

FORESTRY COMMISSION.

SECOND ANNUAL REPORT

OF THE

FORESTRY COMMISSIONERS.

Year ending September 30th, 1921

(Presented pursuant to Act 9 & 10 Geo. V., c. 58, s. 8(4).)

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NOTE BY THE COMMISSIONERS.

The Commissioners regret the delay in the presentation of their Second Annual Report. At the time when the Report was due to be prepared the whole future of State forestry was in the melting pot and they were engaged in presenting afresh the national need for a forest policy. In the circumstances they felt it less urgent to report progress than to ensure that there should be progress to report.

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FOREST POLICY.

The immediate and ultimate objectives of the forest policy on which the Commissioners are working were explained on pages 13-29 of the First Annual Report. The immediate objectives were summarised as follows :—

1. The afforestation of 150,000 acres of new land by direct action of the State.
2. Assistance to Local Authorities and private owners for the afforestation or re-afforestation of 110,000 acres
3. The purchase and reconstruction of hardwood areas.
4. Education of forest officers, landowners and land agents, working foresters and foremen.
5. Research and experiment.
6. Encouragement of forest industries.

For the above purposes a fund of £3,500,000 has been voted by Parliament. This fund has also to bear the establishment as well as all incidental charges of the Forestry Commission.

FINANCE.—Owing to financial stringency the grant for the financial year 1920-21 was reduced to £200,000. In view of the carry over of £383,371 from the preceding year and alterations in procedure which are referred to later, this sum was sufficient for the purposes of the Commission.

LAND ACQUISITION.—In order to reduce current expenditure to a minimum the policy has been pursued of leasing or feuing as much and purchasing as little land as possible. The procedure recommended by the Acland Committee was that one-third of the area planted annually should be land acquired by purchase

and two-thirds land acquired by lease. The actual are compared with the proposed areas in the table below :—

Acquisition of Plantable Land.

		By Leasing or Feuing,			By Purchase.			Total.		
Year ended 30th September.	Proposed.	Actual.	Excess (+), Deficit (-).	Proposed.	Actual.	Excess (+), Deficit (-).	Proposed.	Actual.	Excess (+), Deficit (-).	
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	
1920 ...	8,800	26,944	+18,144	22,000	6,684	-15,316	30,800	33,628	+ 2,828	
1921 ...	9,200	19,893	+10,693	22,000	14,968	- 7,032	31,200	34,801	+ 3,601	
Total ...	18,000	46,837	+28,837	44,000	21,652	-22,348	62,000	68,489	+ 6,489	

It was proposed further that land taken on lease should be planted at the rate of one-fourth per annum, *i.e.*, that the afforestation of a given area should be completed in four years, and that land acquired by purchase be planted at the rate of one-twentieth per annum.

The experience gained in the last two years shows that while the time suggested for planting leased land is too short, the time allowed for planting purchased land might, in many cases, be reduced without loss of efficiency. The rent or purchase price of hill pasture or waste land suitable for forestry represents such a small portion of the total cost of establishing plantations that it is advisable in every case to allow sufficient time to carry out in good order the operations preliminary to planting, such as the provision of the most suitable plants, drainage, adaptation of buildings, etc. The amount of land—mainly leased land—which will be held by the Commission will, in consequence, be higher than that laid down in the schedule of the Acland Report.

During the first half of the year the acquisition of land proceeded at a satisfactory rate and on very good terms. In March, 1921, however, the standing Treasury authority to acquire land on stated terms was withdrawn, and no further acquisitions were made during the forest year ending September 30th, 1921. This break in the continuity of acquisitions was unfortunate. After suspending surveys and negotiations for land for six months, the Commissioners found it necessary in October, 1921, to enter into negotiations for the acquisition of 25,000 acres of plantable land in order to provide the maximum amount of work for the unemployed in districts where unemployment was acute.

Planting Programme.

(A) STATE FORESTS.

Conifers.—The programme proposed by the Acland Committee, its modification by the Commissioners and the actual areas planted are stated in the table below :—

Year.	Acland Committee's Programme.	Commission's Revised Programme.	Actually Planted.	Surplus (+) or Deficit (—) on	
				Acland Committee's Programme.	Commission's Programme.
	Acres.	Acres.	Acres.	Acres.	Acres.
1st yr. 1919–20	Nil	1,600	1,296	+1,296	– 304
2nd „ 1920–21	3,300	5,700	6,105	+2,805	+405
3rd „ 1921–22	6,700	8,100			
4th „ 1922–23	10,000	11,500	7,401	+4,101	+101
5th „ 1923–24	13,300	14,800			
6th „ 1924–25	16,700				
7th „ 1925–26	20,000				
8th „ 1926–27	23,300				
9th „ 1927–28	26,700				
10th „ 1928–29	30,000				
Total ...	150,000				

The reasons for exceeding the Acland Committee's programme in its earlier stages were stated in the Annual Report for 1919–20, the main consideration being to render less heavy the task of the last two or three years of the ten-year period and still to complete the total of 150,000 acres.

