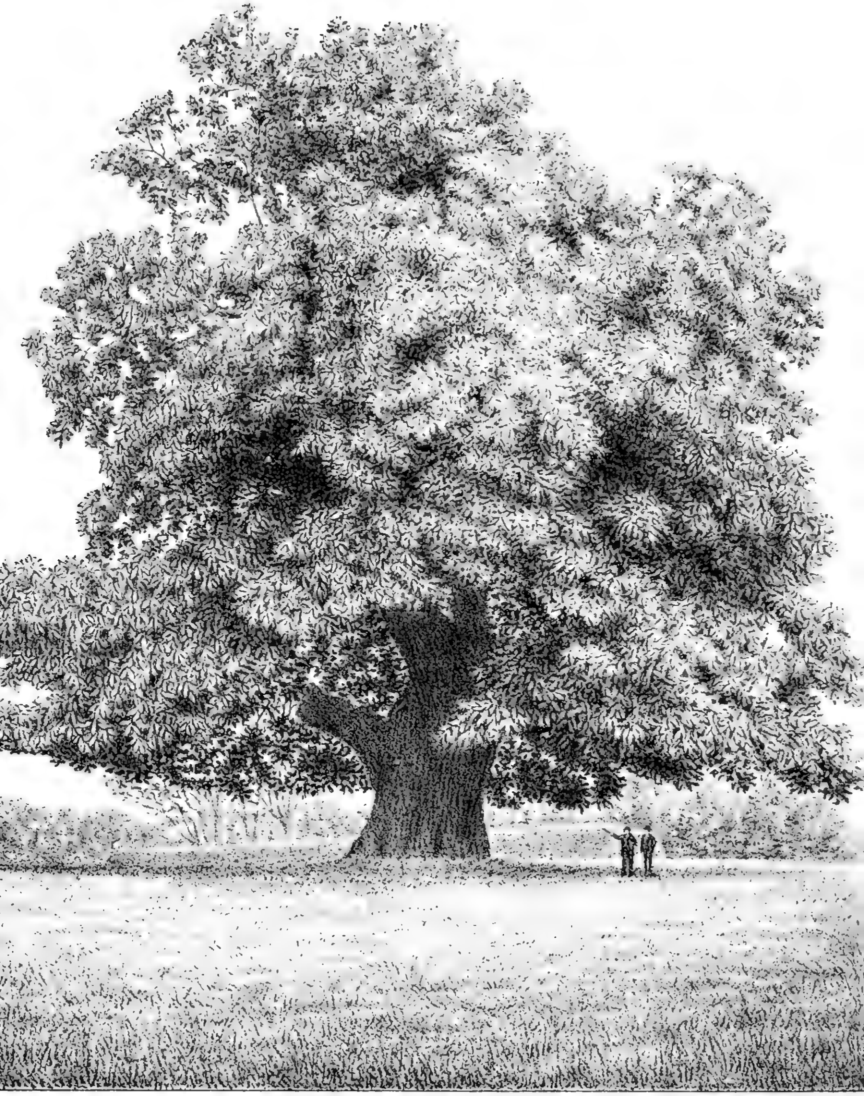
Branch		£	s.	d.
I.	Arrears of Subscriptions due, but unpaid at 31st December 1888,	£59	7	0
II.	Subscriptions outstanding for current year 1888,	78	16	0
III.	Accounts paid:— Printing, Stationery, Prizes, Postages, and Incidental Charges,	113	7	4
IV.	Salary and Expenses of Secretary and Treasurer,	31	5	5
V.	Paid into Bank,	12	11	0
	Balance in hand at 31st December 1888,	5	14	10
		£301	1	7

STATE of the FUNDS as at 31st DECEMBER 1888.

Sinking Fund, being price paid for £100 of Bank of Scotland Stock, and transfer of same,				£327	5	0
Less due to Bank at 31st July 1887,	£45	7	5			
Sum overdrawn between that date and 31st December 1888,	24	14	9			
				70	2	2
Nett Funds of the Society at 31st December 1888,				£257	2	10

Edinburgh, 25th January 1889.—I have examined the above Statement as at 31st December 1888, and have compared it with the vouchers and other instructions produced to me, and find the Account accurately stated and sufficiently vouched; the balance in hands of the Treasurer is Five pounds fourteen shillings and tenpence (£5, 14s. 10d.). The Nett Funds of the Society as at 31st December 1888 amount to Two hundred and fifty-seven pounds two shillings and tenpence sterling.

JOHN ORD MACKENZIE, *Auditor.*



Mc Farlane & Erskine, Lithrs Edinr

SPANISH CHESTNUT,
AT STEVENSTONE, DEVON.

McFarlane & Erskine, Lithrs Edinr

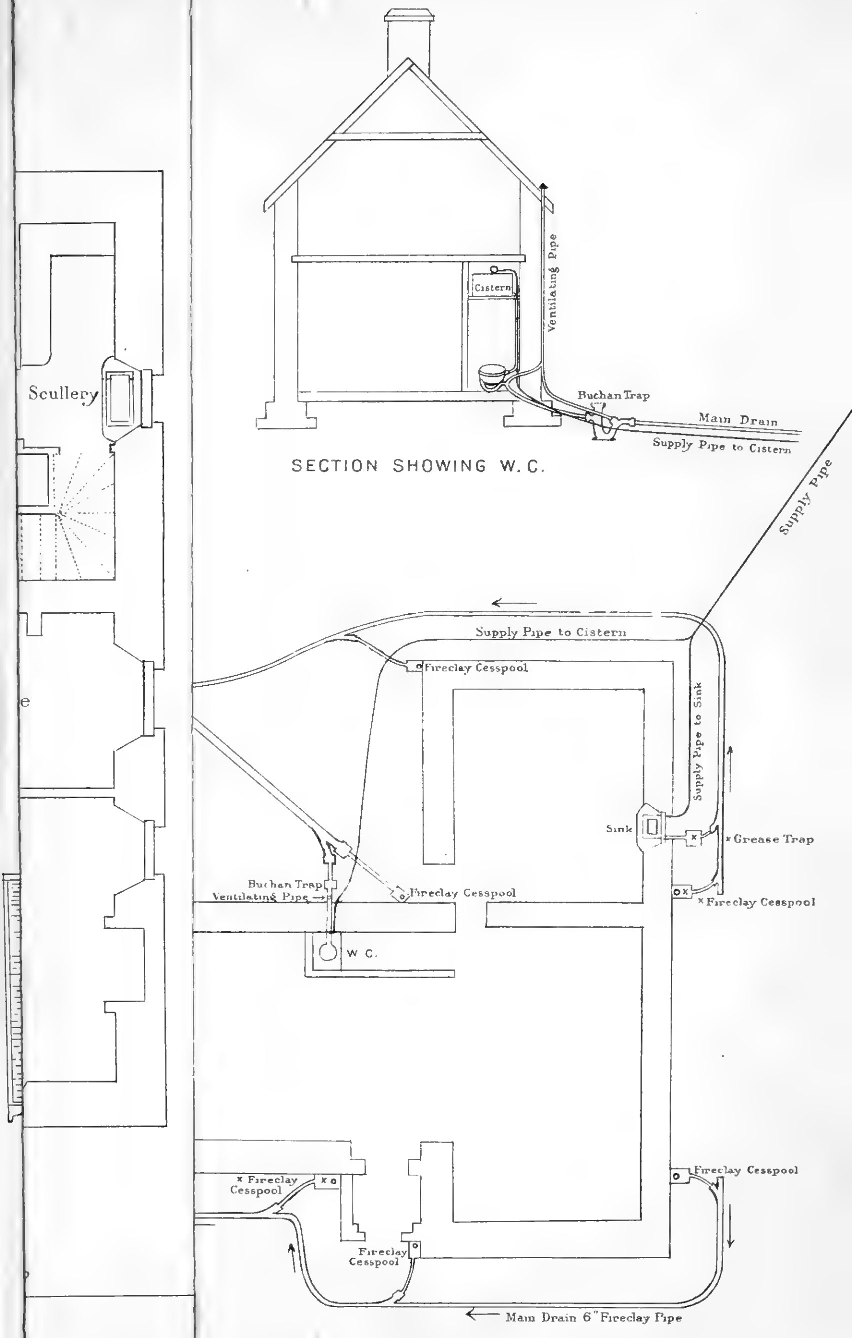
SECTION OF STEM OF SPANISH CHESTNUT
AT STEVENSTONE, DEVON.

M'Farlane & Erskine Lith. Edin.

OAK.
AT STEVENSTONE, DEVON.

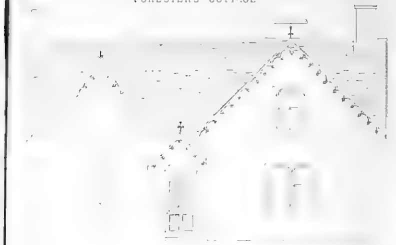
McFarlane & Erskine Lithrs Edinr

SECTION OF STEM OF OAK,
AT STEVENSTONE, DEVON.



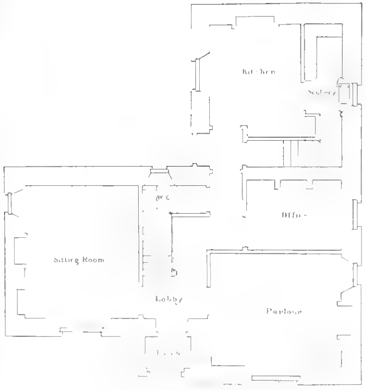
MR RESTER'S COTTAGE,—SHOWING SANITARY ARRANGEMENTS.

FORESTERS COTTAGE



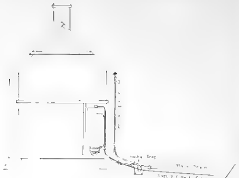
FRONT ELEVATION

SIDE ELEVATION

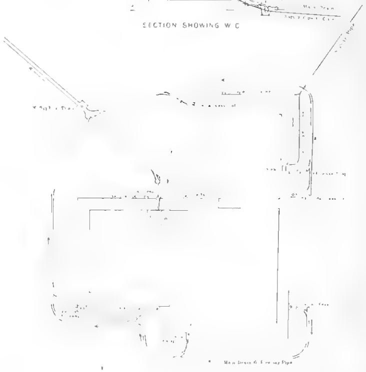


GROUND PLAN.

UPPER FLOOR.



SECTION SHOWING W.C.



BLOCK PLAN FORESTERS COTTAGE SHOWING SANITARY ARRANGEMENTS

TRANSACTIONS

OF THE

ROYAL
SCOTTISH ARBORICULTURAL SOCIETY

VOL. XII.—PART III.

SECRETARY AND TREASURER,

WILLIAM J. MOFFAT,

FELLOW OF THE BOTANICAL SOCIETY, EDINBURGH.

EDINBURGH:

PRINTED FOR THE SOCIETY.

SOLD BY DOUGLAS & FOULIS, CASTLE STREET.

MDCCCXC.

Royal Scottish Arboricultural Society.

SUBSCRIPTIONS.

The Council respectfully request that Subscriptions be paid on receipt of *Transactions*, and those Members in Arrear are especially asked to be good enough to include outstanding Subscriptions in their remittance, so as to avoid unnecessary expense to the Society in making repeated applications.

By order.

W. J. MOFFAT,
Secretary and Treasurer.

5 ST ANDREW SQUARE,
EDINBURGH, *February* 1890.

THE EXCURSION of 1890 will be to Estates in EASTER ROSS. Intimation of Route, Charges, etc., will be notified to Members in due course.

By order.

W. J. MOFFAT,
Secretary and Treasurer.

5 ST ANDREW SQUARE,
EDINBURGH, *February* 1890.

on the duties of Deputy-Surveyor of Dean Forest, Gloucestershire. After dinner on that occasion, the subject of the propriety of forming an Arboricultural Society was broached and fully discussed by those present. Mr Wm. Thomson, Deputy-Surveyor

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

XXI. *Address delivered at the Thirty-sixth Annual Meeting, 6th August,* 1889. By WILLIAM M'CORQUODALE, Scone, Vice-President.

GENTLEMEN,—We all deeply regret that our esteemed President, the Right Honourable the Earl of Hopetoun, is unable, owing to other engagements, to act as Chairman of this meeting. It has therefore become my duty, as senior Vice-President, to act in his stead. While gratefully acknowledging your kindness in placing me in this honourable position, I cannot but deplore the loss and disappointment which the Society has sustained through his Lordship's absence. For had the President been able to take the chair to-day, I am certain that he would have delivered an address that must have not only been powerful and eloquent, but would have greatly advanced the interests of this Society. I beg, gentlemen, that you will kindly bear with me while I make the following brief opening remarks.

This is now the Thirty-sixth Annual Meeting of our Society. It may be interesting to many of you to know that the Society was established on the occasion of Mr James Brown, author of "Brown's Forester," being entertained to a complimentary dinner at Edinburgh on the 17th February 1854, prior to his entering on the duties of Deputy-Surveyor of Dean Forest, Gloucestershire. After dinner on that occasion, the subject of the propriety of forming an Arboricultural Society was broached and fully discussed by those present. Mr Wm. Thomson, Deputy-Surveyor of Chopwell Forest, County Durham, moved, and I seconded, that an Arboricultural Society be established. A committee was thereupon appointed to carry out the resolution of the meeting. This was the origin of our Society, now known as the Royal Scottish Arboricultural Society.

Mr Thomson took a deep interest in the Society as long as he lived, and other members strove hard to foster it at first, yet it proved very uphill work for some years to keep the Society in existence. However, through time, its members increased in numbers, its utility was more and more recognised, and now the Society is strong and flourishing.

Still there is great room for improvement as regards the support that might be given in many quarters. I often regret to see so many of our able practical members withholding their support, and that many who are well qualified for the work fail to contribute articles to the *Transactions* of the Society. There is an old saying, which I believe is quite true, that "Union is strength;" and it is only by the whole-hearted devotion of its members that the Royal Scottish Arboricultural Society can become a living force in the land, and a centre around which all may gather to give and receive information.

All the true friends of forestry as a science, that is daily gaining prominence and popularity, cannot but hail with the utmost satisfaction the appointment of Dr Somerville to the "Chair of Forestry" in the University of Edinburgh. In the history of British forestry this is the first appointment of the kind that has ever taken place in Scotland, and it augurs well for the future of forestry in our native land.

I happen to know from friends who have watched Dr Somerville's career from his boyhood, that he is well qualified by natural talents, as well as by careful preparation and training, for the post that he is called to fill. He is also, from all that I have learned, a great enthusiast in the study of Arboriculture, so that we may have every confidence that the interests of our Society will be promoted, and the science of forestry become more and more popular by his appointment. During the coming University Session, commencing in October, Dr Somerville will deliver a course of one hundred Lectures on Forestry, and it is to be hoped that many students will take advantage of those lectures, and reap great benefit from them.

When I first went to the Duke of Montrose's estate, Buchanan, Stirlingshire, to acquire a knowledge of forestry—long before the days of railroads—there were few opportunities for foresters meeting and discussing forestry questions. Nowadays the facilities for meeting together for diffusion of knowledge in forest matters, for gathering facts and comparing experiences, and for general advancement in our profession, are very great. There is now a considerable amount of forest literature within reach. Science has been experimenting in many directions. Old systems of rearing plantations have been tested, and where found wanting have been supplanted by new methods and improved principles. In short, such progress has been made in the science of forestry as has not been manifested in any other period prior to the establishment of the Royal Scottish Arboricultural Society. Surely these matters are worthy of our diligent study, and afford an admirable field for the labours of our Society.

I would take the liberty here of offering a word of counsel, more especially to my younger brethren in the profession—to assistants and beginners—in the work of treating forest trees. I believe that a great future is dawning for forestry in this country. With agricultural affairs so depressed, the value of tillage land falling year by year, and the supplies of foreign timber becoming rapidly more circumscribed, landowners will soon begin to find out the great necessity of looking more to their woodlands. In other words, Arboriculture, instead of being kept in the background as it has been for many generations, will now of necessity take a prominent part in estate management; therefore, no doubt, immense tracts of waste lands and hillsides will soon be afforested. There, then, is the field that is opening up for experienced and talented men. Young men ought to study the nature and constitution of trees, the soils congenial to the healthy growth of different kinds of trees, and the localities and climates where trees have to be grown. A sound judgment is also requisite to determine what are likely to be the commercial prospects of various kinds of timber in the distant future. For it must be always borne in mind that forest crops are very different from ordinary agricultural produce. A crop of forest trees takes more than a lifetime to grow to maturity, and therefore a thorough knowledge of Arboriculture in all its details is absolutely necessary in order to plant judiciously, and with the best prospects of future remuneration.

Oak coppice, for example, is not worth cultivating nowadays;

and since iron has taken the place of wood in shipbuilding, growing oak for timber is not profitable. Again, many kinds of the newer coniferous trees are not to be recommended as plantation trees. The *Abies Douglasii*, *Abies Menziesii*, *Picea nobilis*, and *Pinus Laricio* are, however, all valuable plantation trees in suitable soils and situations. After fifty years' experience in the rearing of the *Abies Douglasii* tree, I have no hesitation in saying, that in a proper soil and situation this will become the most profitable plantation tree in our country. The Douglas fir will not succeed in heavy clay land, in humid or in poor soils, or in exposed situations.

And now permit me to say a word on the commercial outlook of the timber trade both at home and abroad. It cannot be denied that, since the check experienced at the time when iron took the place of wood in shipbuilding, the consumption of timber all over the world has been rapidly increasing. It was then believed by many that the market for timber was irretrievably ruined, but this prophecy, thanks to railways and new industries, has been entirely falsified. In the formation and upholding of railways, in buildings, and for all other commercial and economic purposes throughout the world, the consumption of wood has risen to such proportions in recent years as to cause serious apprehensions as to the sufficiency of the existing supplies of timber for a not distant future. At all events, it is certain that the difficulties and cost of carriage which are always involved in the further receding of the forests from the ports of shipment will always enhance the price of foreign timber, and thus furnish a more favourable market for home-grown wood. If the foreign supply was seriously curtailed, our whole stock of home-grown pine that is fit for sleepers would in a few years be exhausted.

It is high time, therefore, that our government, and extensive landed proprietors, were bestirring themselves to see to the wide extension of plantations, by afforesting largely the waste lands.

Were our home woods exhausted, as they might easily be in their present condition and proportions, and a timber famine occurring, it would certainly prove a very serious affair for us. In such a case a generation at least must elapse before our forests could be replenished and occupied with timber fit for the immediate wants of our country.

XXII. *On the Old and Remarkable Yew Trees in Scotland* (Taxus baccata, L.). By Robert Hutchison of Carlowrie, F.R.S.E.

Taxus, the Latin name of the yew, from the Greek τάξος (taxos), which, from τάσσω, "to arrange," has probably reference to the leaves being two-rowed or distichous on the branchlets like the teeth of a comb; or probably from τόξον, "a bow," the wood being much used in ancient times for making bows; or from "*toxicum*," poison, the common yew being considered poisonous. Yew, or *yeugh*,—in Chaucer and other old authors, *ewe*; in Aubrey's "Wilts," *eugh*; Anglo-Saxon, *iw*; German, *eibe*; Spanish, *iva*; French, *if*; Welsh, *yw*; Media Latin, *ivus*, *iva*, or *ua*, an abbreviation of *ajuga*, which was a corruption or misspelling of *abiga*, a plant mentioned by Pliny as being the same as χαμαίπιτυς (chamaipitus), so called from its causing abortion. The yew has an extensive area of distribution in the temperate regions of the northern hemisphere. We find it as a large bush or small tree, when fully grown 30 or 40 feet high, and frequently in suitable localities assuming much larger proportions. It is found in most parts of Europe at elevations of from 1000 to 4000 feet; is frequent on the Apennines, the Alps, Greece, Spain, Piedmont, Great Britain, the Pyrenees, the Caucasus, and even in Scandinavia, but is wanting, or only rarely found, in Russia, a circumstance accounted for by the level nature of the country. Preferring elevated situations, often at a considerable height on mountains, it very seldom forms a continuous forest like most of the coniferous tribe, and even when plentiful in its native habitat, it is mixed freely with other varieties of trees. It is not unfrequently solitary, forming on downs or moorlands a conspicuous object from afar, and in its wild state in this country it is found more numerously on the northern slopes of rising ground than on any other aspect, and very frequently under the shade of deciduous trees.

There can be no doubt the yew is indigenous to Great Britain. If a proof were wanting of the indigenous growth of the yew tree in Scotland, we may quote the fact that a very large and aged yew grew about the year 1834,[1] high among the hills, far from any cultivation and from any human dwelling, in the midst of the wild country between Loch Ness and the sources of the river Findhorn. Might

[1] H. Evershed in *The Gardeners' Chronicle*, 1876, vol. vi., p. 99.

not, therefore, even the barrenest ground at high altitudes, and on the coldest of our mountains, be profitably replenished in large tracts with yew for cover, and shelter for ultimate planting? It is of geological antiquity, and formed part of the primeval forests of this country at a period long anterior to historic times. It has been found among the submerged trees along the Norfolk coast, near Cromer;[1] and it again presents itself in another wide forest underlying the Bristol Channel, in the recesses of which bones and other animal remains have been found, showing that at some early epoch the elephant, rhinoceros, and beaver have roamed at will under its shadow. The yew is also indigenous to parts of Eastern and Western Asia, and if *Taxus Canadensis* be only a variety of *T. baccata*, as was supposed by Loudon, it extends its geographical distribution to the North American continent.

Like most trees of slow growth—slow as compared with the more rapid growth and maturity of most of our deciduous trees, and even the coniferæ, to which we are accustomed—the yew is long in attaining maturity, and many centuries elapse ere it shows decay; a fact which we learn from the records of celebrated trees now extinct, as well as from others still in existence, whose history can be traced for upwards of a thousand years. M. de Candolle, and several other botanists of eminence, do not hesitate to assign, and with considerable show of reason and scientific data, a much longer lifetime to some of our still existing yew trees. Reference is fully made to several such specimens in this paper, and details are given of their present measurements and condition in the Tabulated Appendix.

Whether considered from the deep and perpetual sombre verdure of its foliage, conjointly with its great longevity and freedom from decay, as emblematic of immortality, the yew has acquired everywhere an almost sacred character. This association of the tree with religion and places of worship is of very ancient date. Many hypotheses have been formed to explain the connection between the yew and its site in proximity to abbeys and old churches or churchyards, and their relation to such old trees, for it is uncertain in many instances throughout the country whether the churches or religious houses were not planted beside, and for some reason in association with, the old trees already standing. Similar suppositions prevail in regard to some of our old standing stone circles, considered as places of worship, and which, in process of time, came not only to

[1] Dr Ramsay, Physical Geography of Great Britain, p. 134.

make the spot hallowed ground, but to be selected as the site for a primitive church, a building or structure of a more permanent nature, or enduring monument, to give expression by its visible presence of the feelings, the sentiments, and the hopes of our early religion. No doubt the known antiquity of many yew trees in these early times, standing in burial-places or places of worship or sacrifice, strengthened those hallowed associations which took their rise probably at an epoch anterior to the introduction of Christianity into Britain.

Amongst the ancient yews still existing associated with sacred edifices, the following occur to us to mention. Details of their dimensions and condition at the present day will be found in our Tabulated Appendix. The Fortingal yew in Glenlyon, Perthshire, stands near the gateway leading to an old churchyard. The Forgan yew trees (5) in Fife, are beside the ruins of the old parish church of Forgan. The old yew tree at the Colquhouns' burying-ground, is beside a ruin on Inch-Lonaig, an island in Loch Lomond. The Dunkeld yews beside the ruins of the cathedral. The old yew tree at Dryburgh Abbey, and others.

But besides its association with early religious and burying places in our country, the yew has also played a very conspicuous part in our national history. Many venerable and hoary specimens still survive to mark the spots where great events have taken place, and others are connected with the names of historic personages. A still more prominent *rôle*, however, has been played by the yew in our country's early history in supplying the material of which the bow, that national instrument of early warfare, was made. We have said that the yew tree is of very slow growth, whence its wood is amongst the hardest, close-grained, durable, tough, and elastic known; qualities well calculated for use in the making of bows for the chase or for warfare. It hence became widely and generally used in this manufacture, and was formerly what the oak was in more recent times, the basis of the country's strength. Of it the old English yeoman made his bows, which, he proudly vaunted, nobody but an Englishman could bend. The yew, however, was not cultivated only for its toughness and elasticity, but for the durable nature of its timber. It is, to the present day, a common saying among the inhabitants of the New Forest, that a post of yew will outlast a post of iron. The wood being also of a beautiful rich reddish-brown colour, and susceptible of a high polish, was formerly much used for domestic purposes in the manufacture of furniture; and many antique, interesting, and curious specimens are still preserved in the old mansions throughout the country.

While the bow was for centuries the great weapon for defence or attack of our ancestors, the yew was preserved with the utmost care, and statutes were framed for its protection and preservation. In ancient Welsh laws a yew-tree, if *consecrated* (grown in a churchyard), was valued at £1, and at 1s. 3d. if *un*consecrated! These laws were made at first by our early kings, and afterwards by Parliament, and provision was not only made for the preservation, but also for the planting of yew trees, for the supply of yew-wood for bows, for prohibiting exportation, and for regulating the importation and supply of yew timber. Every reader of English history is well aware that the yew bow was for centuries especially the Saxon weapon of warfare, and the doughty achievements of the bowmen—how fields were won, fortresses taken, and deeds of valour and prowess displayed in encounters whose story will not soon be let die in our country's history—all attest the skill and high repute of the English archer of the middle ages.

By degrees, as the introduction of firearms and gunpowder into general use displaced the long and cross bow alike, the yew tree appears to have gradually fallen into oblivion, or at all events into neglect, till during the reign of Elizabeth. So much at that period had the art of bow-making and its kindred occupations declined, that the trades of the bowers (bow-makers) and fletchers (arrow-makers), with the stringers and arrow-head makers, were threatened with extinction; and these crafts accordingly, in 1570, petitioned Queen Elizabeth to enforce the statute of Henry VIII. enjoining every man to have a bow in his house. She did so, and butts, etc., were erected in different places, such as Newington Butts, London, at which every able-bodied man was enjoined to practise archery, while the languishing business of the tradesmen took fresh impulse from the royal favour.

To Evelyn may be accredited the merit of having rescued the yew from the neglect into which it had fallen, and from his time it began once more to play an important part in our domestic history, not in the art of warfare, but in the more peaceful practice of gardening. Towards the end of the sixteenth century, the use of the yew in the formation of hedges for protection or ornament became general. Its improved density when pruned, and its suitability for such treatment, led to the introduction of the fashion of clipping it into artificial shapes, which soon became prevalent, and under the fostering care of Evelyn, a perfect revolution in the previous style of gardening quickly obtained. Geometric figures, the artificial forms of birds, beasts, and every conceivable object in nature, were fashioned by clipping this most tonsile of all trees, which was thus subjected to many indignities, and so clipped and metamorphosed into such a variety of deformities, that one could hardly bring themselves to conceive that it had any natural shape, or the capacity which other trees possess of hanging their branches naturally with freedom and gracefulness. Notwithstanding such treatment, and the marvellous distortion of its natural features thereby, the yew is perhaps one of the most beautiful and graceful evergreens we possess, when left to Nature. It is even superior to the Cedar of Lebanon in the opinion of Loudon; for the same soil which cramps the cedar is congenial to the yew and its development. We seldom see the yew tree in this country at the present day in perfection. In many parts of England, such as in the New Forest where it formerly abounded, it is now getting scarce. It is not so extensively planted as in former times, and as it does not now rank as a timber tree, it is thus, in a certain degree, unprivileged and unprotected by forest laws, so that it is not unfrequently marked out for booty by those who durst not lay violent hands on the oak, ash, elm, or other useful timber trees.