Broadleaved Species.—No definite rate of planting was laid down by the Acland Committee. Twenty thousand acres of land suitable for hardwoods were to be acquired and replanted in part. The areas planted with hardwoods are :—

1919–20	...	...	...	121 acres
1920–21	...	...	...	272 „
Total	...	...	...	393 acres

(B) ASSISTANCE TO LOCAL AUTHORITIES AND PRIVATE OWNERS.

The area proposed to be afforested or replanted by local authorities and private owners for the 10-year period was 110,000 acres, or an average of 11,000 acres per annum.

The Commissioners have not succeeded in making any progress with this very important part of their work.

The reasons for the lack of progress are :—

- (a) The terms under which advances may be made under Section 3 (3) (d) of the Forestry Act, 1919, have not proved attractive.
- (b) The proposed regulations covering advances have not yet been approved by the Treasury.

The keeping of accounts for the whole course of a rotation, which in effect is imposed by the Forestry Act, has undoubtedly proved a deterrent to landowners wishing to take advantage of the advances offered. Two schemes for grants were adjusted in Scotland, one in Argyllshire and the other in Peeblesshire, but sanction for them had not been obtained before the close of the year.

That private owners and corporate bodies are prepared to take their full share in reconstituting the woods in this country, provided a small grant under suitable regulations can be provided, is proved by the experience of the Commissioners in the winter of 1921-22. Under the Forestry Act, 1921, the Commissioners were enabled for a period of six months to make grants for planting schemes unencumbered by any conditions except that unemployed labour should be utilised. Notwithstanding the inherent difficulty of organising and in many cases of improvising forestry work with unskilled or semi-skilled labour, they were able to make contracts with landowners and corporate bodies for the planting of 11,000 acres, and the preparation of land for the planting of nearly 11,500 acres, an important addition to the woods of Great Britain.

The Commissioners are financing the Craigmyle scheme, which provides for the afforestation of 390 acres on a partnership scheme commenced by the Development Commission.

Education.

The Commissioners have already stated their general policy in their First Annual Report. It involves :—

- (1) The establishment of the machinery for a complete course of higher education at one of the Universities or education centres in the British Isles.
- (2) The payment of a lecturer in forestry in certain Universities and Colleges where adequate agricultural and estate management courses exist at present.
- (3) The establishment (in State forests where possible) of a sufficient number of woodmen's schools to train the foresters and foremen required for State and private forestry.

With the second and third, satisfactory progress has been made. With regard to the first, an Inter-departmental Committee, including representatives of the India and Colonial Offices and the Forestry Commission, and presided over by Lord Clinton, has recommended that Oxford be selected as the centre. The Colonial Office is favourably impressed with the scheme, while the Government of India is still considering it. Reference to current work in forestry education is made on pp. 21-23.

RESEARCH AND EXPERIMENTAL WORK.—The Commissioners have made steady progress with this work. They have continued the nursery and planting experiments designed to secure the cheapening of the cost of establishing plantations, with thinning experiments, and the investigation of insect and fungus pests, while new research has been commenced on the subject of peat from the planting point of view. Timber research has been allotted by the Cabinet Committee on the Co-ordination of Research to the Department of Scientific and Industrial Research, and the Commissioners are represented on the Forest Products Research Board.

The information so obtained is published from time to time in the Commission's leaflets and bulletins.

ENCOURAGEMENT OF FOREST INDUSTRIES.—By arrangement with the Development Commission, expenditure on this subject will be met from the Development Fund in future, except where the work is carried out on the Commission's properties. A Committee on Rural Industries on which the Commissioners are represented has been set up by the Development Commission to enquire what steps should be taken to promote such industries.

IMPERIAL FORESTRY BUREAU.—The proposal of the Imperial Forestry Conference of 1920 to set up in this country a Forestry Bureau to serve as a centre for the collection and dissemination of information bearing on forestry and forest products has been sympathetically received by many of the constituent parts of the Empire. The Commissioners have not yet succeeded in securing permission to incur the expenditure (estimated at £5,000) for setting the proposal on foot.