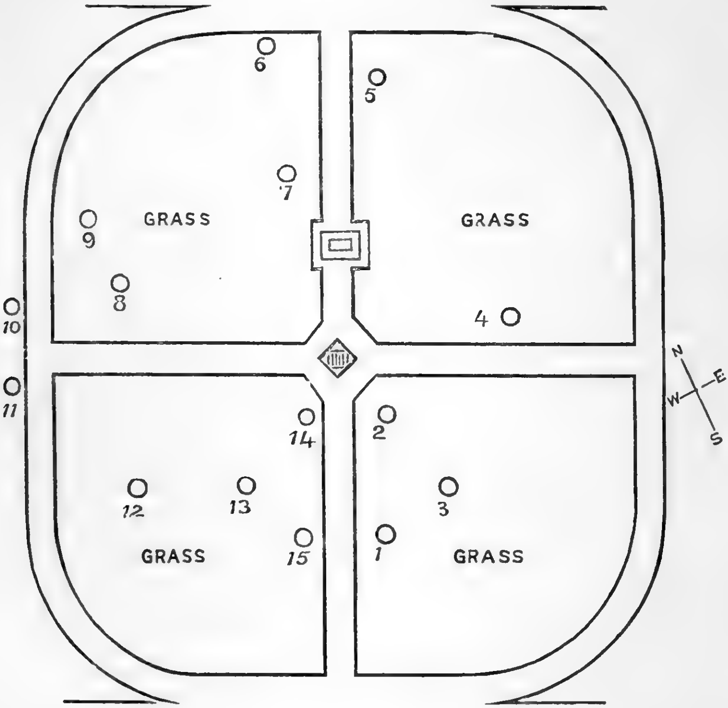
Having cursorily noticed the yew generally, and its characteristics, we may now turn to the list of old and remarkable specimens which we have been able, after considerable trouble and research, to tabulate and lay before our readers, as one of the most interesting records hitherto collected of the old and remarkable trees still extant in Scotland. In glancing over the Table, the first feature with which one is struck is the very general distribution over the country of the specimens recorded. No doubt it will be found that they more frequently occur in the South-Western counties of Scotland, and even in some of the Western Islands, but this is not to be wondered at, as the yew from the peculiarity of its root formation prefers and luxuriates in damp situations, such as we find in the districts referred to. For in the case of the yew, the plexus of fibrous rootlets is always very great, even at an advanced age of the tree, so that the absorbent powers of a large yew must be enormous. This is, doubtless, one of the causes that contribute to the longevity of the yew, and it is equally probable that these rootlets have a limited power of selection in the substances taken up by them, since the yew lives and thrives in soils of the most opposite description and maintains a tolerably uniform habit and colour of foliage everywhere. The situation of some of the islands in the lochs in the west and south-west of Scotland is peculiarly suitable for the growth of the yew in this respect, and the tree has for centuries held its habitat, and flourished in luxuriant verdure, on some of these islands. Thus we find that in the year 1814, the islands in Loch Lomond furnished for the axe no fewer than 300 large well-grown trees, and yet a sufficient crop was left. On the island of Inch-Lonaig there still exists an extensive natural forest of yew, which consists entirely of old trees, as the herd of deer which has been kept on the island for ages prevents any young trees from getting up. Many of these yews, when they have begun to decay, have sent up shoots from the roots, close to the old trunk. A number of these coalesce, and form at last a complete new trunk, at the side of which the old one continues to decay. In this way the tree comes to be regenerated from the root. Another particular sort of renovation of an old tree which sometimes takes place, although not confined to the yew species alone, has been observed in many cases on these islands of Loch Lomond. A growth of young bark forms and shoots upwards from the base of the trunk or root in several places, and puts forth fresh branches towards the top of the old trunk; this growth spreads laterally, and covers as with a *callus* parts of the old tree that are dead, often over large buttresses or angular growths on the stem, or even large dead arms devoid of bark. Such is the marvellous recuperative power of Nature, and her methods of grappling with destructive forces, at once ingenious and effectual.

But besides the islands of Loch Lomond, the yew was particularly indigenous to the island of Bernera, adjacent to the Sound of Mull. Sir Duncan Campbell of Lochnell (prior to 1770) cut a yew upon that island "*of vast size.*" Its precise dimensions are, unfortunately, not preserved; but we may judge of its proportions, when we find that the timber of this one tree deeply loaded a Highland six-oared boat, and was sufficient to form a large and elegant staircase in the mansion-house of Lochnell, which was afterwards burned down. The abundance in which the yew tree occurs in this locality, and on the western islands, must, however, in a great degree, be attributed to the geniality of the climate, and the rainfall of the district annually. The rate of growth, height, girth, and length of trunk of all coniferous trees in Britain—and the yew is no exception—are greatly influenced by the amount of moisture in the atmosphere in which the trees are growing, or, which amounts to the same thing, the annual rainfall of the region or district. Numerous examples have been cited during the last thirty years, since the study of meteorology became more popular and received greater attention and been scientifically applied to Nature's operations in tree life and culture, as to other of her arcana, which prove that the rate of growth of coniferous trees in the south-west and west of England is more rapid than in the eastern counties. This is true also of their growth in Scotland. The annual rainfall on the west coast reaches 40 inches, and in particular localities and spots often much more; while on the eastern seaboard of the country not more than about 25 inches is the average. The finest specimens of the rarer coniferæ in Scotland are to be found where the temperature and rainfall are highest; and the same may be said of the yew—soil, exposure, and such adventitious circumstances being equal.

Estimates have been made by different authorities of the ages attained by some of the largest coniferous trees thriving in their native habitats under favourable circumstances as to rainfall and climate, but these must be accepted with an amount of reservation corresponding to the difficulty experienced in ascertaining anything like an approximation to the truth. Thus we are told, that, in favourable sites as to moisture, etc., the following trees will live:—

Wellingtonia gigantea, . . .	from	1500 to 2000	years.
Sequoia sempervirens (Redwood), .	,,	1300 to 1750	,,
Taxus baccata (Yew), ...	,,	1100 to 1250	,,
Taxodium distichum (Deciduous Cypress),	,,	750 to 1000	,,
Cedrus Deodara (Indian Cedar), . .	,,	750 to 900	,,
Cedrus Libani (Cedar of Lebanon), .	,,	600 to 800	,,
Abies Douglasii (Douglas Fir), . .	,,	450 to 600	,,
Abies pectinata (Silver Fir), . .	,,	450 to 600	,,
Cupressus sempervirens, . . .	,,	350 to 500	,,
Pinus Lambertiana, ...	,,	350 to 500	,,

In the north-east of Scotland we find some fine examples of yew trees at Ellon Castle, Aberdeenshire. They are growing in the garden under the shelter of high walls, at an altitude of 50 feet, in a strong yellow loam with gravelly subsoil. The largest in the group girths, at three feet from the ground, 16 feet. In 1852, this tree measured 10 feet 6 inches in circumference about the same point; thus giving it in thirty-six years an increase of no less than 5 feet 6 inches, or about 2 inches per annum. The group of fifteen trees are arranged in the various positions, as shown on the accompanying plan, kindly furnished by Mr Gordon of Ellon, along with the memoranda of dimensions of the trees.



The trees are numbered in accordance with the list in our Appendix, so that at any future time there may be no difficulty in identifying each individual tree, and noting the progress of its growth.

Two of the best upright growing yew trees in the north exist in the manse garden of Arbuthnott, Kincardineshire, in the valley of the river Bervie, about three miles from the sea, and 100 feet above its level. They are male and female. Pinkerton the traveller, who saw them about the beginning of the century, pronounced them to be at least five hundred years old, adding that he could not tell how much more they might be. The church of St Ternan of Arbuthnott, near which they stand, was consecrated by Bishop De Bernham in 1242. It is not at all improbable that they may have been planted about that date. No. 1 girths, at one foot from the ground, 8 feet 11 inches; length of bole to first branch, 12 feet; and total height of tree, 44 feet. Seemingly at a comparatively early period in the life of the tree, the momentum of the swaying branches, or perhaps the superincumbent weight of snowfall on its foliage, had split the main trunk almost to the base. The elasticity of the severed parts, however, had enabled them to recover the perpendicular position, and they have welded themselves together again at several points. The tree is now perfectly healthy, and bears every year a plentiful crop of berries. No. 2 girths, at one foot from the ground, 7 feet 10 inches. Height of bole is 10 feet. This tree appears also to have been split at some early period. It has not had the same power of recovering itself as its fellow, being permanently forked at 4 feet from the ground. That it did not originally branch there may be inferred from the shape of the opposite parts, which, if they could be forced together, would exactly fit into each other. Many years ago the tree bled severely at the angle of the fork in its stem, which a plaster of cow dung and lime effectually stanched; and after repeated applications the wound healed, though the tree is not so vigorous and robust as its neighbour. Both trees are exactly the same height, and meet in one at the top.

At Ochtertyre, Perthshire, there are many very thriving yews of comparatively recent planting, having been introduced within the past hundred years. The evergreens at Ochtertyre are planted in the woods in sections, each species being allotted a separate section for itself, so that the different varieties are brought together, an arrangement both beautiful and useful for comparison. Thus we have large clumps dedicated to varieties of the *Abies*, *Picea*, and *Taxus* respectively. Of the last, there is a collection of no fewer than thirty varieties. At the site of the old castle of Inchbrakie, near Crieff, there stands in the moat a fine old yew, girthing 10 feet 7 inches at five feet from the ground, and with a diameter of spread of branches of about 40 feet. Into this tree it is stated that the Marquis of Montrose, on one occasion when pursued and nearly captured, succeeded in climbing, and found refuge in its umbrageous head. A fine old yew is also growing at Lawers, near Comrie. It is 38 feet high; girths, at five feet up, 12 feet 6 inches; and is in a perfectly vigorous condition.

In the Cathedral grounds at Dunkeld there are two old yew trees worthy of note, as they are different in habit and appearance. No. 1 is planted close to the west gable of the cathedral, and is of a stiff, upright habit of growth, resembling the variety known as the "Neidpath Yew." It is 36 feet in height, and, at one foot above the ground, girths 7 feet 8½ inches. No. 2 is also growing to the west of the cathedral, at the present bowling-green, which is supposed to have been in former times the site of the burying-ground of the monks of the abbey. It is a peculiar-looking, round-headed tree in full vigour, and quite distinct from its neighbour. It is 42 feet high, and 10 feet 8 inches at one foot from the ground. Both occupy very favourable situations—well sheltered, in fine, free, loamy soil, on a cool subsoil, and in the congenial damp atmosphere, close to the banks of the Tay. The old yew growing at Parkhill, near Blairgowrie, girths 15 feet at five feet from the ground, and its length of bole is 7 feet, while the height of the tree is 26 feet. It grows in good loam on a clayey subsoil. This tree is in shape like a large mushroom. From a drawing taken of it in 1774, and still preserved, it presents the same outline, and seems as high then as now. It measures 14 feet 5 inches in girth at the ground, and was probably planted in 1610. There are no other yews near it, nor other large trees, excepting a very old box tree beside it, 10 feet in height, and 2 feet 9 inches in circumference at the ground.

The well-known and frequently-quoted Fortingal Yew has naturally been visited and examined, and is not omitted from our tabulated list of old trees in the Appendix, although, of course, it was impossible to record the information regarding its present condition in the columns of our Table. This aged and now sadly dilapidated patriarch has formed the subject of much controversy amongst botanists and scientists as to its age, and it has, by eminent authorities, been credited with an antiquity far beyond that of any other tree in Britain, and has been thought indeed by no less an authority than De Candolle to be possibly "the most venerable specimen of vegetation in Europe." The site of this patriarch amongst trees is the village churchyard of the parish of Fortingal, at the entrance to Glenlyon in Perthshire, about four miles by road above the confluence of the Tay and Lyon, and about 400 feet above sea-level, in a valley very favourable to tree life. It is within the churchyard, and is protected by a walled enclosure 33 feet by 20 feet. But depredation has not been thus altogether prevented. Two railed openings and a railed gate allow inspection from outside of a mass of vegetation so confused, that the whole enclosure seems simply full of young yews and vigorous spray. It is only by brushing through this mass on obtaining access into the interior, and not easily even then, that an adequate idea can be formed of what is still extant of the ancient tree. The late Sir Robert Christison, who took the deepest interest in all things arboricultural, and made a study of the growths of trees scientifically, was much taken up with the Fortingal Yew, and has written a most elaborate monograph on it and its probable age, to which [1] we have been much indebted for many hints and conclusions regarding its history and probable progress in growth and decline. From data supplied by comparative measurements taken over a series of seasons, and from many examples of the annual growth of the yew tree at different ages, and verifying as far as possible the formula of De Candolle as to the increment of very old yew trees, Sir R. Christison found that his investigations and minute observations on exact lines "tended to show that a healthy yew, favourably circumstanced, should grow for the first sixty or seventy years at the rate of *an inch of radius* every twelve years, or exactly half-an-inch in girth annually." The probable rate of growth in this country, during the first century of the life of a healthy yew tree, under favourable circumstances as to soil and shelter, may be pretty accurately taken from a tree at present growing among the ruins of Dryburgh Abbey. The soil is a deep rich loam of a sandy nature. The tree is planted in the south transept, and opposite the tombstone and last resting-place of Sir Walter Scott. A tablet of stone in the wall on the north side of the Erskine burying-ground, bears that this yew tree "was planted from the seed-bed by the Earl of Buchan, 1789." It is now, August 1887, 3 feet 8 inches in girth at three feet from the ground; at the ground line it is exactly 4 feet. The tree, which is very vigorous and healthy, covers nearly the whole transept gable; and is 60 feet high, with a bole of 35 feet, and is of a very erect habit of growth, partly due to its peculiarly isolated and sheltered situation. If we therefore accept this tree's progress from the seed-bed to the present date (say, a hundred

[1] Edinburgh Botanical Society's *Transactions*, vol. xiii., pp. 217, 394, 410.

years) as 3 feet 6 inches in girth of stem, we have a very accurate testimony to the correctness of Sir Robert Christison's formula as to the early growth and progress of the yew tree—to which reference has been made in another part of this paper. "An increase materially less than this will consequently indicate some unfavourable circumstance in cultivation, and may direct attention to it in good time. On the other hand, we must be prepared to encounter occasionally exceptional instances of unusually quick growth, and trace its cause. The observations available for the period of yew life after seventy years are fewer and less precise. Observations by Bowman extend the twelve years rate to the age even of 120. He measured eighteen young yews in Gresford Churchyard, near Wrexham, the age of which was ascertained by a parish record of the planting of them, and he found that in 120 years they had attained an average diameter of 20 inches, and consequently an average girth of 63 inches. This gives a growth at the rate of an inch of radius of wood in $12\frac{1}{3}$ years. For the next century of yew life after the age of 150, De Candolle brings out, from actual observation, an average growth of an inch of radius in $25\frac{1}{2}$ years, uniformly for its whole existence. This result indicates very slow growth for a yew only 63 inches in girth; and at all events, it gives no insight into the rate of the last century of its life." He then gives other measurements and comparisons, showing the subsequent process of growth during succeeding centuries, and sums up his conclusions after such elaborate arguments and data as follows:—"It seems probable that, under circumstances not unfavourable, a healthy yew in this country grows on an average by an inch of radius every twelve years for the first sixty or seventy years, and will attain the girth of 33 inches at the narrowest part of its trunk; that the same rate of growth may continue to its hundredth year, or even a little later, giving a girth of $4\frac{1}{2}$ feet; that during the second century of life the average rate is reduced to an inch in fifteen years, giving a girth of nearly 8 feet; that during the next three centuries, the rate on an average can scarcely be greater than an inch in twenty-five years, giving a girth of 14 feet at the close of the fifth century; that during the subsequent five centuries, the average rate for which we have few data, will be somewhere between thirty and forty years, say thirty-five, which will increase the girth of trunk to 22 feet at the close of one thousand years. We thus come close upon the girths recorded of many famous English yews of 25, 27, and 28 feet, which historical incidents credit with an age a few centuries above one thousand years of life. I am not aware of any existing yew of much greater magnitude than those in Britain, unless it be the yew of Fortingal; but if there be, there is no authority from measurements that warrant a quicker rate of growth after a thousand years than an inch of radius in forty years. Any evidence to be got from the Fortingal yew itself tends only to confirm that proposition."

De Candolle, with particulars of the tree in his possession in 1831, and by the method of measuring and computing its growth to which we have so fully referred, estimates its age to have been 2500 to 2600 years in 1770; and alluding to it and some others in England—among which, however, he only mentions the Brabourne yew[1] in Kent as vying with it in antiquity,—he adds, "I venture to indicate these trees to botanists and foresters, that they may authenticate them, and establish, if possible, their law of increment; for it is probable that they are the veterans of European vegetation" ("Bibl. Univ.," ii., 66).

The earliest notice of this remarkable relic of many generations is by Pennant, the famed traveller, and also by the Honourable Daines Barrington, a barrister, afterwards a Judge on the English Bench, who seem to have stumbled upon it about the same year (1769). Pennant's "Tour," published in 1771, states that in the churchyard of Fortingal "there is the remains of a prodigious yew, 56½ feet in circumference,"—"the middle part is now decayed to the ground, but within memory was united to the height of 3 feet; Captain Campbell of Glenlyon having assured me, that when a boy he had often climbed over, or rode over, the connecting part."

Barrington, in *The Royal Society Transactions* for 1769, says:—"I measured the circumference of this yew twice, and therefore cannot be mistaken when I inform you that it amounted to fifty-two feet. Nothing scarcely now remains but the outward bark, which hath been separated by the centre of the tree's decaying within these twenty years. What still appears, however, is 34 feet in circumference."

Strutt, in "Silva Britannica," also mentions the tree, and gives a beautiful etching in his folio volume, which, however, represents

[1] Evelyn, in his "Silva" in 1655, describes the Brabourne yew as "a ruin with a trunk of 60 feet in girth." Now (1888), there is nothing left of it unfortunately, but the tradition from Evelyn.—Rev. G. B. Percy.

the old tree in a much less decayed condition than Pennant or other contemporary chroniclers describe it. The etching shows much more foliage and living branches on the tree, so that the branches of the two portions of the trunk intertwine, and form one leafy head, resting on two hollow shells of trunk facing each other. The gap in the trunk is well represented as of large dimensions, and with a funeral in the act of passing through it; this being an invariable practice in olden times when funerals entered the churchyard. When old trees grew in a churchyard near a wall, the custom was to carry the corpse for burial between the old tree and the wall,—a custom also prevalent in mediæval times in Derbyshire, Staffordshire, and Cheshire.

De Candolle in 1831, and again in 1834 ("Physiologie Végétale"), from subsequent examination of the annual rings in several much younger yew trees, concluded that every inch of radius of an elderly yew represented twenty-five years' growth, and that consequently the Fortingal yew was, in Pennant's time, 2500 or 2600 years old. One of the most precise and graphic accounts given by modern authorities who saw the interesting trunk and its condition, the late Mr Patrick Neill, describes it in 1833, and from his narrative it appears to have suffered much depredation and destruction since Strutt's account of it in 1825. He states that large arms had been removed, and even masses of the trunk itself carried off, for the purpose of making drinking-cups, boxes, and other articles of fancy work as relics. "Consequently," says Mr Neill, "the remains of the trunk present the appearance of a semicircular wall, exclusive of traces of decayed wood, which scarcely rises above ground. Great quantities of new spray have issued from the firmer portions of the trunk, and young branches spring up to the height perhaps of 20 feet. The side of the trunk now existing gives a diameter of more than 15 feet; so that it is easy to conceive that the circumference of the bole, when entire, should have exceeded 50 feet. Happily further depredations have been prevented, by means of an iron rail, which now surrounds the sacred object" (*Edin. New Phil. Journal*, 1833, xv., 343, *note*). This information is confirmed in the "New Statistical Account of Scotland," by Rev. R. Macdonald, then minister of Fortingal, who gives some historical information bearing upon the antiquity of the tree. The only information vouchsafed by Sir John Sinclair's "First Statistical Account," after mentioning the yew, is:—"And a very remarkable tree it is!" In the "New Account," however, Mr Macdonald tells us "that at the commencement of his incumbency in 1806, there lived in the village of Kirkton of Fortingal, an old man, Donald Robertson, eighty years of age, who remembered that when a boy going to school, he could hardly pass through between the two parts of the trunk; now several yards separate them, and this dilapidation was mainly occasioned by the boys of the village kindling their fire at Baeltainn within the hollowed trunk. It is from 52 to 56 feet in circumference" ("Statist. Account of Scotland," x., 545, July 1838). Sir Robert Christison had this information verified by Dr Irvine of Pitlochry, who is a grandson of a former owner of the Fortingal burying-ground, Stewart of Garth. His mother often told him that, when she was a girl, about the year 1785, she could with difficulty squeeze through the gap; and that her father at that time built the wall to protect the tree from dilapidation.

Sir R. Christison thus briefly sums up his explorations, measurements, and investigations, regarding this most interesting patriarchal relic of tree life:—"The substance of all [our investigations] seems to be this. In the second quarter of last century it was a great tree, hollow no doubt from decay, and with a gap in its trunk, narrow however, and not extending to the ground. In 1769 the gap had reached the ground, but was still far from wide; and the girth over all was 52 feet by one measurement, and 56½ feet by another. In 1825 the gap had become very much larger; and the remains of the trunk consisted of two large portions of its circumference, the hollows of which directly faced each other. During the next eight years, extensive dilapidations must have been inflicted on it to justify the description of Mr Neill in 1833. But he was clearly wrong in recognising the existence of only one 'semicircular wall' of the old trunk; for another large portion survives to the present day."

One of the portions of the trunk bears now a vigorous head clad with healthy foliage, and 16 feet in height; and the other a fine crop of branchlets and larger arms, very healthy, and upwards of 24 feet in height. Outside the enclosing wall is a vigorous young yew, which may be either a seedling of the old veteran, or the product of some surface root from the old trunk. It is a handsome thriving tree, with a cylindrical trunk, somewhat grooved, 53 inches in girth at five feet from the ground, branching at eight feet, and bearing a fine leafy head, pine-like in habit, and 35 feet in height. Whether it be a scion of the wonderful original parent tree, or only a seedling plant from it, both are now sacredly guarded, and have been put under the charge of the parish minister.

A frequent use to which the yew was put about two centuries ago was in planting avenues. Several beautiful instances of this style of treatment may be met with at the present day, as, for example, at Roseneath, and also at Cleish Castle, Kinross-shire. The latter contains upwards of forty trees from 7 to 12 feet in girth at three feet from the ground, and the arch formed by the interlacing branches overhead presents a very striking and architectural-looking vista, while the columnar-fluted pillar-like trunks of the yews form a very effective picture in the landscape. It is supposed to be about 300 years old. The soil is lightish loam on clay subsoil, and situation sheltered. The altitude of the site is 550 feet above sea-level.

At Otterstone, near Aberdour, Fife, there are six fine yew trees standing in a row, with trunks measuring from 6 feet to 9 feet in girth. These have evidently at one time formed part of an old hedge, but are now fine specimen trees.

In the same county, near the mouth of the Tay, there is a group of five remarkable yews. They grow close beside the ruins of the old church of Forgan or St Fillans, which was one of the priory churches of St Andrews, and was used as the parish church of Forgan until about fifty years ago. The form in which these five old yews are planted suggests a St Andrew's Cross, but there is no tradition regarding them. Two of them are evidently different in variety from the other three, having branches of a lighter foliage, and more erect and upright in habit of growth, while the branches of the other three droop quite to the ground, and in some places spring up from it again. The largest tree in the group is 12 feet 5 inches in girth at six feet from the ground; the length of bole is 18 feet. It has some splendid large branches, stretching on each side to a distance of 37 feet from the trunk, and grows in a light sandy soil, with a subsoil of pure sand. The trunk is twisted and arranged in columns like a pillar. The other yew resembling No. 1 shows very little difference, only smaller in the stem and head. The other three yews are not so remarkable for the girth of their trunks as for their branches. In this respect No. 3 is very striking. Round the extremities of the branches it measures 70 yards in circumference, and is shaped in the general contour of its head like a mushroom. The popular tradition as to the age of the group places them as at least 600 years old.

One of the most remarkable objects with which we have met, in a wide acquaintance with the old and remarkable trees of Scotland, is at Birkhill, in the parish of Balmerino, Fife. By the kindness of the Rev. Dr Campbell we are able to supply details of information regarding it. It is a curious and unique yew hedge, or rather what has several centuries ago been a hedge, allowed to escape the shears or hedge-bill, and overgrow itself in a most remarkable way. It forms three sides of a rectangle, of which the length is considerably greater than the breadth, and it encloses more than a quarter of an acre of ground. Evidently it has been at one time kept low as a hedge, and afterwards allowed to grow to its present height. The trees stand close to each other, and differ a good deal in their girth, but most of them are now veritable trees. Taking the largest trees, one has the following dimensions :—Girth at one foot above ground, 7 feet 2 inches; girth at four feet, 6 feet 9 inches. Another measured at one foot above ground 8 feet, and at four feet, 9 feet 2 inches, swelling out before it separates into branches. Another tree is, at four feet above the ground, 6 feet in girth. The length of bole differs much, but in general the trees separate into branches at 4 or 5 feet above the ground-level, marking their height when kept low as a hedge. The height of the whole hedge is close upon 50 feet; and the top or sky-line is pretty straight and uniform. A few hollies have got interspersed, and are of the same height as the yews. The breadth of this remarkable hedge across from side to side is 20 yards. There is no tradition in the district as to the history of this remarkable yew hedge, but a general idea prevails that the monks of Balmerino Abbey (distant, as the crow flies, two miles) had something to do with it and its formation. In old documents connected with the abbey there is evidence that the abbey forester had his residence about Birkhill, reference being made in charters "to forester's lands;" and this yew hedge may have originally enclosed his garden and been afterwards allowed to grow without the application of the hedge-bill.

The next remarkable yew tree coming under our observation is probably second only to the Fortingal yew in point of age, size, and historical interest, and still flourishes in a vigorous state. The "Ormiston Hall yew" is situated on the Ormiston estate of the Earl of Hopetoun, in East Lothian. It stands at an altitude of 350 feet, in a stiff loam soil, upon sandy gravel, and with a south-east exposure. It has been frequently measured, and its record goes on increasing each time as regards girth of trunk, but it seems to have ceased adding to its height, although increasing in circumference of branches. Its present height is 35 feet, with a bole of 10 feet, and it girths, at one foot from the ground, 13 feet $10\frac{1}{2}$ inches; at three feet, 15 feet; at four feet, 16 feet 10 inches; and 19 feet 8 inches at five feet above ground. The diameter of the spread of its branches is 53 feet. Like many yews, it will be observed that this tree enlarges its circumference as it rises in height, a peculiarity fatal to most comparisons unless all the circumstances of each case are known. Sir R. Christison knew, and had examined in detail, the Ormiston yew when engaged on his investigation into the rate of the annual increase of girths of trees and the exact measurement of them, more particularly in reference to the Fortingal yew, to which we have already adverted, and he used the data from the Ormiston yew's increment in centuries past for comparison in arriving at his conclusions for his formula for measurement.

In the well-known publication *The Bee*, vol. ii., p. 333, the Ormiston yew is mentioned thus:—"Its trunk is 11 feet in circumference and 25 feet in length; the diameter of the ground overspread by its branches is 53 feet; and there is about the twentieth part of an English acre covered by it. It is still growing in full vigour without the least symptom of decay." This was written in 1792. It is said that George Wishart, the martyr, preached under this yew, then celebrated as one of the largest trees of its kind in Scotland. Its outer spread of branches, says the old chronicler, was 218 feet, and its branches fall around the trunk like a huge umbrella, forming an inner circle large enough to afford standing room for 200 to 300 people. Here Wishart preached to an audience composed of the Laird of Ormiston, his dependents and neighbours, and in desponding strains, in harmony with the solemn and funereal aspect of the old yew tree, addressed his last and parting words to those friends from whom he was so soon to be severed for ever. It is believed that shortly after Wishart's judicial murder at St Andrews, the plot to revenge his death, the leader in which conspiracy was Norman Leslie of the house of Rothes, was arranged by Leslie and his associates under the old yew tree of Ormiston. John Knox also used to preach under this venerable yew when he resided at Ormiston in the capacity of tutor or chaplain in the family of the Cockburns of Ormiston, then a leading reforming family.

Another old historical yew tree of great dimensions is still extant in a thriving and vigorous condition at Whittinghame, East Lothian. It stands on the brow of a gentle eminence, sloping to the north, and which it entirely covers. In fact, it has less the appearance of a tree at a little distance than of an enormous bank of the densest foliage. The circumference of its branches, which sweep the sward on all sides, is close on 100 yards; and in one direction the lateral spread of branches is 96 feet. The trunk of the tree is 11 feet in circumference at a foot from the ground, and 10 feet at five feet above the ground-level. The trunk of the yew, which reminds one of the central pillar of a cathedral chapter-house, is 10 feet high before it sends out its branches, which form the roofing of the canopy-like and arched groining, to carry out the architectural simile. Within this gloomy and dark leafy canopy there is, curiously enough, a spring of clear cold water, which is now imprisoned and conducted in a leaden pipe to a tap.