THE EMPIRE FORESTRY ASSOCIATION.—The Commissioners welcome the incorporation under Royal Charter of this Association, which has as its object the promotion of forestry throughout the Empire. His Majesty the King has graciously consented to become patron. Viscount Novar, who is well known for his life-long interest in the industry, is the first President of the Association.

CENSUS OF WOODLANDS.—The enquiry suggested by the Imperial Conference has been started on an experimental scale. Owing to the limited funds available caution is necessary to begin with, but it is proposed to speed up the enquiry as soon as the best procedure has been determined.

OPERATIONS—FOREST YEAR 1920-21.

The Forestry Fund.

The position of the Forestry Fund at the 30th September, 1921, is shown in Table I, which also states the position in 1920.

Table I. Forestry Fund Account.

Year ending September 30th.	Balance from Preceding Year.	Receipts.			Expenditure (Table II, Heads A to K).	Balance remaining in the Fund, 30th September.
		Parliamentary Votes.	Other (Table II, Head L).	Total		
	(1)	(2)	(3)	(4)	(5)	(6)
1920	£ Nil	£ 478,000	£ 12,229	£ 490,229	£ 106,858	£ 383,371
1921	383,371	200,000	29,149	229,149	318,768	293,752
Total		£678,000	£41,378	£719,378	£425,626	

The figures of 1920 differ slightly from those given in the Annual Report for that year, certain amendments having been made on audit. Corresponding adjustments have been made in subsequent tables based on Table I.

The carry over in the Forestry Fund from 1919-20 was £383,371. The Parliamentary Vote amounted to £200,000 and "other receipts" to £29,149, making a total of £612,520. Expenditure amounted to £318,768, and there was consequently a carry over of £293,752 at the end of the forest year. The amount of money to be voted by Parliament to the Forestry Fund under the terms of the Forestry Act, 1919, before the 31st March, 1929, is £3,500,000, of which £678,000 was received to the end of the forest year. The total "receipts" to the end of the forest year amounted to £41,378. As receipts are also available for forestry purposes the total amount of money remaining to be spent before March 31st, 1929, was £3,115,752.

Expenditure : £318,768.—The expenditure by heads under which estimates are presented to Parliament is given in Table II below, both for 1919-20 and 1920-21.

Table II.
Expenditure and Receipts by Parliamentary Heads of Accounts.

Year ending 30th September.	A. Salaries, Wages and Allowances.	B. Head-quarter Charges.	C. Asst. Comm'rs Charges.	D. Divisional Officers' Charges.	E. Forestry Operations.	F. Advances for Afforestation Purposes.	G. Education.	H. Research and Experiment.	J. Agency and Advisory Services.	K. Special Services.	Total.	L. Receipts.	Net Expenditure.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1920	£ 25,156	£ 577	£ 1,825	£ 4,829	£ 66,550	£ —	£ 4,547	£ 1,538	£ 1,577	£ 259	£ 106,858	£ 12,229	£ 94,029
1921	71,925	1,256	3,880	10,207	208,630	352	9,222	3,340	9,557	399	318,768	29,149	289,619
Total	97,081	1,833	5,705	15,036	275,180	352	13,769	4,878	11,134	658	425,626	41,378	384,248

Sub-heads B, C and D were shown only as a total in the Report for the year ending 30th September, 1920. The charge under Sub-head J for 1920 was included in Sub-head E in the first Annual Report; it is in respect of Irish properties acquired by means of the Development Fund or acquired by the Department of Agriculture and Technical Instruction by means of Parliamentary Votes. The management of these properties has been conducted by the Commissioners, and the charges appertaining thereto have now been shown under the Agency head (Sub-head J) as being more appropriate than Sub-head E, which relates to the forestry operations on the Commission's properties.

It was explained in the 1919-20 Report that for Parliamentary Estimates all salaries and allowances have to be kept under one Sub-head (A), but in order to get a clearer view of the true cost of the effective services on which expenditure has been incurred, an allocation of the expenditure under Sub-heads A, B, C and D has to be made to the remaining Sub-heads. This allocation has been made in Table II.

Table IIa. Expenditure re-classified by Objects.