At one point only is it possible to creep below the branches so as to reach the trunk, which when done, an umbrageous chamber is entered, whose gloomy character suits well the dark tradition which haunts the history of this yew tree. The legend is, that in the adjacent castle of the Earl of Bothwell, Earl Morton, Ruthven, and others of the Scottish nobles opposed to Darnley, the husband of Mary, Queen of Scots, had met to discuss the means of getting rid of the obnoxious consort of the Queen; and that, repairing to the sequestered shade of this yew, they formally entered into a covenant or bond to accomplish the death of Darnley, by blowing him up in the Kirk o' Field at Edinburgh. The great age of the tree renders it quite probable the tradition is correct, the more especially as Bothwell was very frequently in this neighbourhood immediately prior to the atrocious murder. A more congenial place for the concocting of a deed of blood could not have been selected by the iron-handed men who plotted the destruction of Mary's unhappy husband.

The old yew at Dryburgh Abbey is also a well-known tree, and has been recorded by Loudon and others, although its dimensions are not remarkably large, and certainly not so noticeable as those of many yews we have mentioned in this paper. This tree stands close to the Abbey of Dryburgh, Berwickshire,[1] and is supposed to have been planted at the time the Abbey was founded in 1136.

[1] Dryburgh Abbey, although popularly supposed to be in Roxburghshire, is really in Berwickshire, a strip of that county running here up to the river Tweed, and including the Abbey.

It is still in perfect vigour, and making wood annually. Standing alone, its branches have freedom to spread on every side, and have thus formed a regularly proportioned head, fully 60 feet in diameter. It is in circumference, at one foot from the ground, 14 feet 3 inches, and at five feet from the ground, 11 feet 4 inches, with a bole of 8 feet.

Near the old castle of Craignethan, in Lanarkshire, there are three yew trees of great age which attract the attention of all who visit the castle, although few know the story connected with these venerable trees. At some period in the feudal ages the governor of the castle was a Captain Lang, a brave and valiant man. On a certain day the castle was besieged by the English, and a bloody fray ensued. Captain Lang, who was wounded by an arrow in the breast, was borne out of the battle to a spot before the mansion-house door, to wait, if possible, the issue of the battle. At last there was heard the cry of "They run!" "Who run?" the captain called. On being told it was the enemy, he exclaimed, "God be praised, I have done my duty." He gave instructions that he was to be buried on the spot where he lay, and three yew trees to be planted over his grave in memory of that battle. On the barbed arrow being drawn from the wound the captain expired. The lands of Chapelknowe, near the castle, "were granted to the family of Captain Lang in recognition of his services," and have remained in his family till within the last fifty years. The trees stand about 15 yards apart, and at a short distance they look like one tree. They girth 10 feet 5 inches, 8 feet 9 inches, and 7 feet 9 inches respectively, at three feet from the ground, and are 42 feet, 36 feet, and 29 feet in height. The soil is a good medium loam on a gravelly subsoil.

There is a fine specimen of yew tree growing on the banks of the river Gryffe at Craigends, in Renfrewshire. Its height is 41 feet 9 inches; the girth, at one foot from the ground, is 21 feet; and at two feet up it breaks into fourteen limbs, the girths of which range from 9 feet to 3 feet. These branches grow in an upright uniform direction, and break out into smaller limbs or branches, which in regular form come down to the ground, along which they spread all around the tree. The circumference of the extremities of the branches is 80 yards, and the branches grow so very close together that it is with some difficulty a person can get near the bole. The river Gryffe flows on the north side of the tree, and at a distance of 60 feet from the stem. The height of the tree is about 9 feet above the bed of the river, the ground rising gradually to the south. It is supposed that the roots are below the bed of the river, but whether this be so or not, it is a fact that it is abundantly supplied with moisture, the river overflowing its banks periodically, and sometimes rising to within a few feet of the bole. The age of this specimen is unknown.

No list of the old and remarkable yews in Scotland would be complete were it to omit the famous old yew tree at Loudon Castle, Galston, Ayrshire. This remarkable tree measures:—Height, 44 feet; girth at one foot, 13 feet 8 inches; and at four feet, 13 feet 9 inches. Length of bole, 6 feet, and spread of branches (E. and W.), 74 feet. It grows close to the south wall of the castle. Being exposed to the west, the lateral branches do not maintain the same vigour as on the east side. The condition of the tree is healthy and growing; the branches rest on the ground, forming a half circle. The following historical incidents are connected with the old yew. It is said that one of the Loudon family charters was signed under it in the time of William the Lion (1165-1214). One of the articles of the Union with England, it is also said, was subscribed by Lord Hugh under its deep shade. When Lord James went into voluntary exile to Holland, he addressed his letters (being afraid of detection) "To the Gudewife at the Auldton" (a few houses half a mile distant) "at the old Yew Tree of Loudoun, Scotland;" and they always reached their intended destination in safety. This yew is supposed to be over eight hundred years old. There is also a group of large and vigorous yews at Loudon Castle, of which the following four may be taken as specimens:—

	Height.	Girth at one foot.	Girth at five feet.	Bole.
No. 1.	40 ft.	9 ft. 4 in.	9 ft. 8 in.	8 ft.
No. 2.	45 ft.	9 ft. 11½ in.	8 ft. 11 in.	18 ft.
No. 3.	40 ft.	11 ft. 5 in.	10 ft. 6 in.	12 ft.
No. 4.	40 ft.	10 ft. 4 in.	9 ft. 5 in.	10 ft.

These grow in loamy soil, with subsoil of sandy clay. The altitude of the site is 230 feet, exposed to the west.

In Kirkcudbrightshire, there are three fine old yew trees at Barskeoch, in the parish of Dalry. The largest is 42 feet high, and measures 9 feet in circumference at one foot, and 8 feet 4 inches at three feet from ground; height of bole, 12 feet, where it divides into three large limbs. No. 2 is 30 feet in height, and girths 7 feet 6 inches at three feet from ground, with a bole of 7 feet, although it has at one time been covered with branches to the base, and at seven feet it branches off into three large main limbs. No. 3 is so covered to the ground with dense foliage, that no very accurate measurements could be taken. These yews are several hundred years old. This place appears to have been of some importance in bygone times. It belonged to an old family named Newalls. The remains of a fine old archway, and a small artificial mound are still to be seen, but no tradition remains at the present day, either regarding the old yew trees themselves, or any historical record of the site or buildings near where they stand.

In concluding this paper on the old and remarkable Yews in Scotland, it is perhaps proper to state that from our Tabulated List of old specimens, there are probably a number of old and remarkable trees omitted, for the Yew has been very generally distributed over most districts of Scotland at an early date, while in England, also, it is to be found in even greater abundance, and of great antiquity. Many fine old relics in a declining state may still be seen at Naworth Castle and at Lanercost Abbey, near Carlisle. At the former place there is a good tree in a thriving state, growing on a steep bank overlooking a stream just outside the garden wall, measuring 15 feet 11 inches in girth at four feet from the ground, with a bole of 11 feet high, when the trunk divides, but one large limb grows in an upright direction till the tree seems to have a bole of 22 feet, afterwards dividing into many large branches. It is 55 feet in height, and although the trunk is giving symptoms of internal decay, it is still a grand old tree. In Lanercost Churchyard, near Naworth, there are two old yews growing near to each other, and not far from the old priory, No. 2 of which is 11 feet 4 inches in girth at four feet from the ground, where its top has been broken off. Its trunk is quite a shell, and one strip is entirely detached, but the bark is growing, and, like the case of the Fortingal tree, is re-uniting over the vacant space. It has a diameter of spread of branches of 38 feet. No. 1 is in better condition, but has not so good and lofty a head. Its trunk is hollow, and is quite broken across at fifteen feet from the ground, but a new head is now forming from numerous side branches which are throwing out healthy growths. It girths 14 feet at three feet from the ground, and is fully more at twelve feet. These are extremely picturesque remains.

Probably one of the finest yew-tree avenues in England at the present day, in good preservation and healthy vigour, is that at

Tusmore Park, near Bicester in Oxfordshire, and leading from Tusmore Park to Hardwick Church, which is S.E. from the house. It is 1296 feet in length, and the trees are planted "square both ways," being 45 feet apart. Two yews from Scottish descent have been planted at a more recent date in the avenue, and are now fully taller than the average of the older trees, and two other old specimens have been blown down, forming gaps in the line of avenue, which have not been filled up. There are twenty-seven trees on either side, and they girth from 6 to 8 feet on an average at four feet from ground, and vary in height from 40 to 60 feet, with a diameter of spread of branches averaging from 40 to 55 feet.

Another interesting and quaint relic of yew-tree antiquity is the "Druid's Grove," at Norbury Park, in the Vale of Mickleham, between Box Hill and Denbies, in Surrey, "which forms," says John Stuart Mill, "a piece of natural scenery, unequalled in the world for its combination of beauty and accessibility." The "Druid's Grove"—the remains of an early aboriginal forest of yews—hangs pendent-like on the slope of a steep bank, leading past the ruined Chantrey of Chapel Farm, on the old Pilgrim's Way from the West Country to Canterbury. Although they have no tangible connection whatever with the Druids, no doubt fancy and imagination may see in these huge buttresses of antique yew trees, regularly planted circles or places for primitive worship or sacrifice; and they are worthy of all respect and reverence, for the oldest amongst them cannot have an age of under 2500 years, judging by comparison with other yew trees of ascertained date elsewhere, and some of which have been referred to in this paper. "They are older far than the Christian religion, twice as old as the English dominion in this island. In some of them, all the original branches are quite dead within, and the bark above lives on in places along the main trunks, supplying sap to new adventitious branchlets, which rise straight into the air, all parallel and perpendicular, like new stems springing from the decay of the old dead ones. This curious last stage of living decrepitude gives a strange weird aspect of witch-like sagacity to some among those hoary giants of antiquity. The tree, indeed, is hardly in any true sense an individual; it is rather a colony or community, like a spray of coral—the leaves, which are the true living individuals, answering separately to the separate polypes. By the light of such a luminous conception alone—due to the greatest of modern biologists—can we understand aright the long persistence of life in such antique monsters, dead, as it were, in all their stony parts, but putting forth afresh, from time to time, new living members at their still active extremities. The rocky coral-branch, the hard woody tissue, outlive and support many generations of polypes or foliage. What is most plastic and protoplasmic within us perishes easily, while the mere dead, mineralized, bony skeleton persists and endures for centuries upon centuries."

There are many varieties of the yew to be found in cultivation. What is well known as the "Irish Yew"—*Taxus baccata fastigata*—retains its fastigiate habit under all circumstances, rendering it quite distinct. It seems to have been originally discovered on a mountain near Florence Court, Co. Fermanagh, Ireland, whence it has been called the "Florence Court Yew." It has been widely disseminated, and is now found in almost every district of Britain. Another variety is *Taxus baccata procumbens*, a low growing, trailing shrub or bush, and resembling a stunted variety of the common yew, or probably the *Taxus Canadensis*, with which it seems to be closely allied, if it is not identical. *Taxus baccata erecta*, the "Neidpath Yew," is an upright growing variety, and is said to have been originally propagated from an old tree of very distinct and peculiar habit growing at the old castle from whence it takes its name, near Peebles, on the banks of the Tweed. *Taxus baccata fructu-luteo*, a variety which is not at all common in Scotland, was originally found in 1817 in an old orchard near Glasnevin, Dublin, but was lost sight of for years, until in 1833 it was again discovered in the grounds of Clontarf Castle, near Dublin. It is a fine variety, very like the common yew, but distinguished by its yellow berries, and is a beautiful object when in fruit, contrasted with the common variety with its bright coral red berries. *Taxus baccata aurea* is one of the most beautiful and persistent of golden foliaged conifers, and is highly prized by the ornamental planter. *Taxus baccata Dovastonii*, a fine pendulous variety, which contrasts effectively with the erect growing kinds, originated about one hundred years ago at Westfelton, near Shrewsbury. Various other species and varieties are employed in the decoration of lawns and shrubberies; the yew tribe being most accommodating and effective for that purpose.

Do.	Hatton House.	..	Light clay loam.	Clay.	S.W.	50 0	..	10 6	9 9	..	..	..	45 0	Planted between 1667 and 1700.
Do.	Do.	..	Do.	Do.	,,	20 0	18 0	8 0	..	7 6	..	..	..	Do. do.
West Lothian.	Hopetoun.	100	Good loam.	Gravel & sand.	N.E.	45 0	16 0	..	..	8 3	..	..	..	
Do.	Do.	,,	Do.	Do.	,,	40 0	18 0	..	..	8 7	..	..	..	
Do.	Do.	,,	Do.	Do.	,,	45 0	20 0	..	..	8 1	..	..	..	
Do.	Niddry Castle.	120	Heavy deep loam.	Clay and gravel,	W.	28 0	8 0	7 6	..	6 11	..	..	..	Said to have been planted by Mary, Queen of Scots. Called "Queen Mary's tree."
East Lothian.	Ormiston Hall.	350	Stiff loam.	Sandy gravel.	S.E.	35 0	10 0	13 10½	15 0	19 8	..	..	217 0	An historical tree.
Do.	Whittinghame.	120	Do.	Do.	N.	45 0	10 0	11 4	..	10 8	..	..	106 0	Do. do.
Do.	Gilmerton.	100	Light sandy loam.	Clay.	N.E.	48 0	11 6	9 8	..	9 4	..	..	..	
Do.	Yester.	430	Light soil.	Gravel.	N.	28 0	..	6 6	..	6 11	..	..	..	Both spring from one root. In Matthew's rookery wood.
Do.	Do.	,,	Do.	Do.	,,	30 0	..	6 8	..	6 10	..	..	..	
Do.	Do.	400	Clay.	Rocky.	..	25 0	3 0	9 2	10 7					On island in the burn east from

3 Four other yews are in same group. The five yews as planted are in the form of a St Andrew's Cross .1 .2 . . . Nos. 1 and 2 are a different variety. Their branches are lighter in foliage, and much more fastigiate in habit. The other three trees are very drooping in habit, trailing along the ground, and sometimes springing up again, and, as it were, *out of* the ground. These trees are popularly said to be 600 years old.

4 A line of yews extends eastward from the castle, on the precipitous banks of the Tweed, and are probably remains of a former avenue or sheltering walk to an ancient garden now extinct. They seem to be at least 300 years old, and are quite vigorous and healthy. The second last tree in the line (at east end) is the parent of the variety known as the "Neidpath Yew," and still distinctly bears the peculiar characteristic of the variety in its upright habit of growth and darker foliage.

5 There are many more yew trees on the island quite as large and vigorous as the two recorded. The island has been an indigenous yew forest for many centuries.

6 The "Clachan" Avenue, of which the above is one, consists of twenty-three similar yew trees, and vary from 6 to 11 feet in girth. They are 160 to 180 years old.

7 A yew hedge here is 37 years old, 10 feet high, 3 feet broad at base, and 1 foot broad at top.

8 There are four old yews in front of the old inn at Brodick, 30 to 35 feet high, 6 to 8 feet in girth, in moist sandy soil, and almost at sea-level.

9 Eleven yew trees, growing close to these, are much younger and smaller. Average girths at three feet, about 6 feet.

10 There are several very fine old yew trees at King's Grange, Dalbeattie, but their dimensions and details have not been ascertained.

11 A third yew here does not admit of measurements, the trunk being covered to base by a dense growth of branches.

TABULATED APPENDIX TO THE OLD AND REMARKABLE YEW TREES IN SCOTLAND.

By ROBERT HUTCHISON of Carlowrie, F.R.S.E.

County.	Place.	Altitude above Sea Level	Soil.	Subsoil.	Exposure of Site.	Height of Tree	Length of Bole.	Present Circumference of Trunk at 1 ft.	2 ft.	3 ft.	Any former recorded Measurements and Dates.	Diameter of Spread of Branches.	Remarks.
		Ft.				Ft. In.		Ft. In.	Ft. In.	Ft. In.		Ft. In.	
Aberdeen.	Ellon Castle.	50	Strong yellow loam	Gravel.	Sh'lt'r'd	27 0	All these have begun branching at from 2 to 4 ft from the ground. No record of their age exists.		12 0		.. ..	24 0	Measured from the trunk.
Do.	Do.	"	Do.	Do.	"	30 0			13 0		.. ..	18 0	Do. These yews grow in a garden sheltered by high walls. Measurements taken 30 years ago show the largest tree to have been only 10 ft. 6 in. in circumference at that time.
Do.	Do.	"	Do.	Do.	"	30 0			11 0	..	.. ..	18 0	Do.
Do.	Do.	"	Do.	Do.	"	32 0			10 9		.. ..	23 0	Do.
Do.	Do.	"	Do.	Do.	"	27 0		12 0			.. ..	15 0	Do.
Do.	Do.	"	Do.	Do.	"	20 0		12 0		..	.. ..	14 0	Do.
Do.	Do.	"	Do.	Do.	"	20 0		8 0			.. ..	14 0	Do.
Do.	Do.	"	Do.	Do.	"	20 0			12 0		.. ..	14 0	Do.
Do.	Do.	"	Do.	Do.	"	18 0			10 6	..	.. ..	14 0	Do.
Do.	Do.	"	Do.	Do.	"	18 0		..	10 8	..	.. ..	14 0	Do.
Do.	Do.	"	Do.	Do.	"	18 0			10 6		.. ..	14 0	Do.
Do.	Do.	"	Do.	Do.	"	25 0			14 0		.. ..	22 0	Do.
Do.	Do.	"	Do.	Do.	"	27 0			11 0		.. ..	22 0	Do.
Do.	Do.	"	Do.	Do.	"	28 0				16 0	10 ft. 6 in. at 1 ft. in 1852	28 0	Do.
Do.	Do.	"	Do.	Do.	"	24 0			14 0	..	..	24 0	Do.
Do.	Pitmedden.	..	Deep black loam.	Clay	S.		Ft. In.	7 3	..	7 7	.. ..	62 ft. from E. to W.	Growing in garden. Recorded in 1860, but impossible now to [illegible]
Do.	Do.	..	Do.	Do.	..			9 3		10 8		..	Planted by Sir A. Seton in 1675.
Do.	Do.	..	Do.	Do.	E.	25 0		14 0	..	14 0	.. ..	51 0	Growing on lawn, east of mansion house.
Do.	Do.	..	Do.	Do.	"	28 0	..	13 9	..	13 0	.. ..	45 0	
Do.	Old Meldrum Manse.	..	Good open loam.	Open sandy clay	Open.	27 6	12 0	..	..	10 0	.. ..	..	Believed to have been planted when manse was removed to present site from the other side of the parish in [illegible]
Do.	Do.	..	Do.	Do.	"	25 0	12 0	..	..	10 2	.. ..	..	
Do.	Tolquhan Castle.	300	Light loam.	Rocky.	Open.	48 0	..	11 2	..	9 0	.. ..	..	This is the last of a group of old yews here
Kincardine.	Arbuthnott Manse.	100	Good loam.	Gravelly, sandy	S.E.	44 0	12 0	8 11	..	..	.. ..	.	A very handsome pair and exactly the same height, meeting at top
Do.	Do.	"	Do.	Do.	"	44 0	10 0	7 10	..	..	.. ..	.	
Forfar.	Brechin Castle.	140	Gravelly.	Gravel & sand.	..	56 0	9 0	9 3	..	8 8	.. ..	60 0	
Do.	Do.	"	Do.	Do.	..	40 0	3 0	8 6	..	9 10	.. ..	60 0	
Do.	Do.	"	Do.	Do.	..	30 0	3 0	6 0	..	7 0	.. ..	52 0	
Do.	Do.	"	Do.	Do.	..	25 0	22 0	7 0	..	6 6	.. ..	48 0	
Do.	Camperdown.	100	Deep sandy loam	Tilly clay.	E.	30 0	2 0	5 4½	..	3 10	.. ..	..	Planted in 1810; very vigorous.
Perth.	Glamis Castle.	230	Black loam.	Gravel & sand.	..	32 0	8 0	10 8	..	11 6	.. ..	45 0	Many others of similar dimensions
Do.	Drummond Castle.	..	Loamy.	Clay.	..	38 0	15 0	8 4	..	7 10	.. ..	..	West of castle.
Do.	Do.[1]	..	Light loam.	Gravel & clay.	..	36 0	6 0	..	..	7 9 at 5 ft.	.. ..	..	In deer park.
Do.	Abercairny.	120	Good sandy loam.	Do.	..	35 0	7 0	..	..	10 7 at 5 ft.	.. ..	39 0	Grows in old moat at Inchbrakie. At one time sheltered the Marquis of Montrose
Do.	Ochtertyre.	250	Good light loam.	Clay.	..	28 0	12 0	..	..	5 5	.. ..		
Do.	Do.	..	Do.	Do.	.	30 0	8 0	..	..	5 0	.. ..	..	Very vigorous. Planted about ninety years ago.
Do.	Do.	..	Do.	Do.	..	35 0	10 0	..	..	4 0	.. ..	..	
Do.	Do.		Do.	Do.		[illegible]	4 0			[illegible]			
Do.	Lawers.	..	Blk earth & gravel	Slate rock at 3 ft.	..	37 8	8 0	10 4	..	12 6	.. ..	40 0	
Do.	Do.	..	Do.	Do.	..	35 0	12 0	7 10	.	7 10	.. ..	48 0	
Do.	Do.	..	Do.	Do.	..	32 8	None	14 4		.	.. ..	60 0	Branches into spreading head near ground.
Do.	Do.	..	Do.	Do.		35 0	15 0	6 0	.	8 6	.. ..	46 4	
Do.	Dunkeld.	..	Open free soil	Damp, gravelly	S.	36 0	12 0	7 5½	..	..	.. ..	..	Upright habit of growth (Neidpath variety)[4]. Growing close to cathedral wall.
Do.	Do.	..	Do.	Do.	..	42 0	8 0	10 8	..		.. ..	..	"Round headed." Do. at bowling green
Do.	Parkhill, Blairgowrie.		Good loam	Clay		26 0	7 0	14 5	.	15 0	..	..	
Do.	Castle Menzies.	250	Light sandy loam	Porous sand & gr'v'l		40 0	10 0	9 8		9 7	..	..	Shaped like a mushroom
Do.	Fortingal[1]	..									.. ..		
Kinross	Cleish Castle[2]										.. ..		
Stirling.	Balakinrain	..	Reddish clay	Clay and rocky	N.	48 8		11 5		11 8 at 5 ft.	..	7 ft. [illegible] both to [illegible]	Branches at 1 ft. from ground, [illegible]
Do.	Do.	.	Do.	Do.	"	41 0		9 7	..	8 11	..	[illegible] apart	Branches at 1 ft. from ground, [illegible]
Do.	Bantaskine.	..	Good loam.	Clay	Open.	40 0	7 0	11 0	.	12 4	.. ..	70 ft. fr. trunk	[illegible] Roman wall
Do.	Arngomery.	.	Light loam	Sandy, gravelly	"	36 0	7 0	15 6		10 4	. .	67 0	Old buildings taken down lately near site of [illegible] of eleventh century
Fife	Kirkton of Forgan.	20	Light sandy loam	Sand	N.E.		15 0			12 5 at 6 ft.	.. ..	37 0 fr. trunk	
Do.	Do.[3]	..	Do.	Do.	.		.				.. ..		
Do.	Otterstone.	.	Light loam.	Gravel & sand	S.	45 0	9 0	.	..	6 8	.. ..	22 0 fr. trunk.	Other four yews are similar in size, and the six being in a row seem to have at one time been part of a yew hedge.
Do.	Do.	..	Do.	Do.	"	50 0	6 0	..	.	8 4	.. ..	18 0 fr. trunk.	
Do.	Birkhill.	40	Light sandy loam.	Gravelly	N.	50 0	5 0	7 0	.	6 0	.. ..	60 0	These three trees grow in a very unique yew-tree hedge. It forms three sides of a rectangle [illegible]
Do.	Do.	"	Do.	Do.	"	50 0	4 5	8 0	9 0	..	.. ..	60 0	
Do.	Do.	"	Do.	Do.	"	45 0	4 6	..	6 0	..	.. ..	60 0	
Midlothian.	Roslyn.	..	Good garden loam.	Clay and gravel.	S.	42 8	12 0	10 3	.	8 0	.. ..	..	
Do.	Hatton House.	..	Light clay loam.	Clay	S.W.	50 0	.	10 0	9 0	..	.. ..	45 0	Planted between 1667 and 1700
Do.	Do.	..	Do.	Do.	"	20 0	18 0	8 0	..	7 0	.. ..	..	Do do.
West Lothian.	Hopetoun.	100	Good loam.	Gravel & sand.	N.E.	45 0	16 0	.	..	8 3	.. ..	..	
Do.	Do.	"	Do.	Do.	"	40 0	18 0	..	..	8 7	.. ..	..	
Do.	Do.	"	Do.	Do.	"	45 0	20 0	..	..	8 1	.. ..	..	
Do.	Niddry Castle.	120	Heavy deep loam.	Clay and gravel.	W.	28 0	8 0	7 6	..	6 11	.. ..	.	Said to have been planted by Mary, Queen of Scots. Called "Queen Mary's tree."
East Lothian.	Ormiston Hall.	350	Stiff loam.	Sandy gravel.	S.E.	35 0	10 0	13 10½	16 0	10 8	.. ..	217 0	An historical tree.
Do.	Whittinghame.	120	Do.	Do.	N.	45 0	10 0	11 4	.	10 5		156 0	Do. do.
Do.	Gilmerton.	100	Light sandy loam.	Clay	N.E.	48 0	11 6	9 8		9 1			
Do.	Yester.	430	Light soil	Gravel	N.	28 0	..	6 0		6 11			Both sprung from one root [illegible]
Do.	Do.	"	Do.	Do.	"	30 0	..	6 8		6 10		.	
Do.	Do.	400	Clay	Rocky		25 0	3 0	9 2	10 7				[illegible]
Do.	Do.	380	Do.	Clay	..	30 0	.	10 4	12 8			..	On road to [illegible] house
Do.	Do.	"	Do.	Do.		33 0		8 1	..	7 11	.. ..	..	Do. do.
Do.	Do.	370	Do.	Do.	.	20 0		8 3	..	8 10	.. ..	..	In avenue. Fine spreading head. Circumference round branches (rooted in ground), 66 yards. Growing together.
Do.	Do.	"	Do.	Do.	.	33 0		8 6	.	8 4	.. ..	..	
Berwick.	Dryburgh Abbey	..	Open loam	Clay and gravel	Sh'lt'r'd	.	7 10	14 3	11 4	11 4	In June 1863 it was 6 ft. 11 in. at 8 ft. up, and not much above 20 ft. high		
Roxburgh.	Wells.	500	Stiff red clay.	Red sandstone	S.E.	18 0	Branches off at root	.	.	.	.. ..	49 yds. in circumf.	Has been broken off at 18 ft. from ground
Do.	Do.	"	Do.	Do.	"	20 0	Branches at root into 2 stems		2 0 and 1 3		.. ..	33 ft. in circumf.	Main stem dead at 10 ft., but branches quite healthy.
Do.	Ferniehirst Castle.	..						.	10 7		.. ..	..	Supposed to be 500 years old.
Peebles.	Neidpath Castle[4]	.											
Lanark.	Craignethan Castle.		Good medium loam	Gravelly	Open	36 0	7 0	.	8 0	.	.. ..	18 0 fr. trunk.	About 15 yds. apart. At a few yards distance they look [illegible]
Do.	Do.	..	Do.	Do.	"	42 0	10 0	..	10 5	..	.. ..	21 0 fr. trunk.	
Do.	Do.		Do.	Do.	"	29 0	6 0	.	7 0	..	.. ..	23 0 fr. trunk	
Do.	Murdostoun.	500	Clayey.	Clay and rocky	..	40 0	..	6 7	.	5 8	.. ..	..	
Do.	Do.	"	Do.	Do.	.	42 0	..	6 11	.	5 4	.. ..	..	
Dumbarton.	Bonhill.	..	Rich loam.	Clay	W.	32 0	8 0	..	11 2	..	.. ..	..	Decaying at top, and dead wood cut away to the extent of several feet 30 years ago
Do.	Rossdhu (Luss).	..	Light black loam.	Gravel & sand	..	36 0	..	12 7	..	..	.. ..	..	At lodge gate. Roots been top-dressed by an artificial mound
Do.	Do.	..	Do.	Do.		[illegible] 0			[illegible]	[illegible]	In 1861 it was 13 ft. at 4 ft. It is also 4 feet higher than in 1861		Stands by ruins of church [illegible]
Do.	Inch-Lonaig Island.	.	Do.	Do.	..	35 0	10 0	..	13 0	..	.. ..	..	Has been eaten bare nearly all round by wild goats on the island; now recovering
Do.	Do.[5]	..	Do.	Do.	..	25 0	12 0	9 8	..	9 3	.. ..	..	Very healthy and vigorous
Do.	Rosneath.	30	Good loam.	Sandy gravel.	..	50 0	13 0	15 0	..	11 2	.. ..	67 0	
Do.	Do.[6]	"	..	..	..	..	..	..	..	..	.. ..		
Renfrew.	Dargavel.	..	Light loam.	Clay and sand.		50 0	14 0	9 4		12 2 at 5 ft.	.		
Do.	Do.[7]	46	Do.	Do.	..	..	..	..	..	..	.. ..	..	
Do.	Craigends.	8	Sandy loam.	Sand.	S.	41 0	1 0	21 0	..	..	.. ..	80 yds. circumf.	Breaks at 2 ft. into 14 limbs of upright growth, and from 9 ft. at 3 ft. in girth.
Bute.	Brodick Castle.[8]	..	..	..	..	..	..	..	..	..	.. ..	..	
Do.	Mount Stuart.	80	Sandy soil	Gravel.	Sh'lt'r'd	39 0	..	6 6	..	.	.. ..	54 0	A fine specimen of weeping yew.
Do.	Do.	100	Do.	Do.	..	64 0	8 0	..	..	8 11	.. ..	66 0	A very beautiful specimen.
Ayrshire	Loudon Castle.	246	Loamy.	Sand clay.	S.W.	44 0	6 0	13 8	..	13 10	.. ..	74 0	
Do.	Do.	230	Do.	Do.	"	40 0	8 0	9 2	..	9 4	.. ..	..	Taken from a group of twenty-nine, south from castle.
Do.	Do.	"	Do.	Do.	"	46 0	19 0	9 11	..	8 11	.. ..	..	
Do.	Do.	"	Do.	Do.	"	47 0	12 0	11 7	..	10 6	.. ..	..	
Do.	Do.	"	Do.	Do.	"	40 0	10 0	10 4	..	9 6	.. ..	..	
Do.	Rowallan Garden	..	Good rich loam.	Clay and gravel.	..	..	.		..	8 9½	.. ..	..	
Do.	Crawfurdland Castle.	.	Light loam.	Sandy.	..	..	..		..	7 0	.. ..	..	
Do.	Nether[illegible] House		Garden loam	Gravelly									Irish yew. Is so large it cannot have sprung from the Irish yew, but from a Scotch stock on which the Irish variety had been grafted.
Do.	Bellfield	..	Do.	Do.		20 0	.	4 2		..	.. ..	41 0 in circ.	Irish yew. A magnificent plant.
Do.	Cloncaird Castle.	..	Light sandy loam	Gravelly.	.	40 0	6 0	.	12 2	.	.. ..	61 0	
Do.	Do.[9]		Do.	Do.									
Kirkcudbright	Dalbeattie[10]	..											
Do.	Barskeoch.	..	Damp loam.	Clay	..	43 0	12 0	9 2	8 4				
Do.	Do.	.	Do.	Do.	..	30 0	7 0	7 6					
Do.	Do.[11]	..	Do.	Do.	..	.	..						

[1] [illegible] in a walled space, 33 feet long, and [illegible] feet broad, this veteran tree will hardly admit of tabulation, but reference is made to the letterpress of this paper, where records of former measurements are given, and data and arguments quoted to form an approximation of its age.

[2] There is here a beautiful avenue of yews, upwards of forty in number, and probably two hundred years old. They are about 40 feet high, and girth from 8 feet to 12 feet at three feet from the ground.

[3] [illegible] the Crown of St Andrews [illegible] are lighter in foliage and [illegible] more fastigiate in habit. The other three trees are very drooping in habit, trailing along the ground, and sometimes springing up again, and, as it were, out of the ground. These trees are popularly said to be 600 years old.

[4] A [illegible] of yews extending outward from the [illegible] avenue or sheltering walk to an ancient garden now extinct. They seem to be at least [illegible] years old [illegible] the parent of the variety known as the "Neidpath Yew," and still have [illegible] habit of growth and darker foliage.

[5] There are many more yew trees on the island quite as large as [illegible] as the two recorded. The island has been an indigenous yew forest for many centuries.

[6] The "Clachan" Avenue, of which the above is one, consists of twenty-three similar yew trees, and vary from 6 to 11 feet in girth. They are 100 to 150 years old.

[7] A yew hedge here is 37 years old, 10 feet high, 3 feet broad at base, and 1 foot broad at top.

[8] There are four old yews in front of the old inn at Brodick, 30 to 35 feet high, 6 to 8 feet in girth, in most [illegible]

[9] Eleven yew trees, growing close to these, are much younger and smaller. Average girths at three feet, about 6 feet.

[10] There are several very fine old yew trees at [illegible] but their dimensions and details have not been ascertained.

[11] A [illegible] of yew here does not admit of measurement, the trunk being covered to base by a dense growth of [illegible]

XXIII. *Influences affecting British Forestry. Inaugural Lecture in the Course of Forestry, Edinburgh University, 23d October* 1889. By William Somerville, D.Œc., B.Sc., F.R.S.E.

In opening this course of lectures, it has occurred to me that a little of our time might not be unprofitably occupied in glancing at the present position of British Forestry, and in reviewing some of the conditions which have exerted, and are still exerting, their influences upon it. In doing so it will be necessary sometimes to turn aside in order to mark what is being done in similar directions in other countries, so that we may obtain the means for comparison and thus be enabled to arrive at a correct estimate of our position.

It is a common belief that, as regards the cultivation, management, and utilization of woods and forests, Britain does not occupy such a high position as most of the other countries of Europe. This may be true of Sylviculture, but is not true of Arboriculture. If we accept the etymological distinction which exists between these two terms, and confine the meaning of Arboriculture to the planting, training, and general management of individual trees, I believe no one will deny us the foremost position in this department. Various causes have combined to give us pre-eminence in this particular branch of tree-culture. One is that we, as a nation, are rich, and possess a rich landed aristocracy. Now it is only when a proprietor of land is in a position, partly at least, to ignore considerations of profit or rent, that he can afford to set aside a portion of his estate in order to indulge his taste for tree-planting in the way we find in our great British parks. The amount of space requisite to the development of that large mass of branches, considered such an essential feature in park-trees, is too great to admit of the hope of deriving much, if any, profit from their timber. Nor are they cut down and made use of when they have arrived at the period of maturity, or have begun to exhibit symptoms of decay, but, on the contrary, they are allowed to remain till the natural termination of their life is reached, unless indeed they be overthrown by storms. Park-trees are planted and preserved in order to afford pleasure to their owner, and differ in no essential respect from other articles of luxury.

A park-like treatment of the trees is frequently observable even in those woodlands which are planted primarily with a view to profit. By this is meant that in the formation of woodlands there is often a tendency to plant young trees at a greater distance from each other than is suitable for the growth of commercial timber; the after-management being also directed towards the maintenance of considerable isolation for the individual trees. This mode of management is sometimes adopted by the owner from a desire to secure beauty without altogether losing sight of profit. I believe, however, that it is frequently adopted in cases where æsthetic considerations have no place, but merely because the mind of the owner has been influenced to such an extent by the general tendency, so common in this country, to keep trees far apart from each other, that he has come to regard an open state of the woods as absolutely necessary for tree-growth, and the system as the right one to practice under all circumstances. As, in such cases, the individual trees are unduly favoured to the disadvantage of the plantation as a whole, this mode of treatment must be regarded as Arboricultural rather than as Sylvicultural.

Britain was enabled by her wealth to take up the foremost position in Arboriculture, while our countrymen's love of travel has enabled her to keep it. It was owing to this that most of the exotic trees of Europe reached this country first, and had frequently been cultivated in considerable numbers on our soil before they were "discovered" by our Continental neighbours. This is well seen in the case of the numerous class of North American conifers, as well as those whose home is in the mountains of Asia and Africa. For instance, the cedar of Lebanon was introduced into this country in 1683, but did not find its way to Central Europe till 1734; while the *Cedrus Atlantica* has grown in this country for a century, but was not planted in Germany till the present decade.

Although in the past we have, as it were, stolen a march upon our friends across the Channel, they are now too much alive to the advantages to be gained to remain far behind us. Government forestal-experimental stations have, within recent years, been established literally by the score, each under the charge of one or more experienced investigators with able assistants, and the mass of information bearing upon Arboricultural and Sylvicultural subjects contained in their voluminous annual reports is, for variety and extent, truly astonishing. Not the least important work entrusted to these experimental stations is that of cultivating the newest varieties of trees under all conditions of soil, climate, exposure, management, etc., and of conducting investigations with a view to determining the technical qualities of new timbers. When the merits of an exotic tree seem to warrant its cultivation on a large scale, it is strongly recommended to the notice of planters, and, at the same time, advice is given as to conditions of situation and management to be adopted or avoided. Thereafter it may be regarded as a desirable addition to the list of indigenous trees, and as worthy of a place in the State forests.

While a foremost position is conceded to us as regards Arboriculture, or the culture of individual trees, a similar dignity must be denied us as regards Sylviculture, or the culture of masses of trees—that is to say, Forestry. If we inquire into the reason of this, a combination of causes furnishes us with the explanation. One great cause is the comparative absence of state forests in this country. In many countries of continental Europe these, along with communal forests, for the most part under state management, occupy more than 50 per cent. of the whole forest area, and their produce is expected to furnish an important and reliable item of revenue. In order to ensure their being well managed it is for the interest of the state possessing them to establish fully-equipped forest schools, so that the forest officers may receive the best possible education before entering upon their duties. In Bavaria, for instance, any one entering the forest service must fulfil the following conditions:—On presenting himself at the forest school of Aschaffenburg he must submit a medical certificate of physical fitness, as well as a certificate of general education, which is equivalent in its scope to a pass in our preliminary examinations in medicine or science, and is, in fact, just our recently adopted "leaving certificate." If these have been found satisfactory, and there be no objections to the candidate on moral grounds, he is admitted to the school, where he engages in the study of the elements of his profession for at least two years. At the end of that time he must pass an examination and thereafter proceed to the University of Munich, where he remains at least other two years, comprising four complete sessions. Having completed his academic training, the candidate is required to spend three years in practical work in the forests under the guidance and supervision of a head forester.

During this time no pay is given—it is virtually an apprenticeship that is being served. At the end, then, of seven years of training, provided all examinations have been successfully overcome, the young forester is allowed to accept the lowest post in the service—namely, that of forest assessor. In this position he remains for a longer or shorter period, usually seven to ten years, and receives £70 to £90 a-year of salary. Afterwards he rises gradually to the higher offices in the service, receiving in the end £300 to £400 a-year, with house and firewood.

I have thus briefly sketched the career of a Bavarian forest officer, but it is practically the same in all continental countries with a forest service.

Under these forest officers there are overseers who receive their education at special forest schools located in important forest centres. Of course the theoretical training which these men receive is more elementary than that of the forest officers, nor can they hope to rise to the higher grades of the service.

Then, still further down the social scale, come the ordinary forest workmen, from whom no education is demanded, and who, for the most part, perform their work by contract.

As is well known, the Government of India has modelled its forest department on exactly the lines which have been followed on the continent of Europe. In an article entitled "The Progress of Forestry in India," Sir Dietrich Brandis says,—"In future it will be necessary to maintain an intimate connection between forest administration in India and in those countries of Europe where scientific forestry is based upon the experience of centuries. Climate and the species of trees are different in India, but the principles upon which systematic forestry is based are the same in all countries, and the aim in future must be, as it has been in the past, to build the system of forestry in India not upon the ideas and theories of individual men, but upon the results which long experience has furnished in those countries in Europe where scientific forestry is oldest and best understood."

The splendid results obtainable under a proper system of forest administration may be well seen in the case of the Indian State forests, where the average annual net revenue has steadily risen since the Government took the matter in hand in 1864, until it is now nearly four times as much as it was twenty-five years ago.

It is easy to see that if Britain had had large areas of state forests managed by men who had received a thorough scientific and practical education, these forests would have served, and would still be serving, as models to which the owners of private forests could at any time turn for information and instruction. In this way state forests exercise a powerful educational influence upon a country; the more powerful of course the more numerous and equally distributed they are, and the better managed.

But besides being didactic as regards the *details* of forestry, state forests, where they have long been carefully administered, are able to exhibit a properly organised system. A proper forest system should ensure a regular annual harvest of the various classes of timber and other produce, and should, at the same time, preserve the capital stock intact—that is to say, no more should be annually withdrawn from a forest area than is annually produced. Where the state is the owner of the forests, it demands a system or rotation which shall fulfil these conditions, otherwise, in drawing up the Budget, no reliable forecast of the probable revenue can be made. But in order to organise a comprehensive system of management in a large forest area, about a century is required; therefore it is only the state which can successfully inaugurate a system which cannot be in complete working order until the end of that long period of time. Those who are appointed to carry out the details of the scheme inevitably change frequently before the fulfilment is reached, but the state still exists and guarantees the carrying out of the broad principles of the main scheme.

In the case of private forests, in a country practically destitute of state forests, a comprehensive system is hardly to be expected. Here there are no forests to which private owners can turn for guidance or for information as to what the final results of any proposed system will be. The consequence is, that if systems are tried at all it is in a tentative and nervous sort of way, a man having but little faith in the success of his own scheme, for he has no precedent to guide him. Then, again, a man may inaugurate a system of management for his woodlands which is founded upon thoroughly scientific and economic grounds; but what hope is there that his successors will carry forward the work on the lines originally laid down? Each possessor is not likely to be of exactly the same mind as his predecessor, or, if he be, then a variety of circumstances may intervene to raise an insuperable barrier to his good intentions. The result too often is, that by the time a system should be getting into well-organised shape, its chief character is an entire absence of any organisation or shape whatever!

It is undoubtedly true that we have lost much through the paucity of our state forests, for had they been present in greater numbers the regrettable condition of many of our private woodlands would not now have existed. This would have been a great gain to the country in general, but if the same improvements could have been brought about by some other means than the extension of government forests, the gain would have been still greater. The experiences of all nations, however, tend to show that no other means have ever had much effect. It is true that we have always managed to maintain our position in other departments with the very minimum of state interference and example, and undoubtedly the independent spirit which has thus been developed has stood us in good stead in carrying us over many difficulties; but the peculiar conditions and circumstances consequent to the ownership of forests all point to the state as being in a more favourable position to make the best use of land stocked with trees than the private individual can be. It is a great question, and one whose discussion in all its various ramifications would lead us far beyond our limits of time; suffice it to say, that the experiences of nations and the investigations of political economists point to the conclusion that, although the state proves a bad farmer, it makes an excellent forester.

But, apart altogether from the purely economic bearings of the case, many circumstances may be present to compel a state to interfere with forest management in order to secure the public welfare. Extensive denudation near the headwaters of rivers has often been followed by destructive floods, affecting, not the owners of the cleared areas, but the inhabitants of districts situated, it may be, hundreds of miles away. This has been strikingly exemplified in many parts of Austria, where the wholesale removal of trees from large areas in the Tyrol without any steps being taken to restock them, has resulted in widespread inundations and immense loss of life and property. The cause of these Austrian floods has, within recent years, been made the subject of government inquiry, with the result that the state has purchased large tracts of private land in the Tyrolese valleys in order to preserve the existing forests, and restore those which have been spoiled. America can furnish many cases of flooding following denudation, and in a recent number of *Garden and Forest*, a connection seems to be established between the late appalling disaster which destroyed Johnstown in Pennsylvania and the irrational management of the forests there.

Besides the dangers of inundations, those arising from avalanches are also increased by denudation, and many valleys in Switzerland, the Tyrol, and North Italy are comparatively safe only through the preservation of large masses of wood on the mountain slopes. In these cases, and many others which will occur to your minds, state interference in the management of forests is not only excusable but absolutely unavoidable on the grounds of public safety. None of them, however, apply with much force to our own country. At one time the maintenance of a supply of oak for our navy was a question of great national importance, but is now only historically interesting.

It would thus appear that in this country the state might very well refrain from meddling with forestry as an important department of national finance, were it not for the beneficial educational influences which would be created. On this account the state forests which we already possess should be made models of good management, and others should be obtained in important centres; care being taken to select places where the extra work would be a decided benefit to the rural population. This would apply more especially to many parts of Ireland and the north-west of Scotland; and there, too, owing to the nature of the climate and the configuration of the land, the venture would be most likely to succeed. A suggestion of this kind was made in the report of the Royal Commission appointed to inquire into the condition of the Highland Crofters, where the formation of woodlands was recommended as a likely means of alleviating the general distress, and at the same time of improving the climate; but this, like much other good advice on the subject of forestry from time to time given to the government, has so far been disregarded.

Another factor which has exerted a powerful influence upon British forestry is to be found in our insular position. On account of our comparative proximity to the vast forests of Northern Europe we have been made practically independent of the home production of those most important timbers, pine and spruce. We have carried on the system of importation so long and so extensively, that builders, railway companies, and others using large quantities of timber, have come practically to ignore home-grown wood, and to look abroad for nearly all their supplies. Of course it is essential, with our small forest area, that we import large quantities of timber, but there is no reason at all for the little that we have to offer being unable to compete, as regards quality, with foreign wood produced by the same species of tree. As a matter of fact, however, the timber which we import from the Baltic is of such uniformly excellent quality, and our own pine and spruce are so often bad, that many refuse to believe that the wood is produced by the same species of trees, whereas, in reality, the so-called "red wood" is just our Scots pine, and "white wood" the common spruce. Those who do admit that we are dealing with wood produced by the same species of tree assert that there is something in our soil or climate which must for ever preclude the possibility of our growing as good wood at home. Such a belief is entirely the result of the mismanagement of our woods and forests, and is not attributable at all to the soil, and in very small part to the climate.

M. Boppe, in his "Report on a Visit to Scottish and English Forests," says:—"Everywhere, both at a few feet above the sea-level and on the sides of mountains at a height of 2500 feet, in the sands of Forres and in the schists, red sandstones, granites, and gneiss of the interior, we were struck by the wonderful aptitude of the soil to forest vegetation, favoured as it is by a regular climate and the constant humidity of the atmosphere." There are hundreds of thousands of acres of land in Scotland (the observer just quoted says five millions) which at present yields the miserable grazing rent of two or three shillings an acre, which could grow as good timber as any in the North of Europe. The practical difficulty is getting the land stocked with trees, for the great expense which must necessarily be incurred, and the time which must elapse before an adequate return can be looked for, act as powerful deterrents to its being undertaken on a large scale by private enterprise. That the venture would prove profitable even at present prices there can be no doubt, and all appearances point to a large rise in the value of timber in the near future.

Dr Schlich, in his recently published *Manual of Forestry*, directs attention to the fact that Canada is the only British colony which supplies us with an appreciable quantity of wood. At any moment, however, these exports may be diverted to the United States, for even now the latter country could take all the timber which Canada can spare. As a matter of fact our wood-imports from that colony have decreased thirty-two per cent. within the last five years, and as they may be extinguished before other five years, we shall have to depend entirely for our imported timber upon countries over whose policy we have no control. Dr Schlich points out that we import £13,000,000 worth of forest-produce which we could grow at home, for which purpose the afforesting of six million acres would be necessary. This land he believes to be all available in Scotland, and strongly urges the desirability of extended sylvicultural operations.

We have now discussed two of the conditions which have exercised an influence upon British Forestry; a third is to be found in our fortune in possessing such rich and extensive coal-fields. No country in Europe can approach us in this respect. Whereas wood is still the most important article of fuel in wide regions of the Continent, it is but little valued for heating purposes in this country. Had the case been different we would have been compelled to look to our forests to furnish an appreciable supplement to our supplies of coal-fuel, and necessity would have forced us to bestow more care upon our forest-management. Those who have given their attention to the subject tell us that we are now within measurable distance of the time when we shall have to face a diminishing coal-supply, and, finally, exhausted coal-fields. Although it is probable that the question of providing a substitute for coal will not urgently demand a solution in our time, still it is undeniable that sooner or later it must be faced. Some enthusiastic foresters press the desirability of more extensive tree-planting, so that a store of firewood may be laid up against the evil day. That there is wisdom in the suggestion no one will deny, but Professor Helferich's [1] calculations with regard to the matter do not afford us a large measure of comfort. He says that if we take 2·7 lbs. of wood as giving the same quantity of heat as 1 lb. of coal, and one acre planted with Scots pine trees as capable of yielding annually $86\frac{1}{3}$ cubic feet of wood, equal to 28 cwts., without the capital stock of timber on the land being encroached upon; then, in order to yield the equivalent of the coal out-put of England and Wales, it would take a fully productive forest area more than six times the total

[1] Schönberg's *Handbuch der Politischen Oekonomie*, 2d edit., vol. ii., p. 263.

extent of these countries, even supposing our present import of timber to suffer no diminution. From this it is evident that even with a largely extended area our forests cannot be expected to furnish a complete substitute for coal, although they might assist to a considerable extent.

A fourth factor which has exerted, and is still exerting, an important influence upon our system of Forestry, is game. There can exist no doubt about this being *the* factor whose modifying influences are most felt at the present time; those of the others may be more powerful, but are less apparent. Let us look for a little at the part played by game in British Forestry. In the first place the presence of ground-game, to the extent we almost always meet with it here, precludes any great hope of success attending attempts at the natural regeneration of our woods and forests, or their artificial regeneration by sowing. One need not go the length of saying that the renewal of woodlands by natural or artificial sowing is always the best method to adopt, but where circumstances interpose a barrier to prevent these methods being employed in cases where they would otherwise be considered advantageous, then, of course, action is hampered, and ultimately some other system must be adopted, which, had the conditions been different, would have been considered quite inferior. Where practicable, the natural regeneration system is the most rational and economical system, and gives the best results. I will not encroach upon your time by adducing figures to prove that timber yielded by naturally renewed forests is better than that yielded by such as have been artificially planted, but one or two reasons may be indicated to explain why it is so. Where the parent trees are mature and healthy, very large quantities of seeds are shed, annually or periodically, far more, indeed, than are actually required for restocking the ground. Although an immense number of the seeds perish, still a sufficient number germinate to produce a dense covering of young plants, and in this way the moisture in the soil is protected against evaporation due to direct insolation, or to drying winds. To the shading of the ground is also to be attributed an increase in its fertility, for nitrification is hardly of less importance in Forestry than in Agriculture. The beneficial effects upon tree-growth which accompany a complete shading of the ground are far greater than would be considered possible by those who had not watched the results. This is a matter whose importance is fully appreciated on the Continent, where nothing in the whole management of forests is more insisted upon than the preservation of an unbroken umbrageous covering. In the middle period of the life of a forest this is not difficult to accomplish, but in the earlier period, as well as in the later period after extensive thinning has taken place, the ground can only be completely and, at the same time, profitably shaded by the process of natural regeneration. Professor Marshall Ward, in a recently published work,[1] mentions a case which came under his observation two years ago. In the district of Freising, in Bavaria, there is a larch plantation about seventy years old. Twenty years ago the trees were showing unmistakable signs of lack of vigour,—that is to say, they were making little growth, and were assuming a stunted appearance. Now, as is well known, the larch has a comparatively small mass of foliage, and therefore cannot shade the ground to the same degree as many other trees. In the plantation in question the plan was adopted of stocking the ground with young beeches, and this succeeded so well, that now all signs of premature ripeness in the trees have passed away, and a new lease of life seems to have been granted to the plantation.

Scarcely less important than the shading of the ground is the shading of the lower parts of the stems or boles of the trees, for, by this means, the undue formation of the inferior wood first produced in a growing season is prevented. By the ordinary methods of cultivation adopted in this country the young trees pass the first ten or fifteen years of their life in a semi-isolated condition,—that is to say, a considerable number of years is necessary to enable the young trees to close in on each other. During this time the influence of the sun on the lower parts of the stems and on the roots makes itself felt much sooner in each season of growth than would be the case were the stocking thicker, and a dense forest or plantation earlier obtained. Owing to this an abnormal development of the so-called "spring-zone" in the annual wood-rings is brought about, and consequently the average specific gravity and quality of the resulting timber are much lowered. In addition to this, the trees do not possess such straight stems, the wood contains a much larger number of knots, especially those most undesirable ones known as "loose knots," and the annual wood-rings are much broader towards the centre than towards the periphery of the stem, which latter condition,

[1] *Timber and some of its Diseases*, p. 35.

for many purposes, reduces the value of the timber, besides pre-disposing it to ring-shake. Where practicable, the best means which can be employed to attain the desirable closeness in the early stages of the life-history of a wood or forest are to be found in well-arranged systems of natural regeneration, or in artificial sowing. The much greater expense inseparable from the operation of stocking the ground as closely by planting as can be done by natural or artificial seeding can never allow the former to be carried out with much hope of a profitable return. Perhaps it need hardly be said that more careful attention must be given in its earlier stages to a naturally renewed wood than to one artificially planted, or otherwise the closeness which is so desirable in many ways may prove to be a source of great danger. Thinning must begin earlier and be oftener repeated in a wood raised from seed, and if the process is to be properly conducted, a higher standard of excellency is demanded of the workmen. To show the great amount of attention and care bestowed upon the preservation of closeness in young woods, it may be mentioned that in many parts of the Continent it is a common practice to remove rings of bark from the trees which are destined soon to be thinned out, so that they may very gradually die off and thus allow the neighbouring trees to close-in on each other before the actual separation of the former from the ground. In this way the shading of the ground, as well as that of the young stems, is maintained as completely as is possible without unduly retarding the process of thinning.

Where regeneration by natural or artificial sowing is by any means prevented, the quality of the timber suffers, not only in the earlier but also in the later years of the life-history of a wood. In this country one finds, generally speaking, little to complain of as regards the closeness of plantations during the middle period of their existence. After this, however, the state of things is usually very unsatisfactory, for storms and the hand of man have been busily at work interrupting the leafy canopy, so that great gaps become very common; indeed it is nothing unusual to find the trees standing so far apart from each other that neither the boles nor the ground are properly shaded. The quality of the annual increments of wood is thus reduced, and great loss of soil-fertility and moisture must result. In addition to these drawbacks, the surface is probably not even half stocked with trees, and consequently cannot be yielding half the rent of which it is capable. Were it possible systematically to make use of the process of natural regeneration, then the surface of the ground underneath the gaps in the overhead foliage would quickly be covered by a growth of shade-bearing trees, which would not only preserve and shade the lower part of the boles of the older ones, but would also ensure a stocking of young trees being present when the last of the older generation were finally removed. By this mode of procedure, one would find, instead of a bare surface, whose restocking would be an expensive and difficult operation, a more or less complete stocking of young trees, which, at the most, would require only a little artificial assistance to make perfect. Thus the restocking would not only be effected cheaply and well, but an immense advantage would be gained in the amount of time saved. Although, under specially favourable circumstances, a partial restocking by natural means might be obtained, notwithstanding considerable abundance of ground-game, still that uniform and perfect distribution of the young plants which is of so much importance cannot be looked for.

Apart from the question of natural renewal of woodlands, we all know what a hindrance ground-game interposes to their artificial renewal by planting. It is no uncommon experience for the young trees with which the ground has been stocked at great trouble and expense to be entirely destroyed, not once nor twice, but many times; and when this happens it is almost too much to expect that the plantation will ever be a financial success. In a few years material may be destroyed whose value is more than that of the land, and as this must be added to capital a satisfactory return can scarcely be looked for. Where measures for preserving the young trees from the attacks of vermin are adopted, the expense incurred falls also to be added to capital, thereby reducing the rate of interest ultimately to be obtained. It need excite no surprise, therefore, that landlords find forestry an unprofitable department of rural economy, or that they confine their sylvicultural operations within narrow limits.

We have seen, in particular, how ground-game modifies systems of forestry, but considerations of game, in general, are accountable for still more. These frequently regulate more or less the shape, situation, and composition of plantations, as well as their general management. In order to afford shelter for game excessive thinning is frequently resorted to, so that the trees may be induced to retain their lower branches. This is accompanied by all the evils which have already been indicated, and attention may be directed to one other, which applies more to dicotyledonous trees than to conifers.