Year ending 30th September.	Expenditure Sub-heads A. to D.				E. Forestry Operations.	F. Advances for afforestation purposes.	G. Education.	H. Research and Experiment.	J. Agency and Advisory Services.	K. Special Services.	Totals Cols. (3) to (9) inclusive.
	Sub-head.	Total.	Allocated to sub-heads E.-K.	Unallocated.							
1920	A, B, C, and D	£ 32,387	£ 18,387	£ 14,000	£ 76,641	—	£ 6,359	£ 3,497	£ 4,696	£ 1,675	£ 106,858
1921	A.	71,925	32,346	39,579	14,858	240	4,428	4,290	5,888	2,642	71,925
	B.	1,256	—	1,256	—	—	—	—	—	—	1,256
	C.	3,880	467	3,413	281	3	30	30	28	67	3,880
	D.	10,207	10,207	—	6,486	109	68	77	77	2,755	712	10,207
	Direct Expenditure	—	—	—	208,630	352	9,222	3,340	9,557	399	231,500
Total 1921	...	87,268	43,020	44,248	230,255	704	13,748	7,737	18,226	3,850	318,708
Grand Total 1920 and 1921	...	119,655	61,407	58,248	306,896	704	20,107	11,234	22,012	5,525	425,626

In the above table the salaries and expenses of the Chief Technical Assistants, the Divisional and District Officers have been apportioned on a time basis to the various objects on which they were engaged. Charges in connection with Divisional Officers' staffs and expenses have been allocated in the same proportions. The unallocated charges consist of the salaries and expenses of the Commissioners, Assistant Commissioners and their clerical and accounting staff, and office expenses, such as rent, rates and taxes, fuel, light, and postages.

Sub-heads A to D. General Organisation.

The system described in the First Annual Report has worked satisfactorily, and no changes have been necessary.

Sub-head E. Forestry Operations : Expenditure £230,255.

The total direct expenditure on forestry operations, *i.e.*, on all work connected with the Development of the State afforestation programme, was £208,630, to which must be added £21,625 allocated from Sub-heads A, B, C and D, making a total gross expenditure of £230,255. The main items of expenditure are shown in Table E, which also gives comparative figures for the previous year.

Table E. Analysis of Forestry Operations (Table IIa, Column E).

Year.	(1) Superior Supervision Charges.	(2) Local Supervision.	(3) Surveys and Working Plans.	(4) Acquisition of Land, &c.	(5) Cultural Operations.	(6) Roads and Buildings.	(7) Preparation and Sale of Produce.	(8) Transport.	(9) Stores and Miscellaneous Payments.	(10) Gross Total.	(11) Receipts.	(12) Net Total.
1020	£10,001	£1,375	£10	£40,486	£19,151	£1,472	£337	£2,011	£1,708	£76,641	£9,771	£60,870
1021	21,625	5,186	96	92,877	90,533	8,020	1,670	910	9,638	230,255	16,890	213,365
Totals	31,716	6,561	106	133,363	100,684	9,492	2,007	2,621	11,346	306,896	26,661	280,235

Receipts amounted to £16,890, of which £10,262 was in respect of sales of forest produce, £3,891 in respect of rents and £2,737 miscellaneous.

Superior Supervision : Expenditure £21,625.—As already explained this is an allocated charge, and represents the cost of time, travelling, office and clerical expenses of officers engaged in acquisition of land, the preparation of working plans, supervision of nursery and planting operations, &c.

Local Supervision : Expenditure £5,186.—This item represents the salaries and wages of foresters and foremen, their numbers at the end of the year being 32 foresters and 34 foremen.

IRELAND

- 1 Ballykelly
- 2 Baronscourt
- 3 Castle Caldwell
- 4 Knockmany
- 5 Baileyborough
- 6 Aghrane
- 7 Woodford
- 8 Slieve Bloom
- 9 Glendalough
- 10 Ballyboy
- 11 Killaduff
- 12 Roddenagh
- 13 Kilrush
- 14 Dundrum
- 15 Camolin
- 16 Ballyhoura
- 17 Gortashall
- 18 Cregg
- 19 Clohernagh
- 20 Roddenagh Wood

SCOTLAND

Crown Woods

- 1 Inverliever

Forestry Commission Areas

- 2 Borgie
- 3 Portclair
- 4 Inchnacranach
- 5 South Laggan
- 6 Monaughty
- 7 Craigmyle
- 8 Glenduror
- 9 Glentress
- 10 Slattadale
- 11 Achnashelleach
- 12 Ralaghan
- 13 Kirkhill
- 14 Montreatmont
- 15 New Galloway
- 16 Newcastleton