When a wood is over-thinned large crowns develop on the individual trees, and the increase of leaf-surface, combined with the less restricted action of the wind, causes greater expiration of water to take place than would occur were the crowns smaller and more sheltered. But if the soil be not of the best quality, it by no means follows that, when the quantity of water raised from the soil to the leaves increases, so does the quantity of inorganic salts therein contained increase. What may, and in fact generally does happen, is that the same amount of raw plant food is merely contained in a larger amount of water; in other words, the solution becomes weaker. But, in order to provide a passage for the extra water, the liquid-conducting channels in the wood must be enlarged without a correspondingly increased formation of new wood resulting. This, then, increases the porosity of the timber, and consequently reduces its specific gravity and quality. The truth of this has been frequently demonstrated. Trees have been selected whose stems were clad with branches almost down to the ground, and one-half to two-thirds of their branches have been removed. In this state they have been allowed to grow for some years, and have then been felled and examined, when it has been found that the annual quantity of wood formed after pruning has been as great as, or even greater than, it was before the operation was conducted, while the specific gravity and the quality have been greatly raised. This clearly shows that large and heavy branches can often be advantageously dispensed with, for they themselves consume all the nutritive materials which they produce; so that, while adding nothing to the nourishment of the cambium of the stem, they lower the specific gravity of the wood there by keeping open an enlarged water-channel.

Other hindrances to a properly conducted system of forestry could be easily traced to the influence of game, but enough has probably been said to show that the game question as affecting sylviculture is a very pressing one. As is the case with most other great questions, so with this, it is much easier to point out the difficulties than to suggest means by which they can be overcome. Game in this country is not only a luxury, but also a marketable commodity, and, as such, yields an immediate return to the owner. Present sporting rents, although not so large as prospective forest returns, are usually infinitely more attractive, and are apt to prove too powerful for our forestal prosperity. Unless landowners can be convinced by actual demonstration of the superior advantages which well-managed woods have to offer as compared with game-infested ones, it is exceedingly difficult to see how the present system can be altered. A few Government forests to serve as models would be extremely useful, but only if managed in a really systematic manner by men selected, as our Indian forest officers are, for conspicuous ability. No good results can be expected to flow from the present management of the crown forests of England. If examples are required to encourage us in bringing in a new *régime*, we have only to turn in any direction except homewards to find them. America offers us an interesting and instructive set of annual forest reports, from which, and the beautiful forest maps, it is evident that she is bent upon accomplishing great things. Many States of the Union have appointed forestry commissions, and vigorous action is being taken in the direction of forest conservancy. Australia shows by her splendid official publications that she is fully alive to the importance of her forests. Japan has, by the munificence of her offers, attracted to the far east some of the most highly-trained foresters of Germany. Cape Colony has laid France under contribution to supply the skill necessary to place her forest system upon a proper basis. In all directions the same extraordinary activity is manifested. Were we at all an impressionable people, we could not have resisted long ago being infected by the universal enthusiasm. But at last a careful observer may descry a few signs of animation, if not of activity. The promise of a Forest Board has raised the expectation that a new epoch is at hand. Meanwhile we can but hope that the fulfilment will not long be delayed, and that, when established, the Forest Board will resolutely set to work to raise the reputation of British forestry to that position which befits a great nation.

XXIV. *On the Creation of Leasehold Timber Farms.* By A. T. WILLIAMSON, Corstorphine.

Public attention has in recent years been directed, as it has never been before, to the wisdom of planting our waste lands, and thus providing a supply of timber for future generations, near and remote. The enormously increasing volume of importations of timber, and the decreasing available supply of home produce, have made clear to the public mind the serious state of matters into which we have drifted in this respect. Landlords in general have failed in their duty heretofore in utilising the resources at their control towards maintaining the supply of home-grown timber, and although many have shown excellent examples in recent years, still the fringe only of the resources of the country has been touched. The Government also have been totally indifferent in regard to the subject. Some other method must therefore be propounded whereby the waste lands, mountain sides, rugged valleys, and low lands, may be made to yield the produce of which they are capable in the shape of timber, instead of being, as we are at present, dependent upon foreign countries.

Perhaps in no previous year's experience has the question been brought home more directly than at present, of the vast loss our poverty in home timber produce is to the nation's wealth. The revival in trade lately experienced so greatly increased our demands, that the immediate consequence was an enhanced value of foreign timber imports, the whole advance going into the pockets of the foreign producer; instances of the rise in prices being so remarkable, that "fresh woods and pastures new" have had to be looked out from whence to import the necessary supplies. Quebec pine timber has for generations been the popular commodity, particularly in the West of Scotland, for the industrial trades, but the price has so greatly advanced that a new timber has been looked out in the Far West, and shipped from British Columbian ports to this country, a greater distance, no doubt, but in the meantime at a lower and paying price.

It may be asked, is this state of matters to continue? Are our abundant resources to lie idle while the beneficial effects of periodical revivals of trade pass entirely into the hands of the foreigner as regards our timber wants? Seeing that both the Government and the landlords have failed to supply a remedy, the only course open is to afford reasonable opportunity and facility to the mercantile or industrial community to take the matter up. This can only be done by the medium of a lease of the land, with permission to the lessee to cultivate it for the production of timber. The proposition is no doubt surrounded with many difficulties and obstacles, but none of these are so great that they cannot with a little consideration be overcome. The first difficulty to face would be the securing of tenants possessed of sufficient capital necessary to plant and stock a farm of any extent, but with reasonable inducements in the shape of rent, etc., offered, the probability is, that the men engaging in this new avocation would be wood merchants, or consumers, men of capital who would take this up as a necessary branch of their business. It would require only a few years' growth of the trees to convert the growing produce into a mercantile security for the purpose of obtaining financial advances in the same way as is done in shipping and other commercial affairs. The difficulty of paying rent on the land while yielding no return might easily be got over by deferring payment thereof for the first fifteen or twenty years. These years' rent to be apportioned over, say, the succeeding ten years, when the farmer's income would be an annual and continuous one; while the security to the landlord would be amply provided in the growing crop. The minimum term of lease would require to be thirty years, and by way of giving security of tenure over that period, or any period to which the original lease might extend, compensation for growing crop would have to be paid on the decision of competent valuators. A lease engaged in, would naturally contain conditions, and make provision, for the maintenance of a continuous crop of trees, even after the first and subsequent plantings had matured and been realised.

The great hindrance to the manufacture of timber productions in this country is the smallness of individual woodlands. The waterways traversing the country are not utilised as in some other countries, whereby timber is conveyed long distances at a nominal expense to sawmills specially constructed for dealing with rough timber. The consequence is, that the expense of railway carriage of rough trees to a central sawmill places our merchants beyond the pale of competition with our foreign neighbours; and the individual woodlands are of such a limited extent, that the construction on the ground of costly sawmills, which are necessary in our days of modern improvements, to be demolished at the longest in the course of two or three years, would never pay any one. Portable sawmills are very useful in many cases, but to employ them to cut up battens and scantlings wholesale, in competition with Scandinavian imports, would be as likely of success as placing the old mail coach in competition with the express train. It would therefore be necessary that these timber farms should be on a large scale, extending to not less than a thousand acres, in order that timber would ultimately be provided in sufficient quantities to warrant the construction on the farm of machinery capable of converting it in the speediest and best manner possible. While a thousand acres is indicated as a minimum size of farm, it is only put forth as a necessity if conversion or manufacture of the timber is intended. Farms to yield only pit timber may be of any size; but the extent of the farms would speedily regulate itself. We should, no doubt, have syndicates springing up from time to time desirous of taking up, perhaps, ten thousand acres in one farm, and it is to be regretted that in many districts, areas of even greater extent are now waste and unproductive. We only instance these few difficulties as those most likely to arise, and suggest remedies to meet them. A hundred other difficulties might crop up when the matter was brought to a practical test, but none of so serious a nature that could not be as easily remedied as those we have referred to.

In the offering of inducements on the part of landlords to encourage timber merchants and consumers to undertake the working of a timber farm, it would be necessary for them not only to give favourable conditions in the shape of deferred payment of the early years' rent as indicated, but the rate of rent must be considered somewhat from the point of value attachable or earnable from the land in its present state. For landlords to begin to consider the lucrative results following from timber cultivation, and base their idea of rent thereon, would be quite destructive to a development of the system. It is certainly quite apparent that timber growing yields a large return to the producer, but this is realisable at the risk of the "farmer," and in return for his capital expended, also labour and management. Carried out under this system in a commercial spirit, with a stricter regard for economy than has hitherto been practised, the profits would be very much enhanced; but nevertheless all these must necessarily become the property of the speculator, be he landlord or tenant.

Another inducement would be the granting of long leases. We have indicated thirty years as a minimum, but a merchant before risking his capital and labour should have a reasonable prospect of continuity of tenure, and a reasonable period of lease would be fifty years, or even longer, as, in the case of cultivating hardwoods, less than this period would be practically useless.

It would also be necessary to abolish all game restrictions, and the land would have to be left practically untrammelled by such reservations as are to be found in agricultural leases. This would certainly be no hardship to landlords, as the land which would in all probability be given over to timber farms is not at present occupied as game preserves.

Much has been written and said about the Government advancing money for the purpose of planting waste lands, but however much Governments have been to blame for their neglect in forestry matters, this system should not be looked upon with approval. Success in anything is best attainable by self-help, and the adoption of "timber farms" offers the medium whereby self-help can secure reasonable prospects of yielding rich returns; and while self-interest would be the only consideration of the farmer in following this out, he would be steadily advancing the interests of forestry, covering our mountains with a wealth of timber, creating almost an entirely new branch of industry in timber manufacture, providing work to numberless people, and producing within the country that which it is capable of consuming. Progress is only effected by genuine labour and persevering work, and it is only by these means that an advance can be made. The self-interest of the "farmer" will ensure the principle being applied on his timber farms, and we should soon see manifested a development of the timber resources of the country, with results that would be beneficial to the whole community.

The public have now learned to look upon the matter of our timber supply as an important question. They have heard a great deal about experiments with rare conifers, and recommendations for the planting of various trees. The results of all these will be valued at their proper worth, but meantime the advance in forestry has been very dilatory. Let commercial men take the matter up on the system suggested here, and hard matter-of-fact lines of profit and loss will be worth a thousand theoretical experiments and recommendations. The trees that will thrive and pay best under particular circumstances and conditions will be speedily found out. The commercial man quickly learns by failures. The ordinary operations of forestry with him, will not lend themselves too readily to literary treatment; practical experience will be his chief guide, and thus, a real advance will be made in the knowledge and practice of forestry. That the system suggested in this paper would be favourably entertained by men of capital is nearly certain, from the fact that several instances already exist where suitable estates, either well wooded or adapted for wood cultivation, have been purchased by those associated with the timber trade, for the purpose of developing timber growing as a commercial speculation. When we have these instances before us, where men of capital have been found ready to purchase land for this purpose, how much more reasonable is it to expect that they would eagerly avail themselves, if opportunities and inducements were offered to become leaseholders, with lesser capital involved, and none of the responsibilities pertaining to land ownership.

In point of time the present appears peculiarly opportune for initiating such a system. The condition of trade, the introduction of new foreign woods into the country caused by the costlier production of Canadian timber, and the enhanced value of home produce, with the large popular interest taken in the whole subject of forestry, all tend to offer special encouragement to engage in what appears to be a lucrative and money-making branch of industry.

The subject of timber supply is one that touches every branch of industry; it is a necessary commodity to all who construct anything, to all who manufacture or use anything. Hence the reason that the present enhanced value of it, should cause the subject to occupy so much public attention, and forces us to seriously consider how far our resources can be made available for providing a proportion of these supplies. With the present feeling as to future lucrative returns, any advances made by landowners with the views here suggested, have every prospect of being reciprocated by many who would desire to become "Timber Farmers."

XXV. *The Larch Bug, "Aphis," or "Blight"* (Chermes laricis). By Dr W. Schlich, Professor of Forestry, Cooper's Hill Engineering College, Staines, Surrey.

Every Scottish forester will halt when the dreaded name of the "Larch Bug" (*Chermes laricis*) reaches his ear, because this little insect is known to be one of the most deadly enemies of the larch tree. Owing to the attacks of this pest young larches are often injured for life, and sometimes killed outright; moreover, the wounds produced by it in the bark are probably one of the chief means by which the larch cancer (*Peziza Willkommii*) establishes itself, the result being that in many parts of Scotland the production of larch has become almost impossible.

Under these circumstances the Members of the Society will no doubt be interested in the following information:—

There are several species of Chermes, and amongst them are the two forms, *C. laricis*, hitherto observed on the larch, and *C. abietis*, which forms the spruce galls. A Professor Blachmann noticed that the females which emerged from the spruce galls did not deposit their eggs on the spruce, but he found about that time numerous eggs deposited on the needles of young larches. This induced him to make a number of experiments, and amongst others he brought together, under thin nets, some spruce galls ready to open for the flight of the females—

(1.) with branches of spruce only.
(2.) ,, ,, larch ,,
(3.) ,, ,, spruce and larch.

After a while it was observed that the females had deposited their eggs, just as in the open, *but only on the* Larch *branches.* Professor Blachmann maintains, in consequence, that *C. laricis* and *C. abietis* are in reality only one and the same species, which lives alternately on larch and spruce—in other words, that the females which leave the spruce galls about August lay their eggs on the larch, where they are hatched, the insects remaining there over winter. These either return to the spruce in the spring after having developed wings, or they produce a fresh "winged" generation, which returns to the spruce.

It has frequently been noticed that the *C. laricis* has been specially numerous where spruce and larch are growing mixed together, or in woods at a short distance apart. On the other hand, larch when mixed with beech, remains, as a rule, singularly free from the attacks of the insect.

It seems, therefore, highly desirable that Scottish foresters should direct their closest attention to this matter, and, if the result be that Professor Blachmann's observations are confirmed, it will clearly demonstrate that spruce should not be grown in the vicinity of larch woods; and, more especially, they should not be allowed to grow near the nurseries where larch plants are raised. In many cases it may be possible to remove and destroy the spruce galls before the females have left them, and if young spruce trees are seen to be infested with the insects, the galls should be promptly picked off them while fresh, and burned to destroy the vermin. By taking proper precautions to clear the galls off young trees as soon as they are observed, and to avoid planting larch and spruce in the same plantation, or in the vicinity of each other, the injurious attacks of this notorious pest will be very much lessened, if not entirely stamped out in course of time, in many localities where it has hitherto been the ruin of all larch trees.

The subject is of such vital importance to the successful cultivation of the larch in many parts of the country, that it deserves to receive the most careful attention and closest observation of every forester and entomologist. Should a close study of the life-history of the *Chermes laricis* prove that in its transitions it requires to change from the spruce to the larch, and *vice versa*, in the various phases of its life, a discovery of great value to forestry in Britain will be made, and thereby the profitable cultivation of the larch will be vastly extended.

XXVI. *The Effect of the Railway and Canal Traffic Act, 1888, in relation to Forestry.* By A. T. Williamson, Corstorphine.

The immense importance of our timber supplies is clearly manifested by the magnitude of our imports, as shown in the Board of Trade returns, which, with each succeeding year, display an ever-increasing total, amounting in 1888 to the enormous quantity of 6,321,333 loads, or, if computed in feet, a little over three hundred millions of cubic measure. This certainly indicates the remarkable progress and development of our national industries; but, alas! it also exhibits, to some extent, the deplorable results of the neglect of the subject of forestry, not only by forgotten generations, but by those immediately preceding our own, in failing to give practical effect to the honest consideration of making provision for the wants of succeeding generations, by a replacement at least of the supplies which, although handed down to them by their ancestors, they selfishly utilised for their own necessities.

It would be preposterous to suggest that the industrial demands for timber at the present time could be conserved within ourselves, or that our supplies could by any development of forestry be made to meet the wants of the nation. Still it is an undeniable fact that were the resources of the country utilised only to a reasonable extent for the cultivation and production of timber, the importation of such an enormous quantity as three hundred millions of feet of timber annually would be quite unnecessary, and much of the £20,000,000 sterling which we pay for it would be saved to the nation.

Many plausible arguments may be adduced in justification of the action, or rather inaction, of those more intimately and personally interested in the subject, for having brought the country into the position of being unable to provide its proper proportion of timber to meet our industrial wants. To many, however, who are practically interested in the commercial aspect of the question, the impression is that the economic side of forestry has been made subservient, to a considerable extent, to what are perhaps proper enough in their own sphere,—viz., the æsthetic and scientific results, by those immediately engaged in forestry operations. Had an equal amount of energy and consideration been applied towards the removal of those obstacles by which the development of timber production is surrounded, they would have been greatly modified long ere this, and a different state of affairs would have prevailed.

In connection with the production of timber of low value, such as firs, which are generally rapid in their growth, and beneficial, if not essential, to the proper cultivation of many other species, the preferential rates of carriage imposed by railway and carrying companies in favour of imported goods have been a decided obstacle, forming, as they do, a tariff on the home produce, which makes it well-nigh an impossibility to compete in the open market with the foreign imports. The legislature, in its wisdom, has now made an enactment in the "Railway and Canal Traffic Act, 1888," which will greatly remedy this state of matters, and without commenting on the details of this Act of Parliament, or on the new schedule of rates and maximum charges submitted by railway companies, one feature materially affecting forestry is made quite clear, that preferential rates must be greatly restricted, if not altogether eliminated. If this be done, the home produce will be placed in a position to enter the market on equal terms with its foreign competitor as regards at least conveyance within our own shores.

The application of this Act ought to have a powerful effect in stimulating the utilisation of our waste lands, and bringing the cultivation of firs within the area of profitable production. It should also stimulate those engaged in forestry to a closer study of the commercial and industrial branches of the subject. The farmer, and the producer generally of necessary commodities, while making it his study to grow crops suited to the land and circumstances in which he is placed, in the greatest quantity of which the land is capable, also contrives to produce the exact varieties for which there exists the greatest demand, and what will with a reasonable likelihood yield the greatest profits for his capital and labour. Equally so should it be the study of the forester to find out the industrial exigencies as regards timber, and from that knowledge to practice the art of forestry by rearing crops of wood in as large quantities as the conditions permit of, applying to this end the scientific studies to which we have referred, and the æsthetic results will follow in natural sequence.

As already mentioned, the variety of timber that will be most beneficially affected by the action of the new system of railway rating will be firs, the native tree of the country. Of course it cannot be expected to be placed in such a position as to successfully compete with Scandinavian "sawn" timber, because of the unfavourable conditions in which we are placed in river intercommunication as compared with Norway and Sweden, unless our forests were so extensive as to permit, with propriety, the construction of the most modern and powerful machinery on the spot where the timber is cultivated. With these for the purpose of conversion into battens and scantlings, and thereafter seasoning them on the ground, the new Railway Act would apply with equal force, as in the case of that branch of the fir trade to which reference is about to be made. In passing it may here be remarked that the increasing commercial interest now being taken in this subject, and the strenuous efforts that are being put forth for the advancement of forestry and the Government recognition of it, indicates that events are developing towards the time when proprietors, or commercial lessees, will possess forest tracts of sufficient extent, continuously and in perpetuity, as to offer a speculative attraction for the construction of permanent saw-mill machinery for the manufacture of timber of equal quality to foreign. The timber being dry, and subject only to carriage on the useful article, relieved of all waste and superfluous timber, competition will not only become possible, but highly probable, and for all or nearly all industrial purposes Scots fir battens are equal in quality to Scandinavian goods, while in many cases they are far superior.

The branch of the trade, however, which will be most beneficially affected is that which is connected with the mining industries. Some idea of the immense consumption of the raw, unmanufactured material may be formed, when it is known that to the Firth of Forth, the chief emporium for Scotland, somewhere about ten millions of cubic feet of mining timber, chiefly pit-props, are annually imported. These come in small sizes, varying from $2\frac{1}{2}$ inches in diameter and upwards, and from 2 feet in length up to 20 feet. The timber after arrival in this country is subject to railway carriage, and very frequently has to be conveyed long distances to the coal-fields of Lanarkshire, Ayrshire, Fifeshire, and elsewhere. The fact that these foreign imports of pitwood have been peculiarly favoured by preferential railway rates, must be the principal reason why the position of the home produce should have hitherto been so very much prejudiced and made unable to compete as regards price with the Norwegian wood, the delivery from the forest in this country to the nearest railway station being counterbalanced by the expenses incurred in delivering from the forests in Norway to the shipping port. Where the value of such wood is proportionately smaller, the evil effects of preferential rates are more keenly felt. In many cases they have been less than one-half of what has been charged for equal distances between two inland points.

As affecting the cultivation of young firs for pit purposes, the application of the new Railway Schedules should act as the greatest incentive, more particularly in the Midland Counties of Scotland, where much land is at present comparatively worthless for agricultural purposes. The counties of Fife, Stirling, Perth, etc., abound in poor land admirably adapted to the growth and cultivation of Scots fir, and which at present yields only the smallest return of rent as grazing or arable land. The expense connected with the maintaining of young plantations for the first fifteen years, beyond the first cost of planting, is very light, and after that period the income would be continuous and perpetual. The railway carriage from the midland counties to the colliery centres would, generally, be the same as that from the shipping ports to the collieries, seeing that rating will be entirely regulated by mileage. The beneficial effects of the Act as regards mature fir-timber in these districts does not in the meantime so appreciably apply, seeing that mature forests of sufficient extent do not exist to warrant the erection of machinery for the conversion of the timber.

The new schedule of rates and charges lodged by railway companies under this Act of Parliament has as yet not been adjusted by the Board of Trade, and it is premature to indulge on the effects they may have on timber carried for lengthened distances, as for instance from Kirkcudbright in the south, or Inverness in the north; but the general scope of the system seems greatly to favour and encourage distant traffic by charging a minimum mileage rate beyond the first twenty miles. The rates leviable on distances under this, whether high or low, do not affect the position of the home produce, as the same rates, whatever they may be, are equally leviable on the foreign, which in great measure is subject to an average railway carriage of twenty miles, thereby equalising competition. The minimum mileage rate chargeable for distances beyond twenty miles will to a large extent remove an obstacle now existing against the cultivation of home pitwood in distant parts of the country. This should stimulate the planting and growth of colliery timber in these distant districts to an enormous extent,—consuming within the country our native produce, and utilising for the national benefit many tracts of land which now are said to be unproductive either to the proprietor or for the general good.

In considering the revenue to be derived from pitwood, it is no exaggeration to expect an eighteen years' growth of fir to produce 30,000 lineal feet of light props per acre, the market price of which at a shipping port is four shillings per 100 feet, and which on an average, if grown within the twenty-mile radius of the colliery districts, is of the same value at the nearest railway station. This gives a gross value of £60 per acre for the eighteen years; and deducting therefrom the recognised average outlay for planting, tending, and delivery to a station, say six miles distant, at £20, leaves a nett revenue to the credit of rent of £40 for the acre for eighteen years. This calculation is based on a minimum of production of timber, and assuming this to be of the smallest size; but the revolution that has taken place in the conduct of the pitwood trade caused by the colliery legislation of recent years, has led merchants to adapt the trade to the demands, and instead of long lengths being supplied to consumers direct, as had previously been the custom, the operatives being allowed to crosscut their own wood, Parliament now stipulates that operatives shall be supplied with their exact requirements. In cross-cutting, therefore, in the woods, or at shipping ports, as is now done, an average tree of eighteen years' growth will produce half its length of a much larger size, so that instead of four shillings being realised as the price, the full value is increased by 30 to 40 per cent. It has also been assumed that the whole area of ground has been planted with firs, the lowest priced produce, while the generally approved practice would naturally be carried out by an admixture of larch, which would again yield a proportionate increase of value in the total revenue from the acre. These figures are not given for the purpose of demonstrating the lucrative results of tree cultivation. This has repeatedly been shown, but the numerous obstacles in the way of realisation have been generally excluded. The removal, however, of the serious obstacle which has hitherto existed in the shape of preferential railway rates ought to stir up enthusiasm in the advancement of forestry; and in the development that must follow, measures and contrivances will readily be found to mitigate and remove the remaining obstacles that act as a hindrance in the development of our resources for timber cultivation.

With the comparatively early return of profits which the cultivation of young timber would certainly produce, the commercial spirit would be stimulated, and instead of the scientific and æsthetic enthusiasm so long indulged in, a healthy, economic, and practical forestry which looks carefully after profit and loss would be fostered for the benefit of the individual, as well as for the public interests.

The adjustment of the railway rates grievance will also have a powerful effect in inducing and encouraging the leasing of land from proprietors, for tree cultivation as a mercantile investment. If carried out where direct personal interest is involved, the consummation of advanced economic forestry would be rapidly reached; and the present prospects clearly indicate that it is by this method of production that the full ultimate utilisation of our immense timber resources will be attained. The scientific experiments that have been made to the decided advantage of forestry, and the knowledge gained therefrom, would then be practically applied by the "forest farmer," dealing only with the commercial or profit and loss aspect of the question. He must make his forest farm pay, else ruin will quickly overtake him; while the owners of our woodlands, generally speaking, have not had this force behind them, and consequently their methods of management have not received the wholesome stimulus of mercantile competition to spur them on to make a greater profit out of their land.

XXVII. *On the Comparative Value of the different Timber Trees grown for profit in Britain; with Rate of Growth of each Species in a given time.* By DAVID TAIT, Overseer, Owston Park, Doncaster, Yorkshire.

This is a very important subject to all owners of woodlands, and those interested in their management and produce. There are many local influences at work which render the same kind of tree very profitable to cultivate in one district, while in another, and perhaps not far distant district, it is quite the reverse, and these influences must all be reckoned with by the successful planter; soil, altitude, and exposure, in particular, greatly influencing the rate of growth of all kinds of trees. In dealing with a subject of this nature, there is a difficulty in giving sufficient details to bring out all the facts, while at the same time avoiding wearisome repetitions. To record the rate of growth of single specimen trees would not be a satisfactory way of treating the subject, as the greater space they occupy would require consideration, as well as the rate of growth. Neither could a fair comparison be made by taking only one kind of soil, as some trees grow fastest in one soil, and some in another of a totally different character. I have therefore come to the conclusion, that the fairest comparison can be made by considering the growth of trees on four kinds of soil, viz.—No. 1, good loamy soil; No. 2, peaty soil resting on clay; No. 3, strong clay; and No. 4, sandy loam resting on gravel. For conciseness these soils are referred to by their numbers in this essay, and also in the comparative table at the end of it.

The number of trees allowed per acre in my calculations may be objected to by some, but as each kind is treated in relative proportions, the numbers do not affect the conclusions arrived at. It is true that we often find in plantations much fewer trees per acre than the numbers given in this essay, but from whatever cause this may arise, it is quite practicable to have the numbers stated at the various stages of growth.

I have not attempted to give the net value of any variety, for the sufficient reason that doing so leads to too many speculative figures to make out the necessary details. In all cases I give *gross values,* without any deductions whatever. No note is taken of the many disappointments suffered by the planter—the result of storms, droughts, or the ravages of vermin—nor is the distance from market considered. What I have aimed at is, to bring out clearly the approximate difference in the returns which the planter may expect from various species of trees grown under similar conditions.

The figures given, as to size and rates of growth, of the various species of trees, apply to a locality where hardwood and coniferous trees thrive equally well. No sensational figures are quoted, for although individual trees may and do grow much faster, all practical men know that the average size of a regular crop of trees on an acre of land, is a very different thing from that of an individual specimen. The prices quoted for the various timbers are the rates prevailing in 1889, in a district with good railway facilities, and distant twenty-five miles from the consumer.

THE OAK, *Quercus Robur.*

The Oak, as "Monarch of the Woods," claims first consideration. Its almost exclusive use in former days in building the "Wooden Walls" for the protection of our country, and also, I believe, by Government giving premiums to landowners for planting oaks on their property, caused it to be planted very extensively till about 50 years ago. Since then, the use of iron and foreign timber in shipbuilding have greatly lessened the demand for oak, and its value has decreased in proportion. Still, well-matured timber brings a good paying price at the present time, and scarcely any mixed plantations are formed without a fair sprinkling of oaks in them. This is as it ought to be, as for many purposes its timber cannot be superseded by that of any of our forest trees. The oak has also the advantage of its bark being of considerable value, although this, like many other articles of native produce, does not now command the price it did a few years ago.

On an acre of No. 1 soil, I find 600 trees growing at 30 years old (in speaking of the age of the trees, I give the years that have elapsed since they were planted), their cubic contents varying from 9 inches to 5 feet, or an average each of 3 cubic feet; value at 6d. per cubic foot, £45; to which has to be added 9 tons of bark at 35s. per ton, giving a total value of £60, 15s. At 32 years, 200 trees sold for £25, including bark. At 40 years, 200 trees sold for £55. At 45 years, the average contents of 200 trees was 10 cubic feet; value at 10d. per foot, £83; and 12 tons of bark at 35s., £21. Total value, £104. At 48 years, 100 trees sold for £82. At 58 years, 50 trees sold for £68. At 60 years, the remaining 50 trees averaged 20 feet; value at 1s. 4d., £66, 13s. 4d., including bark. I have allowed nothing for thinnings previous to 30 years of age, as the cost of thinning equalled the receipts. *Total value of crop at* 60 *years, and thinnings since* 30 *years old*, £296, 13s. 4d.