ENGLAND & WALES

Crown Woods

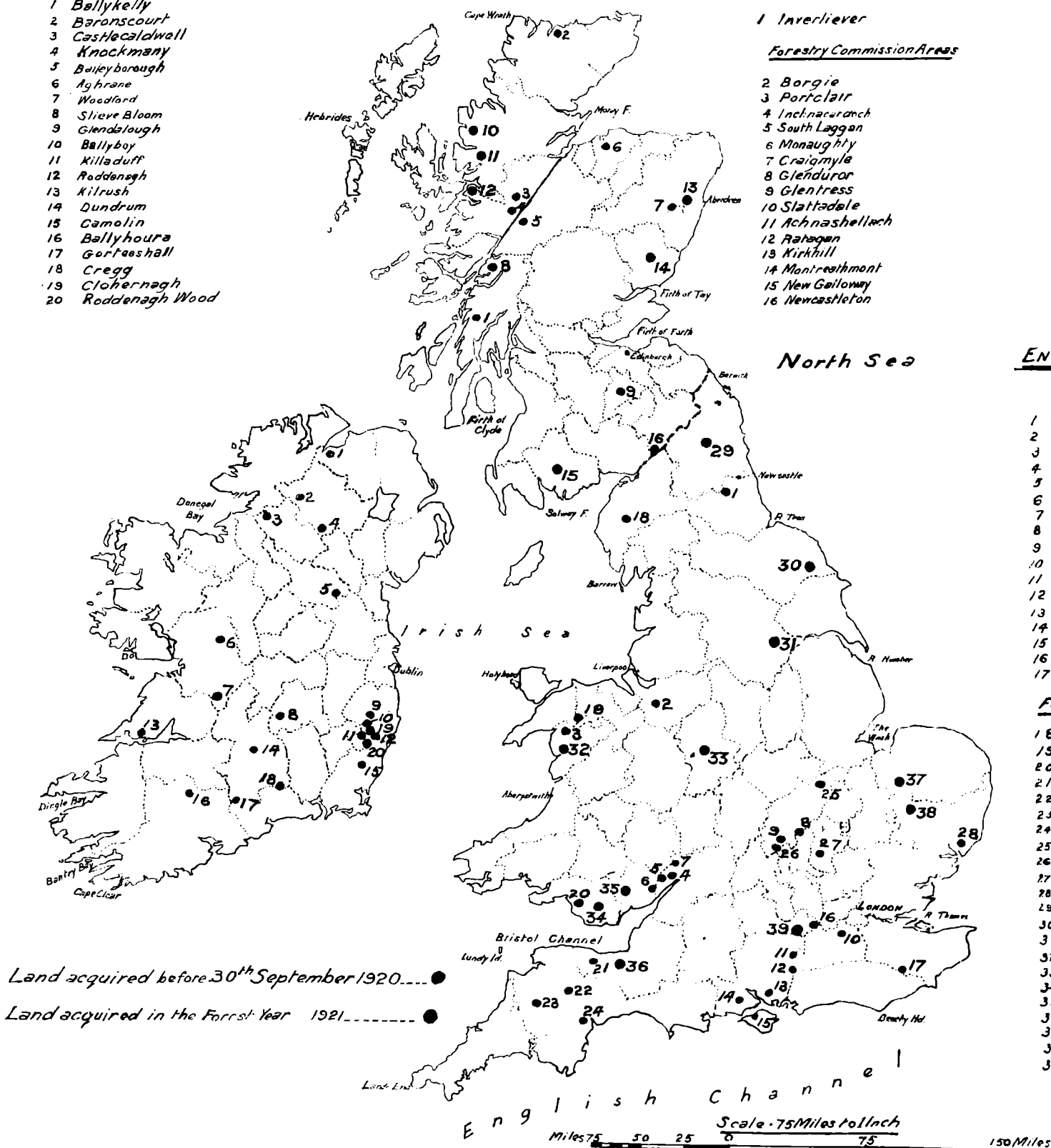
- 1 Chapwell Woods
- 2 Delamere Forest
- 3 Hatfield Forest
- 4 Dean Forest
- 5 Highmeadon Woods
- 6 Tintern Woods
- 7 Dymock Woods
- 8 Salcey Forest
- 9 Hazelborough Wood
- 10 Esher Woods
- 11 Alice Holt Woods
- 12 Woolmer Forest
- 13 Bere Woods
- 14 New Forest
- 15 Parkhurst Wood
- 16 Windsor Forest
- 17 Bedebury

Forestry Commission Areas

- 18 Thornthwaite
- 19 Gwydyr
- 20 Margam
- 21 Exmoor
- 22 Eggesford
- 23 Halwill
- 24 Haldon
- 25 Apethorpe
- 26 Brackley
- 27 Amptwell
- 28 Rendlesham
- 29 Rothbury
- 30 Allarston
- 31 Selby
- 32 Vaughan
- 33 Cannock Chase
- 34 Llantrisant
- 35 Llanorer
- 36 Quantocks
- 37 Swaffham
- 38 Elvedon
- 39 Wokingham

Land acquired before 30th September 1920.....●

Land acquired in the Forest Year 1921.....●



Acquisition of Land, Buildings and Standing Timber : Expenditure £92,877.—During the year £86,506 was paid in respect of the purchase of land, including the standing timber and buildings thereon, and £2,949 in respect of land held on lease or feu. The latter item also includes £236 in respect of rent of land used for nursery purposes. Legal and similar charges account for the balance of the expenditure.

The average rent paid for leased land is approximately 2s. per acre, and the average price for purchased land £1 8s. per acre, or, if the whole be charged against plantable land only, 3s. and £2 17s. respectively.

The actual area which the Commissioners had completely acquired, that is to say for which the deeds had been executed and purchase money paid by 30th September, 1921, was 61,171 acres, the corresponding figure at 30th September, 1920, being 11,454 acres.

In addition to the completed acquisitions entry had been secured on a number of other properties. Details for the different parts of the United Kingdom are given in the table below, which also shows the area of "plantable" and "other land," *i.e.*, land which is either too poor to plant or is required for other purposes. The table omits land previously acquired in Ireland by the Department of Agriculture and Technical Instruction.

Acquisition of Land. Total to 30th September, 1921.

Country.	By Lease or Feu.			By Purchase.			Total by Lease or Feu and Purchase.
	Plantable (including planted).	Other Land.	Total.	Plantable (including planted).	Other Land.	Total.	
	Acres.	Aores.	Acres.	Acres.	Aores.	Acres.	Acres.
<i>England and Wales.</i>							
Finally completed ...	9,391	87	9,478	8,451	631	9,082	18,560
Entry secured ...	16,766	750	17,516	606	—	606	18,122
Total ...	26,157	837	26,994	9,057	631	9,688	36,682
<i>Scotland.</i>							
Finally completed...	5,827	2,998	8,825	9,563	19,269	28,832	37,657
Entry secured ...	12,566	10,018	22,584	1,000	—	1,000	23,584
Total ...	18,393	13,016	31,409	10,563	19,269	29,832	61,241
<i>Ireland.</i>							
Finally completed...	2,287	532	2,819	1,557	578	2,135	4,954
Entry secured ...	—	—	—	475	220	695	695
Total ...	2,287	532	2,819	2,032	798	2,830	5,649
Grand Total (United Kingdom)	46,837	14,385	61,222	21,652	20,698	42,350	103,572

Cultural Operations : Expenditure £90,533.—Two items are included under this head, viz., plantations and nurseries, of which the former cost £60,339 and the latter £30,194. The expenditure shown in Table E 5, as incurred by Headquarters (£4,480) was in respect of seed, which is purchased centrally. The bulk of the expenditure in Ireland appears under Sub-head J.

Table E 5. *Cultural Operations : Expenditure (Table E, Col. 5).*

Year ended 30th September, 1921.	Head-quarters.	Great Britain.	Ireland.	Total.
	£	£	£	£
Plantations	—	59,807	532	60,339
Nurseries	4,480	25,153	561	30,194
Total	£4,480	£84,960	£1,093	£90,533

Plantations : Expenditure £60,399.—Of the total expenditure £58,786 was in respect of first plantings, and £1,553 in respect of weeding and beating up the previous year's work. Details are given in Table E 5 (a)

Table E 5 (a). *Plantations : Expenditure.*

Year ended September 30th.	First Plantings.							Second and subsequent Years.		
	Preparation of Ground.	Drainage.	Fencing.	Planting.	Weeding.	Other.	Total.	Weeding.	Beating up.	Total.
	£	£	£	£	£	£	£	£	£	£
1920. (United Kingdom) ...	3,185	793	3,090	3,361	665	173	11,276	—	—	—
1921. England and Wales ...	9,704	686	9,820	22,748	744	1,828	45,620	688	537	1,225
Scotland ...	1,466	1,213	3,283	5,728	332	612	12,634	173	155	328
Ireland ...	131	136	138	122	—	5	532	—	—	—
Totals ...	11,391	2,035	13,241	28,598	1,076	2,445	58,786	861	692	1,553
Totals 1920 and 1921	14,576	2,828	16,340	31,050	1,741	2,618	70,062	861	692	1,553

The total area planted in the Forest Year 1921 was 6,463 acres, of which 6,191 acres were placed under coniferous and 272 acres under broadleaved species.