On No. 2 soil, at 30 years, the trees were shorter and not so clean grown as the previous lot; their average contents being 2 cubic feet; and the value of the 600 trees and bark being £40, 10s. At 32 years, 200 trees sold for £15. At 40 years, 200 trees sold for £40. At 45 years, the average of 200 trees was 8 feet; value at 8d., £70, 10s., including 10 tons of bark. At 48 years, 70 trees sold for £52. At 56 years, 40 trees sold for £30. At 60 years, the remaining 90 trees averaged 14 feet; value at 1s., £63, and 8 tons of bark, £14. *Total value of crop*, £214.

On No. 3 soil, at 30 years, there were 600 trees, with an average of $1\frac{3}{4}$ cubic feet, value, £26, 5s.; and $5\frac{1}{4}$ tons of bark, value £9, 3s. At 32 years, 200 trees sold for £14. At 40 years, 200 trees sold for £47. At 45 years, 200 trees averaged 6 feet; at 8d., £40; and $7\frac{1}{2}$ tons of bark, £13. At 48 years, 60 trees sold for £23. At 58 years, 50 trees sold for £25. At 60 years, the average of the remaining 90 trees was 11 feet; value at 1s., £49, 10s.; value of bark, £12. *Total value of crop*, £170, 10s.

On No. 4 soil, the 600 trees at 30 years of age contained 3 cubic feet each, at 6d.; value, including 9 tons of bark, £60, 15s. At 32 years, 200 trees sold for £24. At 40 years, 200 trees sold for £50. At 45 years, 200 trees averaged 9 feet; value at 10d., £75; and 11 tons of bark, £19. At 48 years, 80 trees sold for £54. At 56 years, 60 trees sold for £50. At 60 years, the remaining 60 trees averaged 16 feet; value at 1s. 4d., £64; and 6 tons of bark, £10, 10s. *Total value of crop*, £252, 10s.

Before passing on from the oak, it may be as well to explain that at 60 years, it is at a period of its life when its increase in size and value is at a much greater ratio than in the preceding stages of its growth; but, as 60 years is an age at which many of our timber trees have arrived at maturity, and most of them can be felled with advantage, I deem it best not to extend the comparisons further.

The Ash, *Fraxinus excelsior*.

Although there are not the same patriotic or legendary associations connected with the Ash, as with the Oak; yet, for general utility, and the early age at which it can be profitably used, it is second to none of our forest trees.

On No. 1 soil, at 30 years, there were 500 trees per acre, averaging 4 feet; value at 10d. per foot, £83. As the result of previous thinnings, there was a profit of £20 over the expenses of felling. At 32 years, 150 trees sold for £38. At 40 years, 100 trees sold for £35. At 45 years, 250 trees averaged 10 feet; value, £125. At 46 years, 100 trees sold for £53. At 52 years, 40 trees sold for £42. At 58 years, 30 trees sold for £38. At 60 years the remaining 80 trees averaged 26 feet; value at 1s. 6d., £156. *Total value of crop*, £382.

On No. 2 soil, at 30 years, there were 450 trees, averaging 6 cubic feet; value at 1s., £135. At 32 years, 150 trees sold for £45. At 40 years, 100 trees sold for £50. The 200 trees standing at 45 years, averaged 13 feet; value, £130. At 46 years, 100 trees sold for £70. At 54 years, 50 trees sold for £53. At 60 years, the remaining 50 trees averaged 25 feet; value at 1s. 6d., £93, 15s. *Total value of crop (including £25 for thinnings previous to* 30 *years old)*, £336, 15s.

On No. 3 soil, at 30 years, there were 550 trees averaging 3 feet; value at 9d. per foot, £61. At 32 years, 200 trees sold for £26. At 40 years, 150 trees sold for £35. At 45 years, 200 trees averaged 7 feet; value, £70. At 48 years, 80 trees sold for £32. At 56 years, 30 trees sold for £17. At 60 years the average of the remaining 90 trees was 12 feet; value at 1s. per foot, £54, which, with £10 for thinnings previous to 30 years old, makes the —*Total value of crop*, £174.

On No. 4 soil, at 30 years, there were 500 trees averaging 4 feet; value, £75. At 45 years, 150 trees averaged 9 feet; value, £67, 10s. At 60 years, there were 90 trees averaging 15 feet; value, £84. The value of thinnings previous to 30 years old was £10; since then, £170. *Total value of crop*, £264.

The Sycamore, *Acer Pseudo-platanus*.

The Sycamore, or "Plane-tree," as it is called in Scotland, is a very profitable timber tree when of large size and good quality, but in its early stages of growth it is of comparatively small value.

On No. 1 soil, at 30 years, there were 450 trees per acre, averaging 5 feet; value at 5d. per foot, £46, 17s. 6d. At 32 years, 150 trees sold for £18. At 38 years, 100 trees sold for £23. At 44 years, 40 trees sold for £24. At 45 years, 160 trees averaged 15 feet, at 1s. per foot; value, £120. At 50 years, 60 trees sold for £90. At 58 years, 40 trees sold for £66. At 60 years, the average of the remaining 60 trees was 25 feet; value at 2s. per foot, £150. *Total value of crop*, £371.

No. 2 soil is not suitable for the sycamore.

On No. 3 soil, at 30 years, there were 500 trees averaging 3 feet; value at 5d. per foot, £31, 5s. At 32 years, 200 trees sold for £15. At 40 years, 150 trees sold for £23. At 45 years, 150 trees averaged 7 feet; value at 9d. per foot, £43, 10s. At 50 years, 70 trees sold for £35. At 60 years the remaining 80 trees averaged 15 feet; value, £90. *Total value of crop*, £163.

On No. 4 soil, at 30 years, there were 450 trees averaging 4 feet; value at 5d. per foot, £37, 10s. At 32 years, 200 trees sold for £19. At 44 years, 100 trees sold for £34. At 45 years, the average of 150 trees was 9 feet; value at 9d. per foot, £50, 10s. At 54 years, 70 trees sold for £46. At 60 years, the remaining 80 trees averaged 20 feet; value at 1s. 8d., £133, 6s. 8d. *Total value of crop*, £232, 6s. 8d.

The Black Italian Poplar, *Populus monilifera*.

The Black Italian is the best timber tree, and also one of the fastest growing of all the poplars. Its timber brought a high price a few years ago, but since then it has decreased in value to a greater extent than most other home-grown timbers.

On No. 1 soil, at 30 years, there were 300 trees averaging 20 feet; value at 4d. per foot, £100. At 32 years, 140 trees sold for £51. At 40 years, 60 trees sold for £60. At 45 years, 100 trees averaged 45 feet; value at 7d. per foot, £131. At 50 years, 30 trees sold for £50. At 58 years, 30 trees sold for £67. At 60 years, the remaining 40 trees averaged 65 feet; value at 9d. per foot, £97, 10s. *Total value of crop*, £325, 10s.

On No. 2 soil, at 30 years, there were 300 trees averaging 13 feet; value, £75. At 32 years, 150 trees sold for £40. At 44 years, 70 trees sold for £52. At 45 years, 80 trees averaged 32 feet; value at 6d. per foot, £64. At 54 years, 30 trees sold for £40. At 60 years, the remaining 50 trees averaged 55 feet;

value at 9d. per foot, £103, 2s. 6d. *Total value of crop*, £235, 2s. 6d.

On No. 3 soil, at 30 years, there were 300 trees averaging 12 feet; value, £60. At 32 years, 150 trees sold for £36. At 44 years, 50 trees sold for £18. At 45 years, 100 trees averaged 24 feet; value, £60. At 54 years, 40 trees sold for £30; and at 60 years, the remaining 60 trees averaged 40 feet; value at 7d. per foot, £70. *Total value of crop*, £154.

On No. 4 soil, at 30 years, there were 300 trees averaging 10 feet; value, £50. At 32 years, 150 trees sold for £28. At 42 years, 60 trees sold for £14. At 45 years, 90 trees averaged 20 feet; value at 5d. per foot, £38. At 52 years, 40 trees sold for £30. At 60 years, the remaining 50 trees averaged 44 feet; value at 8d. per foot, £73. *Total value of crop*, £145.

THE BIRCH, *Betula alba.*

This is a valuable tree for planting in many soils, and in situations where hardly any other tree will grow. It is equally at home on low swampy ground, and high up the mountain side among stones and rocks. It has the advantage of being rabbit proof, which is no mean consideration to the planter.

At 30 years old, on No. 1 soil, there were 680 trees per acre, averaging 4 feet; value at 6d. per foot, £68. At 40 years, 380 trees sold for £66. At 45 years, 300 trees averaged 9 feet; value at 6d. per foot, £67, 10s. At 50 years, 140 trees sold for £42. At 60 years, the remaining 160 trees averaged 16 feet; value at 6d. per foot, £64. *Total value of crop*, £172.

On No. 2 soil, at 30 years, there were 600 trees averaging 5 feet; value at 6d. per foot, £75. At 40 years, 300 trees sold for £67. At 45 years, 300 trees averaged 12 feet; value at 6d. per foot, £90. At 50 years, 150 trees sold for £56. At 60 years, the remaining 150 trees averaged 20 feet; value at 6d. per foot, £75. *Total value of crop*, £198.

On No. 3 soil, at 30 years, there were 680 trees averaging 3 feet; value at 6d. per foot, £51. At 40 years, 380 trees sold for £47. At 45 years, 300 trees averaged 7 feet; value at 6d. per foot, £52, 10s. At 50 years, 140 trees sold for £33. At 60 years, the remaining 160 trees averaged 14 feet; value at 6d. per foot, £56. *Total value of crop*, £136.

On No. 4 soil, the growth and value of birch is much the same as on No. 3.

The Alder, *Alnus glutinosa.*

Although the Alder is not one of the most valuable of our timber trees, it is very useful for planting in wet situations.

On No. 2 soil, at 30 years, 680 trees averaged 4½ feet; value at 6d. per foot, £76, 10s. At 40 years, 380 trees sold for £70. At 45 years, 300 trees averaged 10 feet; value at 6d. per foot, £75. At 50 years, 140 trees sold for £45. At 60 years, the remaining 160 trees averaged 16 feet; value at 6d. per foot, £64. *Total value of crop*, £179.

The Beech, *Fagus sylvatica.*

The Beech accommodates itself to a variety of soils, but on wet marshy land it will not succeed.

On No. 1 soil, at 30 years, 400 trees averaged 4 feet; value at 4d. per foot, £26, 13s. 4d. At 32 years, 150 trees sold for £12. At 44 years, 100 trees sold for £22. At 45 years, the trees averaged 10 feet; value at 6d. per foot, £37, 10s. At 52 years, 60 trees sold for £22. At 58 years, 40 trees sold for £26. The remaining 50 trees, at 60 years, averaged 25 feet; value at 10d. per foot, £52, 1s. 8d. *Total value of crop*, £134, 1s. 8d.

The Scots or Wych Elm, *Ulmus montana.*

This grows best on No. 1 soil. On some soils, more especially light sandy soil, it is liable to heart-rot, which renders its timber valueless. At 30 years, 450 trees averaged 3½ feet; value at 5d. per foot, £32, 16s. 3d. At 32 years, 200 trees sold for £17. At 40 years, 150 trees sold for £28. At 45 years, 100 trees averaged 8 feet; value at 7d. per foot, £23. At 48 years, 30 trees sold for £18. At 56 years, 20 trees sold for £14. At 60 years, the remaining 50 trees averaged 20 feet; value at 10d. per foot, £41, 13s. 4d. *Total value of crop*, £118, 13s. 4d.

The English Elm, *Ulmus campestris.*

This is of a much straighter and taller habit than the Scots elm. It is also quicker in its growth than most of our timber trees.

On No. 1 soil, at 30 years, 500 trees averaged 5 feet; value at 4d. per foot, £41, 13s. 4d. At 32 years, 200 trees sold for £19. At 40 years, 100 trees sold for £20. At 45 years, 200 trees averaged 16 feet; value at 6d. per foot, £80. At 48 years, 80 trees sold for £39. At 56 years, 60 trees sold for £58. At 60 years, the remaining 60 trees averaged 30 feet; value at 9d. per foot, £67, 10s. *Total value of crop*, £203, 10s.

The Spanish Chestnut, *Castanea vesca.*

This is often included in a mixed plantation of hardwood trees, as it grows quickly, and its timber matures early; but when full grown, it is very frequently found ring-shaken when felled, which spoils its quality and lessens its value.

On No. 1 soil, at 30 years, 500 trees averaged 6 feet; value, at 6d. per foot, £75. At 32 years, 200 trees sold for £32. At 40 years, 150 trees sold for £37. At 45 years, 150 trees averaged 12 feet; value at 6d. per foot, £46, 10s. At 48 years, 50 trees sold for £19. At 56 years, 50 trees sold for £40. At 60 years the value of the remaining 50 trees was £58, their average being 28 feet. *Total value of crop*, £186.

The horse-chestnut, lime, cherry, and several other trees are more of an ornamental than a commercial value, although the timber of all of them sells well when of a large size and clean growth.

The Scots Fir, *Pinus sylvestris.*

The Scots Fir is a most useful tree, and is found producing good timber in all kinds of soils and situations. It is invaluable for forming plantations in exposed positions and at high altitudes. It is to be found growing in the clefts of rocks, with hardly a vestige of soil to be seen, and on low lying sandy wastes close to the sea shore.

On No. 1 soil, at 30 years, 680 trees averaged 6 feet; value at 6d. per foot, £102. Previous to this, 660 trees had been sold for £33. At 36 years, 200 trees sold for £40. At 45 years, 480 trees averaged 12 feet; value at 6d. per foot, £147. At 46 years, 180 trees sold for £50. At 54 years, 150 trees sold for £60. At 60 years, the remaining 150 trees averaged 26 feet; value at 8d. per foot, £130. *Total value of crop*, £313.

On No. 2 soil, the timber of Scots fir is softer and coarser. At 30 years, the average size of 680 trees was 6 feet; value at 4d. per foot, £68. Previous to this, 660 trees had been sold for £24. At 36 years, 200 trees sold for £34. At 45 years, 460 trees averaged 10 feet; value at 5d. per foot, £95. At 46 years, 180 trees sold for £46. At 54 years, 150 trees sold for £55. At 60 years, the remaining 150 trees averaged 22 feet; value at 7d. per foot, £96, 5s. *Total value of crop*, £255.

No. 3 soil is that on which Scots fir will give the poorest return. At 30 years, 680 trees averaged 5 feet; value at 4d. per foot, £56, 13s. 4d. Previous to this, 660 trees were sold for £22. At 36 years, 200 trees sold for £34. At 45 years, 460 trees averaged 9 feet; value at 5d. per foot, £86. At 46 years, 180 trees sold for £42. At 54 years, 150 trees sold for £50. At 60 years, the remaining 150 trees averaged 20 feet; value at 7d. per foot, £87, 10s. *Total value of crop*, £235, 10s.

THE LARCH, *Larix europœa.*

The Larch is the most important of our coniferous trees, and is planted on a variety of soils and situations. It is useful in every stage of its growth, and is always in demand.

On No. 1 soil, at 30 years, there were 1360 trees averaging 5 feet; value at 7d. per foot, £198, 6s. 8d. The thinnings previous to this were sold for £18. At 31 years, 680 trees sold for £100. At 40 years, 200 trees sold for £53. At 45 years, 480 trees averaged 10 feet; value at 8d. per foot, £160. At 48 years, 280 trees sold for £147. At 60 years, the remaining 200 trees averaged 20 feet; value at 10d. per foot, £166, 13s. 4d. *Total value of crop*, £484, 13s. 4d.

No. 2 soil is not suited for the growth of the larch, although it might do fairly well for about 25 years.

The larch is often planted on No. 3 soil, but it is not suitable for growing the tree to a large size, and it generally begins to deteriorate when about 36 years of age. As a nurse to other trees the larch pays better than any other kind of tree. At 30 years, 1360 trees averaged 3½ feet; value at 7d. per foot, £139, 13s. 4d. Previous to this the thinnings were sold for £15. At 31 years, 680 trees sold for £75. At 40 years, 280 trees sold for £46. At 45 years, 400 trees averaged 9 feet; value at 9d. per foot, £135. At 48 years, 200 trees sold for £75. At 60 years, the average of the remaining 200 trees was 12 feet; value at 9d. per foot, £90. *Total value of crop*, £301.

On No. 4 soil, at 30 years, 1360 trees averaged 4½ feet; value at 7d. per foot, £178, 10s. The thinnings previous to this were sold for £18. At 31 years, 680 trees sold for £95. At 40 years, 280 trees sold for £70. At 45 years, 400 trees averaged 10 feet; value at 8d. per foot, £134. At 48 years, 200 trees sold for

£105. At 60 years the remaining 200 trees averaged 22 feet; value at 10d. per foot, £183. *Total value of crop*, £471.

Norway Spruce, *Abies excelsa.*

This is used in most plantations as a nurse, and prized for game coverts, and on that account, more than for the value of its timber, it is very extensively planted. Here, of course, we only consider it as a timber tree.

On No. 1 soil, at 30 years, 1360 trees averaged 4 feet; value at 6d. per foot, £136. At 31 years, 680 trees sold for £72. At 40 years, 280 trees sold for £49. At 45 years, 400 trees averaged 9 feet; value at 6d. per foot, £90. At 48 years, 200 trees sold for £55. At 60 years, 200 trees averaged 20 feet; value at 6d. per foot, £100. *Total value of crop*, £276.

On No. 2 soil, at 30 years, 1360 trees averaged 4½ feet; value at 6d. per foot, £153. At 31 years, 680 trees sold for £74. At 40 years, 280 trees sold for £50. At 45, 400 trees averaged 10 feet; value at 6d. per foot, £100. At 48 years, 200 trees sold for £58. At 60 years, 200 trees averaged 22 feet; value at 6d. per foot, £110. *Total value of crop*, £292.

No. 3 soil is not suited for growing spruce to perfection. It grows fairly well up to 36 or 40 years old, after which it begins to fail. At 30 years, 1360 trees averaged 3 feet; value at 6d. per foot, £102. At 31 years, 680 trees sold for £60. At 40 years, 280 trees sold for £46. At 45 years, 400 trees averaged 8 feet; value at 6d. per foot, £80. At 48 years, 200 trees sold for £50. At 60 years, the remaining 200 trees averaged 12 feet; value at 6d. per foot, £60. *Total value of crop*, £216.

On No. 4 soil, at 30 years, 1360 trees averaged 4½ feet; value at 6d. per foot, £153. At 31 years, 680 trees sold for £75. At 40 years, 280 trees sold for £52. At 45 years, 400 trees averaged 10 feet; value at 6d. per foot, £100. At 48 years, 200 trees sold for £60. At 60 years, 200 trees averaged 20 feet; value at 6d. per foot, £100. *Total value of crop*, £287.

The Silver Fir, *Picea pectinata.*

This grows slowly in its early stages, but when older it grows rapidly. It is recommended by some for planting on clay soils, but my experience is that after about 40 years' growth the tree dies off on clay. It thrives well, and grows to a large size on sandy soils.

On No. 4 soil, at 30 years, 680 trees averaged 4 feet; value at 6d. per foot, £68. At 32 years, 280 trees sold for £32. At 40 years, 100 trees sold for £25. At 45 years, 300 trees averaged 18 feet; value at 6d. per foot, £135. At 48 years, 150 trees sold for £82. At 60 years, 150 trees averaged 30 feet; value at 8d. per foot, £150. *Total value of crop*, £289.

The result of our figures is, that the Larch is the most profitable of all our forest trees, giving a return, under favourable circumstances, on No. 1 soil, of £484, 13s. 4d. per acre in 60 years, or of £8, 1s. 6d. per acre per annum. Even on indifferent soil, such as No. 3, it gives a return of £5, 0s. 4d. per acre per annum; a sum much in excess of any other kind of tree on that soil, which is not considered at all suitable for growing first-class larch. The Scots Fir, among coniferous trees, is next to the larch as a profitable timber tree; on No. 1 soil giving a return in 60 years of £5, 4s. 4d. per acre per annum; and on the worst, or No. 3 soil, a yearly return of £3, 18s. 4d. On No. 2 soil, Spruce gives in the same time £4, 17s. 4d.; and on No. 4 soil, Silver Fir gives £4, 16s. 4d. per acre per annum.

Turning to hardwoods, we find the Ash the most valuable tree for cultivation, giving a return in 60 years, in No. 1 soil, of £382, or at the rate of £6, 7s. 4d. per acre per annum. The ash is closely followed by the Sycamore, with £6, 3s. 8d. per acre; and at a considerable distance by the Black Italian Poplar and the Oak, with respectively £5, 11s. 10d. and £4, 18s. 10d. as their values per acre per annum. English Elm gives £3, 7s. 10d.; Birch, £3, 6s.; Spanish Chestnut, £3, 2s.; Alder, £2, 19s. 8d.; Beech, £2, 4s. 8d.; and Wych Elm, £1, 19s. 6d., the lowest return of all; each being grown on the soil best suited for it.

In growing hardwood trees it is an advantage to allow seedlings and suckers to grow up, as soon as the older trees are sufficiently thinned to admit light and air to them, so that eventually successional crops are maintained to take the place of the matured trees as they are removed for timber.

In conclusion, I have only to add that the sizes of the trees quoted in this essay are in accordance with a long experience and close attention to the subject; and although trees may grow faster in some districts and slower in others, that does not affect the results arrived at, as the ratio of growth in the various species is always in the same proportion.

The following Table shows the comparative growth and value of the different timber trees treated of in this essay, at the ages of 30, 45, and 60 years, with the total value of the crop grown on an acre during the period of 60 years:—

TABLE, showing Comparative Growth in cubic feet and value in money, of an acre of various Timber Trees, at the ages of 30, 45, and 60 years, on soils described in Essay as No. 1, No. 2, No. 3, and No. 4. Fractions of a pound sterling are omitted in the values. By DAVID TAIT, Overseer, Owston Park, Yorkshire.

Names of Trees.	Soils.	Value of Produce before 30 years.	At 30 years old.			At 45 years.	At 60 years old.			Value of Produce since 30 years.	Total Value of Produce of an acre in 60 yrs.
			Volume.	No. of Tree.	Value.	Volume.	Volume.	No of Trees.	Value.		
	No.	£	c. ft.		£	c. ft.	c. ft.		£	£	£
Oak, . . .	1	...	3	600	60	10	20	50	66	230	296
Do., . . .	2	...	2	600	40	8	14	90	63	151	214
Do., . . .	3	...	$1\frac{3}{4}$	600	35	6	11	90	61	109	170
Do., . . .	4	...	3	600	60	9	16	60	74	178	252
Ash, . . .	1	20	4	500	83	10	26	80	156	206	382
Do., . . .	2	25	6	450	135	13	25	50	93	218	336
Do., . . .	3	10	3	550	61	7	12	90	54	110	174
Do., . . .	4	10	4	500	75	9	15	90	84	170	264
Sycamore, .	1	...	5	450	47	15	25	60	150	221	371
Do., . .	3	...	3	500	31	7	15	80	90	73	163
Do., . .	4	...	4	450	37	9	20	80	133	99	232
Poplar, . .	1	...	20	300	100	45	65	50	97	228	325
Do., . .	2	...	13	300	75	32	55	50	103	132	235
Do., . .	3	...	12	300	60	24	40	60	70	84	154
Do., . .	4	...	10	300	50	20	44	50	73	72	145
Birch, . .	1	...	4	680	68	9	16	160	64	108	172
Do., . .	2	...	5	600	75	12	20	150	75	123	198
Do., . .	3	...	3	680	51	7	14	160	56	80	136
Alder, . .	2	...	$4\frac{1}{2}$	680	76	10	16	160	64	115	179
Beech, . .	1	...	4	400	26	10	25	50	52	82	134
Wych Elm, .	1	...	$3\frac{1}{2}$	450	33	8	20	50	41	77	118
English Elm, .	1	...	5	500	41	16	30	60	67	136	203
Spanish Chestnut,	1	...	6	500	75	12	28	50	58	128	186
Scots Fir, . .	1	33	6	680	102	12	26	150	130	150	313
Do., . .	2	24	6	680	68	10	22	150	96	135	255
Do., . .	3	22	5	680	56	9	20	150	87	126	235
Larch, . .	1	18	5	1360	198	10	20	200	166	300	484
Do., . .	3	15	$3\frac{1}{2}$	1360	139	9	12	200	90	196	301
Do., . .	4	18	$4\frac{1}{2}$	1360	178	10	22	200	183	270	471
Spruce, . .	1	...	4	1360	136	9	20	200	100	176	276
Do. . .	2	...	$4\frac{1}{2}$	1360	153	10	22	200	110	182	292
Do., . .	3	...	3	1360	102	8	12	200	60	156	216
Do., . .	4	...	$4\frac{1}{2}$	1360	153	10	20	200	100	187	287
Silver Fir, .	4	...	4	680	68	18	30	150	150	139	289

XXVIII. *The Commercial Aspect of Bark-Peeling.* By A. T. Williamson, Corstorphine.

The altered conditions in the manufacture of leather as now carried on, compared with those of only recent years, have had the effect of putting an altogether different aspect on the question of bark-peeling and preserving for industrial purposes. The prices with which we were familiar in bygone times, as readily obtainable for this commodity, are not likely again to be realised. As is well known, the cause of the greatly reduced price of bark is chiefly owing to the introduction some years ago of foreign substitutes for bark in the manufacture of leather. These are now so largely imported at a paying price, that their use effects a considerable saving to the tanner in the cost of his manufactures. The adoption of those substitutes has necessitated the construction by the tanner of new appliances in his manufactory, altogether unsuited for the application of bark in the preservation of hides. This shuts out to a great extent the possibility of returning to the old methods of tanning, and thereby restricts the consumption of bark. Unless the ingenuity of the inventor, or scientist, can discover some other medium by which its properties can be utilised in the industrial world, this restricted demand is likely to continue.

This revolution in leather manufacture has destroyed the possibilities of the bark of any tree possessing only in a small degree the astringent properties necessary for leather curing, being supplied at a price anything like equivalent to the cost of production. Two varieties, however,—viz., the oak and the larch, possess peculiarly rich astringent properties, and for the manufacture of particular qualities of leather they are still indispensable. The price of these barks, notwithstanding their more limited consumption, has been maintained at a point that leaves reasonable expectation that they may be profitably produced. The object of this paper is to consider fully the cost of production of oak bark, and see if, when thoroughly inquired into, the current prices obtainable yield the lucrative returns which a superficial glance at the subject would lead one to suppose.

In the case of larch bark, it must at once be admitted that although the price is much lower the profit is substantial, as not only are the expenses of peeling and harvesting lighter, but even if the bark was of no value whatever, peeling would be very frequently resorted to for the sake of reducing the weight of the trees, as is done with spruce and other firs whose bark is heavy and useless. This barking process effects such a large reduction in the weight, as to save considerably more in railway carriage, if conveyed any distance, than recuperates the expenses of peeling off the bark, without in any way interfering with, or detracting from, the value of the timber itself.

In regard to the oak, quite a different state of matters have to be dealt with; the quality of the timber is materially affected by the season in which the tree is cut down. This is a point that foresters and landlords frequently lose sight of, and even timber merchants sometimes do not consider it too closely. It is needless to mention that the bark is most valuable at the particular season of the year when it possesses, to their fullest extent, those astringent properties for which it is preserved. This occurs at the time when the inner bark is saturated with sap, which is at the beginning of the yearly formation of new wood, and it is at that season that the bark can be easiest removed from the trunk and branches of the oak. But for many industrial purposes the oak is not well suited when felled at the period when the tree contains the largest quantity of sap. The sapwood of previous years is not yet consolidated into heartwood, and is thus rendered more unfit for seasoning, and exposure to the weather only makes it the more liable to decay. This part of the tree is therefore in a great measure lost, being of no value to the merchant or consumer; whereas, if oak is cut down in mid-winter, the sapwood, being practically free from any fresh sap, is for all ordinary purposes of equal value to the heartwood, and is no more liable to decay. In therefore deciding as to the profitable results of bark peeling, this loss of timber must be taken into consideration. Of course this only applies to matured timber, and in the case of the peeling of oak underwood, or coppice, no account requires to be taken of this item. The question seriously to be considered is whether or not the market price of the bark of the year is equivalent to the expenses of production, adding thereto that proportion of the value of the timber lost by the deterioration of the sapwood.