The total addition to the woodland area of the United Kingdom was 4,230 acres, the remaining plantations being on the site of felled woodlands. The number of plants used in making these plantations and in beating up the previous year's plantations was 12,805,000, of which 35 per cent. were Scots and Corsican pines, 33 per cent. Norway and Sitka spruces, 17 per cent. European and Japanese larches, and 11 per cent. Douglas fir.

Plantations. Year ended 30th September, 1921—England and Wales.

Forest.	Area planted (acres).						Species planted, including beating up (thousands).							Total.	
	Afforested.		Re-afforested.		Total.		Scots and Corsican Pine.	Eur. Larch.	Douglas Fir.	Norway and Sitka Spruce.	Oak.	Ash.	Beech.		Others.
	Conifers.	Broad-leaved.	Conifers.	Broad-leaved.	Conifers.	Broad-leaved.									
Thornthwaite	83	—	260	—	343	—	157.7	59.0	490.2	—	—	—	2.0	73.5	782.4
Rothbury	—	—	190	—	190	116.0	198.0	—	—	—	—	—	—	—	314.0
Allerston	254	—	—	—	254	249.2	73.0	—	193.0	—	—	—	—	—	515.2
Selby	—	—	142	81	142	—	226.2	—	30.0	—	145.0	—	—	9.0	410.2
Cannock	90	—	392	—	482	1312.0	—	—	—	—	—	—	—	—	1312.0
Gwydyr	—	—	320	—	320	41.0	130.0	93.0	391.0	—	—	—	10.0	—	665.0
Margam	152	4	—	—	152	71.4	43.3	42.5	51.0	—	—	0.5	6.0	1.0	215.7
Llanover	92	1	—	—	92	2.1	38.0	59.0	30.0	—	—	—	2.0	—	131.1
Llantrisant	69	2	—	—	69	1.5	18.4	58.0	18.0	—	—	—	4.0	—	99.9
Eggesford	10	—	162	10	172	—	51.0	132.0	60.0	—	17.0	—	—	15.0	275.0
Halwill	40	—	100	—	140	—	—	3.0	230.0	—	—	—	—	8.0	241.0
Haldon	157	—	91	—	248	275.0	24.0	45.0	134.0	—	—	—	10.0	16.0	503.0
Exmoor (Dunster)	240	—	—	—	240	289.0	60.0	69.0	20.0	—	—	—	4.0	10.0	452.0
Rendlesham	*653	—	—	—	*653	1248.0	35.0	243.0	—	—	—	—	—	13.0	1539.0
Amphill	—	—	10	—	10	—	—	—	20.0	—	—	—	—	—	20.0
Apethorpe	—	—	16	14	16	100.0	61.3	50.0	65.0	—	—	—	—	—	311.1
Brackley	—	—	283	18	283	25.0	53.5	125.0	286.0	—	44.0	—	—	—	593.5
Total	1,840	132	1,966	123	3,806	3,730.2	1,169.4	978.5	2,018.2	34.8	206.5	38.0	144.5	8320.1	

* Includes 80 acres by direct sowing.

Plantations. Year ended 30th September, 1921—Scotland.

Forest.	Area planted (acres).						Species planted, including beating up (thousands).								
	Afforested.		Re-afforested.		Total.		Scots and Corsican Pine.	Eur. Larch.	Douglas Fir.	Norway and Sitka Spruce.	Oak.	Ash.	Beech.	Others.	Total.
	Conifers.	Broad-leaved.	Conifers.	Broad-leaved.	Conifers.	Broad-leaved.									
Portclair ...	167	—	—	—	167	—	—	50.0	310.0	—	—	—	—	—	360.0
Inchnacardoch ...	201	2	—	—	201	2	1.0	2.0	393.0	—	—	—	—	2.0	400.0
South Laggan ...	245	—	—	—	245	—	—	90.0	483.0	—	—	—	—	—	573.0
Borgie ...	220	—	—	—	220	—	382.0	—	218.0	—	—	—	—	1.0	601.0
Craigmyle, Aberdeen	86	—	—	—	86	—	22.0	74.0	30.0	—	—	—	—	—	126.0
Monaughty, Moray	567	1	—	—	567	1	88.0	24.0	237.0	—	—	—	—	1.0	861.0
Glenstress ...	200	3	—	—	200	3	12.0	181.0	110.0	—	—	—	—	6.5	322.0
Newcastleton	150	—	—	—	150	—	—	56.0	96.0	—	—	—	—	5.3	186.3
Glenduror ...	132	8	—	—	132	8	—	73.2	4.2	180.0	—	—	—	10.2	267.6
Total ...	1,968	14	—	—	1,968	14	505.0	987.2	121.7	2057.0	—	—	—	26.0	3696.9