For the purpose of illustrating this, we may take a hedgerow oak, which yields on an average a ton of bark to 160 cubic feet of wood, or thereby.

The cost of labour in peeling and harvesting is . .	£1	5	0	per ton.
The cost of cartage from the woods to a railway station, including gathering, loading, etc., . . .	0	10	0	,,
Loss on say four months' delay in getting the timber, which, but for the bark, would have been cut down in winter, or four months earlier, . .	0	5	0	,,
Superintendence and extra general expenses of peeling, .	0	1	6	,,
	£2	1	6	,,

These figures, which are an actual outlay, represent a fair average distance from a railway, but they may be somewhat altered favourably or adversely, according to situation. To this sum we may add 10 per cent. for risk in harvesting the bark—a minimum allowance, as it not unfrequently happens that an unfavourable season ruins half of the bark, which brings up the figures to £2, 5s. 6d. per ton.

It is impossible to arrive at an exact estimate of the loss of timber caused by felling the tree at barking time, trees differing considerably, according to circumstances, in the proportion contained in them of sapwood, but when we strike off one-seventh, or 14 per cent., we arrive at a very fair average in the ordinary growth of oak trees. This proportion of wood cannot be altogether reckoned as lost, but for conversion into railway waggon timber, and for all other purposes where timber of the best quality is required, the tree must be altogether relieved of the sapwood. The purposes to which oak containing sapwood may be applied are consequently very limited, but to give a fair allowance we may reckon that 2 per cent. of it may be profitably utilised. This leaves us with a net loss of 12 per cent. on the whole tree, and unfortunately not only has the first cost of this wood been lost, but also all expenses connected with it, including labour, cartage, carriage, etc., fall to be added to the loss. A fair price for the wood is 2s. per cubic foot, 12 per cent. of which is as nearly as possible 3d. per foot. We have, therefore, to debit the peeling process with the deficit on 160 feet to the ton of bark at 3d., amounting to £2, which, with the £2, 5s. 6d. already mentioned as the actual oncost of production, brings the total up to £4, 5s. 6d. per ton. A sum, however, falls to be allowed to the credit of this amount by the saving effected on the cartage and carriage of the oak timber on account of the reduction of its weight by peeling. This allowance cannot be very well computed, as the distance to which oak is conveyed varies to a large extent.

The difference in weight between peeled and unpeeled oak timber is about 16 per cent., and taking at 10s. railway carriage and 5s. cartage rate as being fair mediums for the purpose of calculation, and reckoning 6 tons as the weight of the timber from which a ton of bark has been produced, we have almost 15s. per ton to be deducted from the £4, 5s. 6d. of total cost, or £3, 10s. 6d. per ton of actual net cost of placing heavy oak bark in the market. The vast proportion of oak bark brought into the market is subject to a heavy railway carriage, which on an average may be calculated at 12s. 6d. per ton. The average price for the last year or two for unchopped or whole bark being £5 per ton, leaves £4, 7s. 6d. gross receipt, and less the oncost stated above of £3, 10s. 6d. leaves a net balance of 17s. per ton—a profit that is quite incommensurate with the risk and trouble involved.

The market price of bark allowed for here at £5 per ton is one that has only been reached within a very recent time, but even at this advanced price, when a business calculation is gone into, it is seen that the profit is small, the sum often given by foresters of 50s. per ton, net gain, being delusive in respect to standard oaks.

In returning to the consideration of oak coppice wood as a means of furnishing our supply of bark, we must look in a greater degree to this source in the future. The expense of stripping it is proportionately greater from having to operate on smaller wood; but in dealing with it, the usefulness of the timber for the purposes to which it is put, such as charring, pitwood, and such like, is in no measure deteriorated, although its value for these industrial purposes has reached a point which leaves little or nothing to the producer. The profit derivable from the sale of its bark may be reckoned at fifty shillings per ton, and is sufficiently great to warrant the cultivation of coppice wood solely for the value of the bark, which will yield a good return or rent for the land occupied in its growth. With the decreasing supply of bark from matured timber, resulting from the lowness of price brought about by the restricted demand, thereby encouraging more and more the felling of oak in winter, the attention of foresters and others interested should be directed towards a greater development of oak coppice in districts specially adapted for it. On a closer consideration by foresters and others of the loss involved by the deterioration of the quality of prime oak from being felled in spring to secure the bark, as we have pointed out, the supply from this source will annually be still further restricted, and this circumstance will react in favour of an improved price for the coppice bark, the supply of which it is desirable should be augmented and the production of it encouraged. The prime oak will then be left to hold its own in point of quality, and maintain a successful competition in the timber market against the intense competition it has to stand in the importations from America, Austria, and Russia. The exigencies of the present altered conditions of our industrial trades demand a closer study by foresters in matters of this kind. In their deliberations they must consider the commercial and industrial position in which we are placed, and adapt the science of forestry to current wants, or, in other words, be actuated by the law of supply and demand, present and prospective.

As already pointed out, the position occupied by larch bark as regards price is very unsatisfactory, and, to all appearance, is likely to remain so. In point of fact, it is being continually aggravated by the growing favour which is extended towards the peeled wood by consumers of the smaller sizes of larch trees. It is also much encouraged by timber merchants, seeing that the saving effected in the item of railway carriage affords ample compensation to meet the expenses incurred in the process of peeling, so that the price realisable for the bark, whatever it may be, is in a great measure an item of profit. One effect which this increased production of larch bark may have is that the price reduced to a tempting rate may encourage tanners to again resort to a more extensive use of it, and by discarding the substitutes now in vogue, create a fresh reaction by increasing the consumption, which would enhance considerably the value of the wood to the cultivator. This position can only be attained as the work of time, and certainly no evil can result from overstocking the market with larch bark, and encouraging its extended use by tanners by offering it to them at tempting prices, as a return by them to the old appliances will stimulate a greater permanent demand in the future.

ABSTRACT of ACCOUNTS of the ROYAL SCOTTISH ARBORICULTURAL SOCIETY for YEAR Ending 31st DECEMBER 1889.

CHARGE.

Branch				
	Balance—Cash in hand from last Account,			£5 14 10
I.	Outstanding Subscriptions brought forward from last Account:—			
	Arrears,		£59 7 0	
	Outstanding for year 1888,		78 16 0	
			£138 3 0	
	Less—Written off as irrecoverable, on account of Non-payment, Resignations, want of knowledge of Addresses of Members, and Deaths,		63 12 0	
				74 11 0
II.	Subscriptions due for current year,		£135 4 0	
	Less—Paid in 1888,	£2 16 6		
	Shortpayments on Sums received,	0 2 0		
			2 18 6	
				132 5 6
III.	Sums received for Life Membership,			12 12 0
IV.	Dividend on Bank of Scotland Stock,			12 0 0
V.	Sums received for Advertisements, and Sale of *Transactions*,			14 18 2
VI.	Drawn from Reserve Account,			195 5 0
	Balance—1890 Subscriptions paid in 1889,			3 5 6
				£450 12 0

DISCHARGE.

Branch			
I.	Accounts paid:— Printing, Stationery, Prizes paid in Money, Medals, Advertising, Postages, etc.,		£200 10 9
II.	Salary and Expenses of Secretary and Treasurer,		31 0 0
III.	Repaid Bank Overdraft on Account, with Interest,		78 15 0
	Balance:—		
	Outstanding Arrears,	£49 12 0	
	Current year's Subscriptions unpaid,	61 19 0	
	Balance in Bank,	22 16 0	
	Balance in Treasurer's hands,	5 19 3	
			140 6 3
			£450 12 0

STATE of the FUNDS.

Deposit Receipt, National Bank of Scotland,	£114 3 6
Balance in Bank,	22 16 0
Balance in Treasurer's hands,	5 19 3
	£142 18 9

Edinburgh, 13th *January* 1890.—I have examined the above Statement, and have compared it with the vouchers and other instructions produced to me, and find the Account accurately stated and sufficiently vouched; the balance in hands of the Treasurer is Five pounds nineteen shillings and threepence sterling (£5, 19s. 3d.). The Nett Funds of the Society as at 31st December 1889 amount to One hundred and forty-two pounds eighteen shillings and ninepence sterling.

JOHN ORD MACKENZIE, *Auditor*.

APPENDIX.

Royal Scottish Arboricultural Society.

PATRON—HER MOST GRACIOUS MAJESTY THE QUEEN.

1.—FORMER PRESIDENTS.

YEAR.
1854. JAMES BROWN, Deputy-Surveyor of the Royal Forest of Dean.
1855. Ditto, Wood Commissioner to the Earl of Seafield.
1856. Ditto, ditto.
1857. The Right Hon. THE EARL OF DUCIE.
1858. The Right Hon. THE EARL OF STAIR.
1859. Sir JOHN HALL, Bart., of Dunglass.
1860. His Grace THE DUKE OF ATHOLE.
1861. JOHN J. CHALMERS of Aldbar.
1862. The Right Hon. THE EARL OF AIRLIE.
1863. The Right Hon. T. F. KENNEDY.
1864. ROBERT HUTCHISON of Carlowrie, F.R.S.E.
1865. Ditto, ditto.
1866. Ditto, ditto.
1867. Ditto, ditto.
1868. Ditto, ditto.
1869. Ditto, ditto.
1870. Ditto, ditto.
1871. Ditto, ditto.
1872. HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie.
1873. Ditto, ditto.
1874. JOHN HUTTON BALFOUR, M.D., M.A., F.R.SS.L. & E., Professor of Botany in the University of Edinburgh.
1875. Ditto, ditto.
1876. The Right Hon. W. P. ADAM of Blairadam, M.P.
1877. Ditto, ditto.
1878. Ditto, ditto.
1879. The Most Hon. THE MARQUIS OF LOTHIAN, K.T.
1880. Ditto, ditto.
1881. Ditto, ditto.
1882. ALEXANDER DICKSON, M.D., F.R.S.E., of Hartree, Regius Professor of Botany in the University of Edinburgh.
1883. HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie.
1884. Ditto, ditto.
1885. Ditto, ditto.
1886. Sir HERBERT EUSTACE MAXWELL, Bart., of Monreith, M.P.
1887. Ditto, ditto.
1889. The Right Hon. THE EARL OF HOPETOUN, Hopetoun House, Linlithgow.
1890. His Excellency The Right Hon. THE EARL OF HOPETOUN, Governor of Victoria, Australia.

2.—LIST OF MEMBERS.

Corrected to December 1889.

The Names printed in italics are those of Members whose present Addresses are unknown. Any information regarding these Members will be gladly received by the Secretary.

LAW V. Members in arrear shall not receive the *Transactions* while their Subscriptions remain unpaid. Any Member whose Annual Subscription to the Society remains unpaid for three years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till he shall have paid up his arrears.

Date of Election.

HONORARY MEMBERS.

1873. BRANDIS, Sir Dietrich, K.C S.I., Ph.D., *Ex*-Inspector-General of Forests in India, Bonn, Germany.

1868. BULLEN, Robert, Curator of the Botanic Garden, Glasgow.

1886. CAMPBELL, Sir James, Bart., Whitemead Park, Lydney, Gloucestershire.

1865. CLEGHORN, Hugh, M.D., LL.D., F.R.S.E., Stravithie, St Andrews, Fife (also a *Life* Member by composition).

1886. HOOKER, Sir Joseph D., M.D., K.C.S.I., The Camp, Sunningdale, Berks.

1864. HUTCHISON, Robert, F.R.S.E., of Carlowrie, University Club, Edinburgh.

1886. JACK, Edward, St John, New Brunswick.

1886. JOHORE, The Maharajah of, Johore, Malay Peninsula.

1856. LAWSON, George, LL.D., Ph.D., Secretary for Agriculture, Government of Nova Scotia, Halifax, Nova Scotia.

1869. LOTHIAN, The Most Hon. the Marquis of, K.T., Secretary of State for Scotland, Newbattle Abbey, Dalkeith (also a *Life* Member by composition).

1886. LUBBOCK, Sir John, Bart., M.P., D.C.L., High Elms, Down, Kent.

1854. M'CORQUODALE, William, Forester and Wood Surveyor, Jeanie Bank, Perth (also a *Life* Member by composition).

1886. MICHAEL, General, C.S.I., Ascot.

1889. SARGENT, Professor C. S., Director of the Arnold Arboretum, Harvard College, Brookline, Massachusetts, U.S.A.

1886. SOUTHEY, Hon. Robert, Cape Town.

1889. SCHLICH, Dr William, Professor of Forestry in the Engineering College for India, Cooper's Hill, Surrey.

1881. TEMPLE, Sir Richard, Bart., G.C.S.I., The Nash, Worcestershire.

1886. TOKAI, Tokio, Japan.

Date of Election.

LIFE MEMBERS.

1875. Acland, Sir Thomas Dyke, Bart., M.P., of Killerton, Exeter.
1883. Adam, Sir Charles Elphinstone, Bart. of Blairadam, Kinross-shire.
1874. Addington, The Right Hon. Lord, Addington Manor, Winslow, Bucks.
1883. Alexander, John, Assistant Conservator of Forests, Kandy, Ceylon.
1883. Athole, His Grace the Duke of, K.T., Blair Castle, Blair Athole.
1887. Bailey, Colonel F., India Forest Service, Simla, India.
1884. Balfour of Burleigh, The Right Hon. Lord, Kennet House, Alloa.
1886. Balfour, Edward, of Balbirnie, Markinch, Fife.
1877. Balfour, Isaac Bayley, Sc.D., M.D., F.L.S., Professor of Botany, Edinburgh.
1866. Barrie, James, Forester, Stevenstone, Torrington, North Devon.
1877. Barry, John W., of Fyling Hall, Fylingdales, Scarborough.
1884. Bates, Cadwallader John, of Heddon and Langley Castle, Northumberland.
1871. Bell, William, of Gribdae, Kirkcudbright.
1875. Bertram, William, Ellengowan Villa, Newington, Edinburgh.
1877. Bolckow, C. F. H., of Brackenhoe, Middlesboro'-on-Tees.
1882. Bruce, Hon. Robert Preston, M.P., Broomhall, Dunfermline.
1871. Bruce, Hon. T. C., 24 Hill Street, Berkeley Square, London, W.
1867. Bruce, Thomas Rae, of Slogarie, New Galloway Station.
1879. Buchanan, Charles, Overseer, Penicuik House, Penicuik.
1879. Buccleuch, His Grace the Duke of, K.T., Dalkeith Park, Dalkeith.
1882. Chowler, Christopher, Gamekeeper, Dalkeith Park, Dalkeith.
1877. Clay, J. Spender, Ford Manor, Lingfield, Surrey.
1872. Clerk, Sir George D., Bart., Penicuik House, Penicuik.
1879. Colquhoun, Andrew, Forester, Rossdhu, Luss, Dumbartonshire.
1876. Cowan, Charles W., of Logan House, Valleyfield, Penicuik.
1875. Craig, Wm., M.D., C.M., F.R.S.E., 7 Bruntsfield Place, Edinburgh.
1865. Cross, David G., Forester, Kylisk, Nenagh, Ireland.
1880. Cumberbatch, L. H., Holt Cottage, Brockenhurst, Hants.
1880. Curr, Henry, Factor, Pitkellony House, Muthill, Perthshire.
1884. Currie, Sir Donald, K.C.M.G., M.P., of Garth Castle, Aberfeldy.
1867. Dalgleish, John J., of Ardnamurchan, 8 Athole Crescent, Edinburgh.
1876. Dalgleish, Laurence, of Dalbeath, 8 Athole Crescent, Edinburgh.
1877. Dewar, Daniel, Forester, Beaufort Castle, Beauly.
1871. Duncan, Alexander, of Knossington Grange, Oakham, Leicestershire.
1875. *Duncan, James, late of Benmore.*
1883. Dundas, Charles H., of Dunira, Dalhonzie, Crieff.
1872. Dundas, Robert, of Arniston, Gorebridge.
1867. Dunn, Malcolm, The Palace Gardens, Dalkeith.
1875. Eastwood, James, The Gardens, Bryn-y-Newadd, Bangor, North Wales.
1876. Edwards, William Peacock, S.S.C., 21 Hill Street, Edinburgh.
1881. Elliot, Walter, Manager, Ardtornish, Morvern, Oban.

Date of Election.

1879. Falconer, Dr John, St Ann's, Lasswade.
1888. Ferguson, R. C. Munro, M.P., of Raith and Novar.
1869. Fish, D. T., Hardwick House, Bury St Edmunds.
1874. Fitzwilliam, The Right Hon. the Earl, K.G., Wentworth, Rotherham, Yorkshire.
1885. Fleming, J. B., "Beaconsfield," Kelvinside, Glasgow.
1881. Forbes, Arthur Drummond, Millearne, Auchterarder, Perthshire.
1866. France, Charles S., 11 Bridge Street, Aberdeen.
1856. Gough, William, Wood Manager, Wykeham, York.
1884. Graham, Wm., of Erins, Tarbert, Lochfyne.
1880. Grant, Sir George Macpherson, Bart., M.P., Ballindalloch Castle, Banffshire.
1874. Grant, John, Overseer, Daldowie, Tollcross.
1867. Grimond, Alexander D., of Glenericht, Blairgowrie.
1880. Hare, Colonel, 32 Palmerston Place, Edinburgh.
1874. Herbert, H. A., of Muckross, Killarney.
1884. Heywood, Arthur, Sudbourne Hall, Wickham Market, Suffolk.
1871. Hope, H. W., of Luffness, Drem.
1876. Horne, John, Director, Forests and Gardens, Mauritius.
1876. Horsburgh, John, 131 Princes Street, Edinburgh.
1869. Huth, Louis, of Possingworth, Hawkhurst, Sussex.
1884. Inglis, Alex., Breadalbane Estate Office, Aberfeldy.
1880. Jenner, Charles, Easter Duddingston Lodge, Edinburgh.
1882. Jonas, Henry, Land Agent and Surveyor, 4 Whitehall, London, S.W.
1876. Leicester, The Right Hon. the Earl of, Holkham Hall, Wells, Norfolk.
1868. Leslie, Charles P., of Castle-Leslie, Glasslough, Ireland.
1874. Leslie, The Hon. George Waldegrave, Leslie House, Leslie, Fife.
1883. Loney, Peter, Estate Agent, Marchmont, Duns.
1881. Lonsdale, Claud, Rose Hill, Carlisle.
1880. Love, J. W., St Kilda, Victoria, South Australia.
1875. Lovelace, The Right Hon. the Earl of, East Horsley Towers, Woking, Surrey.
1881. Lumsden, David, of Pitcairnfield, Perth.
1875. Luttrell, George F., of Dunster Castle, Taunton, Somersetshire.
1874. Macdonald, Ranald, Factor, Cluny Castle, Aberdeenshire.
1876. M'Dougall, Captain J. W., jun., of Orchill, Braco, Perthshire.
1884. Macduff, Alex., of Bonhard, Perth.
1868. M'Gregor, John, Forester, Ladywell, Dunkeld, Perthshire.
1879. M'Intosh, Dr W. C., Professor of Natural History, University of St Andrews, 2 Abbotsford Crescent, St Andrews.
1882. M'Kenzie, Alex., Superintendent of Epping Forest, The Warren, Loughton, Essex.
1869. Mackenzie, Colin J., of Portmore, Eddleston, Peebles.
1872. Mackenzie, Donald F., Estate Office, Morton Hall, Edinburgh.
1880. Mackenzie, Sir Kenneth, Bart., Conon House, Dingwall.
1879. M'Laren, John, jun., Pitcullen Terrace, Perth.
1879. MacRitchie, David, C.A., 4 Archibald Place, Edinburgh.
1857. MacTier, A. W., "Rothesay," Bournemouth, Hants.

Date of Election.

1880. Malcolm, Lieut.-Col. E. D., R.E., 18 Queen's Gate Place, London, S.W.

1871. Maxwell, Wellwood H., of Munches, Dalbeattie.

1880. Mesham, Captain, Pontryffydd, Bodvari, Rhyl.

1881. Michie, John, Forester, Balmoral, Ballater.

1858. Minto, The Right Hon. the Earl of, Minto House, Hawick.

1882. Mitchell, Francis, Forester, Warwick Castle, Warwick.

1889. Moffat, James, Assistant Factor, 48 Castle Street, Edinburgh.

1881. Naylor, Christopher John, Brynellywarch, Kerry, Montgomeryshire.

1856. Portsmouth, The Right Hon. the Earl of, Eggesford, North Devon.

1887. Profeit, Dr Alexander, Her Majesty's Commissioner, Balmoral.

1878. Punchard, Frederick, Underley Estate Office, Kirkby Lonsdale, Westmoreland.

1855. Ramsden, Sir John, Bart., 6 Upper Brook Street, London, W.

1876. Ritchie, William, of Middleton, Gorebridge, Edinburgh.

1866. Robertson, James, Wood Manager, Panmure, Carnoustie.

1883. Rollo, The Hon. Wm. Chas. Wordsworth, Master of Rollo, Duncrub Park, Dunning, Perthshire.

1872. Rosebery, The Right Hon. the Earl of, Dalmeny Park, Edinburgh.

1871. Rosslyn, The Right Hon. the Earl of, Dysart House, Fife.

1854. Rutherford, James, Agent, Kirkleatham, Redcar, Yorkshire.

1867. Scott, Daniel, Wood Manager, Darnaway, Forres.

1877. Smith, Thomas Valentine, of Ardtornish, Morvern, Argyleshire.

1882. Smythe, David M., yr. of Methven Castle, Perth.

1883. Sprot, Captain Alexander, of Garnkirk.

1889. Somerville, Dr William, of Corniston, Biggar, B.Sc., F.R.S.E., Lecturer on Forestry in the University of Edinburgh.

1883. Stafford, The Most Hon. the Marquis of, M.P., Dunrobin Castle, Golspie.

1873. Stair, The Right Hon. the Earl of, Lochinch, Castle Kennedy, Wigtownshire.

1883. Stormont, The Right Hon. Viscount, Scone Palace, Perth.

1880. Sutherland, Evan C., of Skibo Castle, Dornoch.

1865. Talbert, Peter, Forester, Glenericht, Blairgowrie.

1877. Terris, James, Factor, Dullomuir, Blairadam, Kinross-shire.

1880. Thomson, Alexander, 35 Chester Street, Edinburgh.

1855. Thomson, John Grant, Wood Manager, Grantown, Strathspey.

1883. Trotter, Colonel H., of Morton Hall, Edinburgh.

1872. Trotter, Colonel, R.A., The Bush, Edinburgh.

1878. Turnbull, John, of Abbey St Bathans, 49 George Square, Edinburgh.

1872. Urquhart, B. C., of Meldrum, Aberdeenshire.

1878. Walker, Major I. Campbell, Conservator of Forests, Forest Office, Madras.

1871. Wemyss, Randolph Gordon Erskine, of Wemyss and Torrie, Fife.

1869. Wild, Albert Edward, Conservator of Forests, Punjab, India.

1889. Wilson, David, jun., of Carbeth, Killearn.

Date of Election.

ORDINARY MEMBERS.

1882. Ahlbottn, Nathaniel, Tree Protective Composition Manufacturer, 50 Shore, Leith.
1881. Airlie, The Right Hon. the Earl of, Cortachy Castle, Forfarshire.
1878. Aitken, Andrew Peebles, M.A., Sc.D., Professor of Chemistry, Veterinary College, Clyde Street, Edinburgh.
1872. Alexander, James, of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1865. Allan, John, Forester, Dalmeny Park, Edinburgh.
1887. Allison, Donald, Assistant Forester, Rosehaugh, Easter Suddie, Ross-shire.
1869. Anderson, Alexander, Forester, St Fort, Newport, Dundee.
1883. Anderson, David, Assistant Forester, Inver, Dunkeld.
1883. Anderson, Hector, Assistant Forester, Ardross, Alness, Ross-shire.
1883. Anderson, James, Forester, Early Wood, Bagshot, Surrey.
1887. Anderson, James, Clerk of Works, Balmoral.
1881. Anderson, Thomas R., Assistant Forester, Idvies, Forfar.
1887. Annand, Adam, Forester, Brucklay Castle, Aberdeenshire.
1887. Annand, John F., Assistant Forester, Brucklay Castle, Aberdeenshire.
1872. Annandale, Robert B., Adderley Lodge, Market Drayton, Shropshire.
1883. Argyll, His Grace the Duke of, K.T., LL.D., D.C.L., F.R.S., F.G.S., Inverary Castle, Argyleshire.
1860. Austin & M'Aslan, Nurserymen, Buchanan Street, Glasgow.

1880. Balden, John, Dilston, Corbridge-on-Tyne, Northumberland.
1880. Balden, John, jun., Corbridge-on-Tyne, Northumberland.
1880. Balden, Robert S., Wood Manager, Castle Howard, York.
1886. Balfour, John, of Balbirnie, Markinch, Fife.
1889. Balfour, John, Gardener, Stravithie, St Andrews.
1877. Barclay, David, Forester, Blackhouse Cottage, *via* Greenock.
1888. Barlass, James, Ironmonger, High Street, Perth.
1884. Barrett, Robert B., Agent, Skipton Castle, Skipton, Yorkshire.
1867. Barrie, David, Forester, Comlongan Castle, Annan.
1882. Barrie, John, Land Steward, Gateforth Hall, Selby, Yorkshire.
1889. Barron, John, Elvaston Nurseries, Borrowash, near Derby.
1886. Barron, James, The Gardens, Meldrum House, Aberdeen.
1874. Barton, James, Forester, Hatfield House, Herts.
1871. Baxter, Robert, Forester, Dalkeith Park, Dalkeith.
1883. Bell, Andrew, Forester, Broomhall, Charlestown, Fife.
1866. Bell, James, The Gardens, Stratfieldsaye, Winchfield, Hants.
1887. Best, Andrew, Assistant Forester, Frystone Hall, Ferrybridge, Yorks.
1889. Berry, Frank, Assistant Forester, Brucklay Castle, Aberdeenshire.
1869. Bissett, William S., Overseer, Moncrieffe House, Perth.
1889. Blair, Peter, Gardener, Trentham, Stoke-on-Trent.
1883. Blake, Jas., Forester, Morton Hall, Edinburgh.
1854. Boa, Andrew, Land Steward, Dalton House, Newcastle-on-Tyne.
1872. Boa, Andrew, jun., Sub-Agent, Great Thurlow, Newmarket, Suffolk.
1876. Booth, John, of Flottbeck Nurseries, Hamburg.

Date of Election.

1857. Borthwick, William, Forester, Dunnichen, Forfar.
1882. Boss, John, Jun., Assistant Forester, Hopetoun, South Queensferry.
1887. Boulger, Professor, 18 Ladbroke Grove, London.
1883. Boyd, John, Forester, Cumbernauld, Dumbartonshire.
1889. Britton, Horatio A., Timber Valuer, 6 Birch Street, Wolverhampton.
1860. Brodie, James, Land Steward, Glasslough, Armagh, Ireland.
1880. Brodie, Thomas D., W.S., 5 Thistle Street, Edinburgh.
1881. Brodie, Vernon Alex., Civil Service, Madras.
1886. Brown, Alexander, Nurseryman, Millport, Bute.
1878. Brown, J. A. Harvie, of Quarter, Dunipace House, Larbert.
1868. Brown, John E., F.L.S., Conservator of Forests, Forest Board Office, Adelaide, South Australia.
1887. Brown, J. R., Wentworth Nurseries, Hexham.
1889. Brown, P. S., Tayview, Broughty Ferry.
1884. Brown, Thomas, Forester, Craigingillan, Dalmellington.
1883. Browning, John M., The Gardens, Dupplin Castle, Perth.
1885. Bruce, Thomas, Assistant Forester, Cross Roads, Kinnell, Friockheim.
1873. Brydon, John, Forester, Rothes, Elgin.
1873. Buchan, Alexander, A.M., F.R.S.E., Secretary of the Scottish Meteorological Society, 72 Northumberland Street, Edinburgh.
1880. Buddicom, W. B., Penbedw, Mold, Flintshire.
1884. Burrows, Alfred J., F.S.I., F.L.S., Land Steward, Pluckley, Kent.

1887. Cadell, George, 14 Canning Road, Addiscombe, Surrey.
1870. Cameron, Alexander, Forester, Countlich Lodge, Ballinluig, Perthshire.
1866. Cameron, Robert, Forester, Pale, Corwen, North Wales.
1889. Campbell, Colin, Agent, Bretby Park, Burton-on-Trent.
1865. Campbell, James, of Tillichewan Castle, Dumbartonshire.
1883. Campbell, John Macnaught, Assistant Curator, City Museum, Kelvingrove Park, Glasgow.
1878. Cantley, N., Superintendent, Botanical Gardens, Singapore.
1867. Chirnside, Francis, Forester, Ladykirk, Berwickshire.
1884. Christie, Alex. D., The Gardens, Ragley, Alcester, Warwickshire.
1883. Christie, William, Nurseryman, Fochabers.
1871. Churnside, Robert, Forester, Edlingham, Alnwick.
1887. Clark, Alexander, 226 High Street, Linlithgow.
1872. Clark, David, Forester, Elie House, Elie, Fife.
1866. Clark, James, Forester, Balvaird Cottage, Strathmiglo, Fife.
1882. Collins, Robt. T., Forester, Trentham, Stoke-on-Trent, Staffordshire.
1887. Cook, Alfred, Assistant Forester, Sandycove Lodge, Husborne Crawley, Woburn, Beds.
1887. Cook, James, Land Steward, Arniston, Gorebridge.
1876. Coupar, George, 24 St Andrew Square, Edinburgh.
1879. Coupar, Robert, Forester, Ashford, Cong, County Galway.
1858. Cowan, James, Forester, Bridgend, Islay.
1872. Cowie, John, Assistant Forester, Mountstuart, Rothesay.
1874. Cowper, R. W., Assistant Agent, 81 High Street, Sittingbourne.
1875. Crabbe, David, Forester, Cortachy Castle, Kirriemuir.
1867. Crabbe, James, Forester, Glamis Castle, Forfarshire.

Date of Election.

1876. Cromb, James, Assistant Forester, Kelly Castle, Arbirlot, Arbroath.
1887. Cumming, Allan, Forester, Willdeans, Kennoway, Fife.
1883. Cunningham, Alex., Assistant Forester, Lilleshall, Newport, Salop.
1881. Cunninghame, J. C., of Craigends, Johnstone, Renfrewshire.
1868. Cunningham, John, Forester, Ardross, Alness, Ross-shire.
1880. Curr, James, Kindar Lodge, Dumfries.
1885. Curtis, Charles, Assistant Superintendent of Forests, Penang.

1884. Dalziel, James, Forester, Culzean Castle, Maybole, Ayrshire.
1869. Daniels, Peter, Forester, Slindon Hall, Arundel, Sussex.
1884. Davidson, Alex., Assistant Forester, Durris, Aberdeen.
1874. Davidson, George, Land Steward, Walton, Linlithgow.
1883. *Davidson, James, Assistant Forester, Cavers, Hawick.*
1865. Davidson, John, Agent, Greenwich Hospital Estates, Haydon Bridge, Northumberland.
1857. Davidson, John, Forester, Aldbar, Brechin.
1884. Deane-Drake, Joseph Edward, Stokestown House, New Ross, Ireland.
1883. Denne, John L., Jun., Greenstreet, Sittingbourne, Kent.
1882. Dick, Archd., Assistant Forester, Hopetoun, South Queensferry.
1884. *Dickson, A., Steward, Baron's Court, Tyrone, Ireland.*
1868. *Dodds, George, Overseer, Rotherham Woods, Rotherham.*
1877. *Doig, Charles, Overseer, Glen Tulchan, Methven, Perth.*
1887. Douglas, Robert, 64 Princes Street, Edinburgh.
1882. Douglas, Captain Palmer, of Cavers, Hawick.
1884. Doughty, Wm., Forester, Langholm Estate, Canonbie, Dumfriesshire.
1889. Don, John, Seedsman, Chapel Bar, Nottingham.
1867. Dow, Thomas, Forester, Bretby, Burton-on-Trent.
1889. Drummond, Robert, Road Surveyor, Midcalder.
1862. Drummond & Sons, William, Nurserymen, Stirling.
1866. Duff, James, Factor, Blackwood, Lesmahagow.
1868. Duff, James, Freeland, Forgandenny, Perthshire.
1884. Dunphy, Edward, Timber Merchant, Inistiogue, Kilkenny.
1875. Duncan, James, Land Steward, Glack, Old Meldrum.
1889. Duncan, J. W., Somerville Place, Broughty Ferry.
1885. Dunn, David, Superintendent, Queen's Park, Heywood, Manchester.
1873. Durward, Robert, Manager, Blelack, Dinnet, Aberdeenshire.

1885. Eddington, Francis, Forester, Windlestone, Ferryhill, County Durham.
1884. *Eden, Henley, Agent to His Grace the Duke of Somerset, Bradley Estate Office, Maiden Bradley, Bath.*
1882. *Elder, Wm., Forester,* 40 *Susannah Street, Alexandria, Dumbartonshire.*
1887. Erskine, William, of Oaklands, Trinity.
1873. Ewing, David, Forester, Strichen House, Aberdeen.

1884. Farquharson, George, Assistant Forester, Durris, Aberdeen.
1887. Ferguson, Robert, Nurseryman, 6 St Andrew Street, Edinburgh.
1880. Fergusson, Sir James Ranken, Bart., Spitalhaugh, West Linton.
1884. *Ferguson, Wm. Hooker, Knowefield Nurseries, Carlisle.*
1872. Fingland, John, Forester, Drumlanrig, Thornhill, Drumfriesshire.

Date of Election.

1883. Finlayson, Robert, Assistant Forester, Hopetoun, South Queensferry.
1869. Fisher, William, Estate Agent, Wentworth Castle, Barnsley, Yorkshire.
1884. Fleming, John, Camperdown Saw-Mills, Dundee.
1884. Forbes, Alex. J., Marybank School, Muir of Ord.
1884. Forbes, John, Buccleuch Nurseries, Hawick.
1878. Forbes, Robert, Overseer, Clova, Lumsden, Aberdeenshire.
1869. Forgan, James, Gardener and Overseer, Bonskeid, Pitlochrie.
1884. Forrest, Thomas, Assistant Forester, Allanton House, Newmains.
1883. Forrest, Sir William J., Bart. of Comiston, Edinburgh.
1889. Forster, William A., Forester, Belgrave Lodge, Eaton, Chester.
1878. Forsythe, John M., Wood Manager, Woburn, Bedfordshire.
1884. Foulis, Thomas, Publisher, 9 South Castle Street, Edinburgh.
1876. *Fraser, Donald, Forester, Poole, South Milford, Yorkshire.*
1883. Fraser, Frank, Gardener, Tillery, Aberdeen.
1857. Fraser, P. Neill, of Rockville, Murrayfield, Edinburgh.
1868. Fraser, Simon, Forester, Haddo House, Aberdeenshire.

1878. Galletly, James, Overseer, Bonhard, Perth.
1874. Galloway, George, Estate Offices, Woodhouses, Whitchurch, Salop.
1854. Gardiner, Robert, Agent, Birchgrove, Crosswood, Aberystwith.
1885. Gibb, James, Assistant Forester, Kinnaird Castle, Brechin.
1870. Gilbert, James, Forester, Gallovie, Kingussie.
1887. Gilbert, W. Matthews, The *Scotsman* Office, Edinburgh.
1881. Gilchrist, William, Forester, Leuchars, Elgin.
1876. Gillanders, Alex. T., Forester, High Leigh Hall, Knutsford, Cheshire.
1876. Glassbrook, Geo., Bailiff, Remenham Farm, Henley-on-Thames, Bucks.
1880. Glen, David A., Assistant Forester, Gartshore, Kirkintilloch.
1887. Gomersall, Edward, Forester, Moor Crichel, Wimborne, Dorset.
1868. Gossip, James, of Howden & Co., The Nurseries, Inverness.
1875. Gow, Peter, Overseer, Laggan, Ballantrae, Ayrshire.
1882. Gow, Robt., Assistant Forester, Raith, Kirkcaldy, Fifeshire.
1887. Grant, Alexander, Assistant Forester, Balmoral.
1882. Grant, Alex. M'D., Assistant Forester, Newton, Winchburgh.
1867. Grant, Donald, Forester, Drumin, Ballindalloch.
1876. Grant, David, Forester, Dalvey, Forres.
1873. Grant, James, Forester, Heath, Chesterfield.
1878. Grant, James, Assistant Forester, Drumpellier, Coatbridge.
1872. Green, Alex., Overseer, Allanton House, Newmains, Lanarkshire.
1883. Green, Arthur A., 20 Annandale Street, Edinburgh.
1872. Greive, James, Messrs Dicksons & Co.'s Nurseries, Pilrig, Edinburgh.
1888. Grieve, James, Waterloo Hotel, Edinburgh.

1879. Haddington, the Right Hon. the Earl of, Tyninghame, Prestonkirk.
1880. Haddon, Walter, Solicitor, Royal Bank, Hawick.
1881. Hadfield, Gordon, Forest Department, Madras.
1882. Hamilton, Donald C., Assistant Forester, Warkton, Kettering, Northamptonshire.
1873. Hamilton, John B. Baillie, of Arnprior, Cambusmore, Callander.
1889. Hankins, Charles, Forester, Empingham, Stamford.

Date of Election.

1887. Hansen, Professor Carl, Royal Agricultural College, Copenhagen.
1872. Hartland, Richard, The Lough Nurseries, Cork.
1888. Harwell, John Hood, Overseer, Whitemoss, Kirknewton.
1880. Havelock, W. B., Forester, Duncombe Park, Helmsley, York.
1889. Hayes, John, Overseer, Dormont, Lockerbie.
1869. Hayman, John, Overseer, Dumfries House, Cumnock.
1866. Henderson, Arch., Forester, Clonad Cottage, Tullamore, King's County.
1871. Henderson, John, Overseer, Vogrie, Ford, Dalkeith.
1883. Henderson, W., The Gardens, Balbirnie, Markinch.
1878. Henry, Kennedy, Forester, Craighall, Rattray, Blairgowrie.
1871. Hetherton, Walter, Forester, Merton, Beaford, Devon.
1886. Hodson, Richard Edmund, Hollybrooke, Bray, Co. Wicklow, Ireland.
1866. Hogarth, James, Forester, Culhorn, Stranraer.
1884. Hogg, Andrew, Assistant Forester, Crofts of Clova, Lumsden, Aberdeen.
1887. Holmes, Joseph, The Gardens, Winton Castle, Pencaitland.
1874. Home, Edward, Assistant Forester, Edington, Chirnside.
1872. Home, George, Forester, Branxholme, by Hawick.
1882. Hood, James, Assistant Forester, Freeland, Forgandenny, Perth.
1880. Hopetoun, His Excellency The Right Hon. the Earl of, *President of the Society*, Governor of Victoria, Australia.
1876. Hull, Frank, Forester, Lilleshall, Newport, Salop.
1878. Hunter, James, Assistant Forester, Dalmeny Park, Edinburgh.
1884. Hunter, Wm., Forester, Drummond Castle, Muthill, Perthshire.
1881. *Hutton, James, Forester, Glenormiston, Innerleithen, Peebles.*

1884. Innes, Richard S., Upholsterer, 77 South Bridge, Edinburgh.
1870. Ireland & Thomson, Nurserymen and Seedsmen, 81 Princes Street, Edinburgh.
1886. Irvine, Daniel, Overseer, Fincastle, Pitlochrie.

1887. Jack, Donald, Assistant Forester, Rosehaugh Mains, Avoch, Inverness.
1875. Jackson, Magnus, *Photographer to the Society*, Princes Street, Perth.
1880. Jackson, Thomas, Princes Street, Perth.
1883. Johnston, Robert, Forester, Somerley, Ringwood, Hants.
1870. Johnston, William, Forester, The Lee, Lanark.
1878. Johnstone, Adam, Forester, Coollattin, Shillelagh, County Wicklow.
1882. Johnstone, Wm., Forester, Munches, Dalbeattie.
1888. Jones, James, Wood Merchant, Larbert.

1867. Kay, James, Wood Manager, Bute Estate, Rothesay.
1880. Keay, Robert B., Findon Estates Office, Conon Bridge.
1870. Keir, David, Forester, Blair Athole, Perthshire.
1876. Kelman, John, Forester, Glenkindie, Aberdeen.
1882. Kennedy, John, Forester, Flakebridge, Appleby, Westmoreland.
1882. Kennedy, Walter, Forester, Achany, Inveran, Sutherlandshire.
1872. Kennedy, William, Overseer, Glen Carradale, Greenock.
1887. Ker, R. D., Writer to the Signet, 50 George Street, Edinburgh.
1870. Kidd, James B., Forester, The Poles, Dornoch.
1879. Kincairney, The Hon. Lord, 6 Heriot Row, Edinburgh.

Date of Election.

1866. Kinghorn, Adam, Forester, Rochsoles, Airdrie.
1883. Kinnear, Alex., Forester, Galloway House, Garlieston.
1878. Knight, Henry, Royal Gardens, Laeken, Brussels, Belgium.
1884. Knox, Henry, Forester, Brae Lodge, Maybole, Ayrshire.
1884. Kyrke, Arthur Venables, Chard, Somersetshire.
1876. Kyrke, R. V., of Penywern, Mold.

1886. Laidlaw, William, Forester, Fasque, Lettercairn.
1885. Laird, James W., Nurseryman, 73 Nethergate, Dundee.
1881. Laird, William, Forester, Durris, Aberdeen.
1858. Lamont, John, Nurseryman, The Glen, Musselburgh.
1873. Lauriston, Alexander, Woodman, Gorse Farm, Rufford, Ollerton, Notts.
1874. Leigh, William, of Woodchester Park, Stonehouse, Gloucestershire.
1880. Leishman, John, Manager, Cavers Estate, Hawick.
1879. Lindsay, Robert, Curator, Royal Botanic Garden, Edinburgh.
1884. *Lindsay, Wm., Assistant Forester, Jardine Hall, Lockerbie.*
1883. Little, William, Côte, St Antoine, Montreal, Canada.
1883. Loch, Sir Henry B., K.C.B., Governor of Cape Colony, South Africa.
1881. Low, Joseph, Forester, Winterwell Thurlbear, Taunton, Somersetshire.

1876. Macbean, John, Forester, Whin Park, Muirtown, Inverness.
1872. M'Coll, James M., Factor, Craignish Castle, Lochgilphead, Argyleshire.
1870. M'Corquodale, D. A., Bank of Scotland, Carnoustie.
1855. M'Corquodale, Donald, Forester, Dunrobin Castle, Golspie.
1887. M'Culloch, James, Forester, Gala House, Galashiels.
1869. M'Cutcheon, Robert, Forester, Whittinghame, Prestonkirk.
1878. *Macdonald, Duncan, Steward and Forester, Clandeboye, County Down, Ireland.*
1887. M'Dougall, Adam, Assistant Forester, Kilcoy, Munlochy, Ross-shire.
1879. M'Dougall, Alex., Forester, Drumbuie Lodge, Dunkeld.
1889. M'Dougall, Alexander, Cumbernauld Estate, Glasgow.
1886. M'Dowall, Thomas, Assistant Forester, Ardgowan, Greenock.
1882. M'Farlane, John, Forester, Tarbet, Loch Lomond.
1886. *M'Farlane, Walter, Assistant Gardener, Morton Hall, Edinburgh.*
1889. M'Gibbon, Adam, Forester, Minard, Inveraray.
1871. M'Grath, Patrick, Forester, Galtee Castle, Mitchelstown, Tipperary.
1886. MacGregor, Alex., Assistant Forester, Cross Roads, Aylesbury.
1878. M'Gregor, Duncan, Forester, Camperdown, Dundee.
1882. *MacGregor, James G., Assistant Forester, Cally Mains, Gatehouse.*
1880. M'Intosh, A. G., Forester, Brocklesby Park, Ulceby, Lincolnshire.
1885. MacIntosh, William, 5 Thistle Street, Edinburgh.
1883. *M'Intyre, Alex., Assistant Forester, Craigengillan, Dalmellington, Ayrshire.*
1882. M'Intyre, John, Wood Merchant, Cardross, Dumbartonshire.
1884. M'Kay, James, Forester, Breadalbane Estates, Killin.
1875. Mackay, John, Lauderdale Estate Office, Wyndhead, Lauder.
1887. Mackay, Peter, Assistant Forester, Scone, Perth.

Date of Election.

1867. Mackenzie, Alex., Warriston Nursery, Inverleith Row, Edinburgh.
1887. Mackenzie, Daniel, Assistant Forester, Raith, Kirkcaldy.
1882. Mackenzie, Sir Alex. Muir, Bart. of Delvine, Dunkeld.
1867. Mackenzie, John Ord, of Dolphinton, W.S., 9 Hill Street, Edinburgh—*Auditor.*
1880. *Mackenzie, Major, of Findon, Mount Gerald, Dingwall.*
1882. Mackie, James H. J., Land Steward, Invermay, Dunning, Perthshire.
1877. M'Kinnon, Alexander, The Gardens, Scone Palace, Perth.
1883. M'Kinnon, George, The Gardens, Melville Castle, Lasswade.
1878. Mackintosh, The, of Mackintosh, Moy Hall, Inverness.
1879. M'Laren, Charles, Land Steward, Cally Lodge, Dunkeld.
1854. M'Laren, John, Inspector and Valuer of Woods, Hawthornvale, Winchburgh.
1878. M'Laren, John T., Overseer, Kennet, Alloa.
1867. M'Lean, Andrew, Forester, Rutherford, Roxburgh.
1866. M'Lean, William, Forester, Eglinton Castle, Irvine.
1865. M'Lellan, Duncan, Superintendent of Parks, 7 Kelvingrove Terrace, Glasgow.
1882. M'Lellan, Robt., 5 Dowan Vale Terrace, Partick.
1874. M'Leod, Angus A., Superintendent of City Gardens, 14 Royal Exchange, Edinburgh.
1883. M'Leod, John, of Dickson & Turnbull, 26 George Street, Perth.
1885. M'Nicoll, Douglas, Estate Office, Mostyn, Holywell.
1884. Main, Adam, Assistant Forester, Cluny Castle, Aberdeen.
1876. Martin, James, Forester, Stoneleigh, Kenilworth, Warwickshire.
1884. Massie, William H., of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1885. Maxtone, John, Forester, Roseneath, Argyleshire.
1886. Maxwell, Sir Herbert E., Bart., of Monreith, M.P., Wigtownshire.
1879. Meikle, R. A., Agent for Lord Alington, Moor Crichel, Dorsetshire.
1889. Melville, The Right Hon. Viscount, Melville Castle, Lasswade.
1873. Menzies, George, Agent, Trentham, Stoke-on-Trent.
1863. Methven, John, of Thomas Methven & Sons, Leith Walk Nurseries, Edinburgh.
1863. Methven, Henry, of Thomas Methven & Sons, 15 Princes Street, Edinburgh.
1865. Michie, Christopher Young, Forester, Cullen House, Banffshire.
1886. Miller, John J. W., Agent for the Marquis of Salisbury, Hatfield, Herts.
1889. Millar, William, Gardener and Assistant Agent, Coombe Abbey, Coventry.
1882. Milne, Alexander, of James Dickson & Sons, 32 Hanover Street, Edinburgh.
1883. Milroy, Alex., Forester, Glencorse, Edinburgh.
1884. Mitchell, David, Assistant Forester, Durris, Aberdeen.
1869. Mitchell, James, Aldie Castle, Kinross.
1886. Mitchell, James, Assistant Forester, Durris Estate, Aberdeen.
1876. Mitchell, John, Forester, Bolton Abbey, Skipton, Yorks.
1889. Mitchell, William, Brantinghampthorpe, Brough, Hull.
1876. Morgan, George, Wood Merchant, Turret Bank, Crieff.

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1877. MORRISON, Alexander, Nurseryman, Elgin.
1862. MORRISON, John, Coney Park Nursery, Stirling.
1884. MORSHEAD, Frank U. A., Salcombe Regis, Sidmouth, Devonshire.
1866. MUIRHEAD, John, Forester, Bicton, Budleigh Salterton, Devonshire.
1876. MUNRO, Hugh, Forester, Holkham Hall, Norfolk.
1883. MURDOCH, James Barclay, Barclay, Langside, Glasgow.
1883. MURRAY, John, Assistant Forester, Murthly Castle, Perthshire.
1871. MYLES, James, Forester, Kinnaird Castle, Brechin.

1885. NEWBIGGING, John W., Nurseryman, Dumfries.
1869. NICOL, W. R., Forester, Kilkerran, Maybole.

1882. OLIVER, George, Assistant Forester, Snettisham, Kings Lynn.

1875. PAGE, Andrew Duncan, Land Steward, Culzean, Maybole.
1857. PALMER & SON, John, Nurserymen, Annan.
1886. *Park, Alexander, Factor, Gartshore, Kirkintilloch.*
1857. PARKER, James, Forester, Belvoir Castle, Grantham.
1885. *Paterson, A. T., Steward, New Hall, Salisbury.*
1889. PATTERSON, Colin M., Sub-Agent, Newbattle Park, Dalkeith.
1879. PATON, Hugh, Nurseryman, Kilmarnock.
1887. PAXTON, Thomas A., Forester, Newbattle, Dalkeith.
1869. PEEBLES, Andrew, Estate Office, Albury, Guildford, Surrey.
1871. PENDREIGH, John, Assistant Forester, Port Bannatyne, Rothesay.
1882. PHILIP, Robt., Assistant Forester, Longleat, Horningsham, Wilts.
1882. *Phillips, Alex., Assistant Forester, Balquhatson, Slamannan.*
1878. *Pitcaithley, Alexander, Forester, Glentruim, Kingussie.*
1874. PLATT, Colonel Henry, Gorddinag, Langairfechan, near Bangor.
1888. PRATER, T. Herbert, Canford Estate Office, Wimborne, Dorset.
1883. PRESTON, Wm. M., Vaynol Park, Bangor, Wales.

1876. RAE, William Alexander, 52 St Swithin Street, Aberdeen.
1888. Ralston, James, Forester, Castlecary, Glasgow.
1886. RAMAGE, J. L., Assistant Forester, Armsheugh, Grougar, Galston.
1870. RATTRAY, Thos., Forester, Westonbirt House, Tetbury, Gloucestershire.
1881. RIACH, John, Assistant Forester, Rosehaugh, Avoch, Ross-shire.
1873. RICHARDSON, Adam, Royal Botanic Garden, Edinburgh.
1877. RIDER, William H., 14 Bartholomew Close, London, E.C.
1876. RITCHIE, Alexander, Assistant Forester, Logiealmond, Perth.
1884. ROBERTSON, A. B., Moncrieffe House, Bridge of Earn.
1879. ROBERTSON, Donald, Forester, Novar, Evanton, Ross-shire.
1882. ROBERTSON, James, Assistant Forester, Baldornoch, Blairgowrie.
1883. ROBERTSON, William, Assistant Forester, Murthly Castle, Perthshire.
1887. ROBERTSON, William, Assistant Forester, Scone, Perth.
1883. *Robertson, W. H., Forester, Loughcrew, Oldcastle, Co. Meath.*
1888. ROBSON, John, Assistant Forester, Lintmill, Cullen, Banffshire.
1887. ROSS, John, Forester, Hopetoun, South Queensferry.
1867. RUSSELL, John, Manager, Craigie House, Ayr.
1872. RUST, Joseph, The Gardens, Eridge Castle, Tunbridge Wells, Kent.
1870. RUTHERFORD, John, Forester, Linthaugh, Jedburgh.

Date of Election.

1858. Sandbach, Henry R., Hafodunos, Abergele.
1875. Sang, Edmund, of E. Sang & Sons, Nurserymen, Kirkcaldy.
1871. Scarth, T. W., Land Agent, Raby Castle, Staindrop, Darlington.
1870. Scott, Adam, Forester, Southwick Park, Fareham, Hants.
1883. Scott, D. P., Hilltown Branch National Bank of Scotland, Dundee.
1881. Scott, James, Forester, Woollaton Hall, Notts.
1880. Scott, John T., Commission Agent, Orrell, near Wigan.
1883. Scott, William, Assistant Forester, Blairhill, Dollar.
1870. Shanks, John, Forester, Kildrummy Castle, Mossat, Aberdeenshire.
1881. Sherrit, James, Jun., Assistant Forester, Idvies, Forfar.
1887. Simpson, Anthony, Assistant Forester, Alloa Park, Alloa.
1882. Sinclair, Peter, Wood Merchant, Perth.
1889. Sinfield, George, Assistant Forester, Witch Wood Lodge, Staple Fitzpaine, Taunton.
1869. Sinton, James, Forester, Stourhead Estate, Stourton, Bath.
1868. Slater, Andrew, Overseer, Haystoun, Peebles.
1880. Smith, David, Forester, Woodend, Rosslyn.
1886. Smith, George, Assistant Forester, Durris Estate, Aberdeen.
1873. Smith, G. B., Wire Fence Manufacturer, 61 West Regent St., Glasgow.
1871. Smith, James, The Gardens, Mentmore, Leighton-Buzzard, Bucks.
1883. Smith, James, The Gardens, Hopetoun, South Queensferry.
1886. Smith, John, Surveyor, Romsey, Hampshire.
1870. Smith, Thomas, Nurseryman, Stranraer.
1883. Smith, William, Chemist, Stockbridge, Edinburgh.
1885. Spiers, David, Overseer, Mugdrum, Newburgh, Fife.
1882. Stalker, Donald, Forester, Murthly Castle, Perthshire.
1886. Stead, F. W., of Ballindean, Villa Hortense, Worthing, Sussex.
1870. Stewart, John, Overseer, Abington, Lanarkshire.
1882. Stewart, John, 13 Burrell Square, Crieff.
1875. Stewart, J. M., Cherry Tree Cottage, Nusworth, Whitefield, near Manchester.
1876. Stewart, Robert, Forester, Stonefield, Tarbert, Lochfyne, N.B.
1876. Stirling, John, Forester, Largie Castle, Tayinloan, Kintyre.
1889. Storie, Robert, 92 High Street, Dalkeith.
1887. Strang, Peter, Forester, Donibristle, Aberdour, Fife.
1876. Stuart, Charles, Forester, Glenmoriston, Inverness.
1878. Sturrock, William, Assistant Forester, The Nurseries, Lanark.
1883. Sturt, W. Neville, Union Club, London.
1872. Swan, R. G., Auctioneer, Duns.
1873. Swinton, A. Campbell, LL.D., F.R.S.E., of Kimmerghame, Duns.
1869. Symon, John, Forester, Cawdor Castle, Nairn.

1869. Tait, David, Overseer, Owston Park, Doncaster, Yorkshire.
1887. Taylor, Andrew, 11 Lutton Place, Edinburgh.
1882. Taylor, William, Assistant Forester, Dupplin Castle, Perthshire.
1889. Taylor, William Fletcher, Knowefield Nurseries, Carlisle.
1869. Thomson, Lockhart, S.S.C., 114 George Street, Edinburgh.
1871. Tomlinson, Wilson, Forester, Clumber Park, Worksop, Notts.
1882 Turnbull, John, Overseer, Brayton Hall, Carlisle.

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1882. Ulyatt, Thomas, Assistant Forester, Rufford, Ollerton, Newark, Notts.
1883. Underwood, Henry E., Sub-Agent, Fornham, St Genevieve, Bury St Edmunds, Suffolk.

1888. Vincent, Frederick D'A., 8 Ebury Street, London.

1870. Wall, G. Young, Land Agent, Grange House, Darlington.
1871. Watson, John, Gardener, Upper Largo, Fife.
1879. Watson, John, of Earnock, Hamilton.
1872. Watt, James, J.P., of Little & Ballantyne, Nurserymen, Carlisle.
1889. Watters, Dennis, Forester, Wester Elchies, Carron, Strathspey.
1887. Waugh, Thomas, Dalkeith Gardens, Dalkeith.
1874. Webster, Angus D., Overseer, Holwood Park, Kent.
1866. Welsh, William M., of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1880. Westwood, Wm., Manager, Belladrum, Beauly.
1883. Whitton, Peter, The Gardens, Methven Castle, Perth.
1884. Whitton, James, The Gardens, Glamis Castle, Glamis.
1883. Wilkie, Charles, Assistant Forester, Lennoxlove, Haddington.
1875. Wilkie, Thos., 25 Bennerly Road, Wandsworth, London.
1882. Williamson, A., Wood Manager, Eridge Castle, Tunbridge Wells, Kent.
1889. Williamson, A. T., *Timber Trades Journal*, Corstorphine.
1887. Wilson, George, Assistant Forester, Scone, Perth.
1872. Wilson, John, Forester, Sudbourne Hall, Wickham Market, Suffolk.
1883. Winning, John G., Estate Office, Branxholm, Hawick.
1868. Wyllie, George, Ballogie, Aboyne, Aberdeenshire.

1875. Young, William, Forester, Morriston Cottage, Earlston, Berwickshire.

ADVERTISEMENTS.