Plantations. Year ended 30th September, 1921.—Ireland.

Forest.	Area planted (acres).				Species planted, including beating up (thousands).										
	Afforested.		Re-afforested.		Total.		Scots and Corsican Pine.	Eur. Larch.	Douglas Fir.	Norway and Sitka Spruce.	Oak.	Ash.	Beech.	Others.	Total.
	Conifer.	Broad-leaved.	Conifer.	Broad-leaved.	Conifer.	Broad-leaved.									
...	—	—	7	—	—	—	11.0	1.1	—	14.2	—	8.0	4.5	—	38.8
...	8	—	13	—	21	—	12.7	—	15.0	13.0	—	—	—	—	40.7
...	—	—	24	—	24	—	—	—	39.0	—	—	—	—	—	39.0
...	—	—	30	—	30	—	17.3	10.4	1.0	16.8	—	—	—	5.9	51.4
...	23	—	3	—	26	—	19.3	—	17.1	3.5	—	—	2.7	1.9	44.5
...	119	—	—	—	119	—	22.0	28.0	108.0	—	—	—	—	—	158.0
...	67	—	—	—	67	—	103.0	—	15.0	—	—	—	—	80.3	198.3
...	—	—	28	—	28	—	2.6	4.2	32.3	0.4	—	—	—	0.5	40.0
...	—	—	39	—	39	—	—	5.2	10.5	50.4	—	—	—	—	66.1
...	10	—	—	—	10	—	—	—	—	17.2	—	—	—	—	17.2
...	—	—	—	—	—	—	—	—	—	7.0	—	3.6	—	—	12.6
...	46	3	—	—	46	3	13.4	1.9	15.6	50.1	—	—	—	—	81.0
Total ...	273	3	144	—	417	3	201.3	50.8	238.5	187.6	—	11.6	7.2	90.6	787.6
<i>Summary.</i>															
England and Wales	1,840	132	1,966	123	3,806	255	3,730.2	1169.4	978.5	2018.2	34.8	206.5	38.0	144.5	8320.1
Scotland	1,968	14	—	—	1,968	14	565.0	987.2	121.7	2057.0	—	—	—	26.0	3696.9
Ireland	273	3	144	—	417	3	201.3	50.8	238.5	187.6	—	11.6	7.2	90.6	787.6
Total, United Kingdom...	4,081	149	2,110	123	6,191	272	4436.5	2207.4	1338.7	4262.8	34.8	218.1	45.2	261.1	12804.6

*Plantations:—Crown Woods under the Technical Supervision of the Forestry Commissioners.
Year ended 30th September, 1921.*

Forest.	Area planted (acres).						Species planted, including beating up (thousands).								
	Afforested.		Re-afforested.		Total.		Scots and Corsican Pine.	Eur. Larch.	Douglas Fir.	Norway and Sitka Spruce.	Oak.	Ash.	Beech.	Others.	Total.
	Conifer.	Broad-leaved.	Conifer.	Broad-leaved.	Conifer.	Broad-leaved.									
New Forest ...	—	—	588	1	588	1	122.0	254.0	282.0	103.0	—	1.3	—	—	762.3
Bere ...	—	—	—	—	—	—	69.0	—	4.0	—	—	—	—	—	—
Parkhurst ...	—	—	20	—	20	—	—	—	—	—	—	—	—	—	73.0
Dean Forest and Hope Wood ...	62	—	154	*16	216	*16	17.6	43.0	69.5	253.0	6.0	9.0	95.0	21.5	514.6
Highmeadow ...	—	—	13	13	13	13	2.0	18.9	11.6	3.7	20.0	0.3	0.8	2.0	59.3
Abbotswood ...	—	—	16	*43	16	*43	3.4	14.0	4.4	2.0	—	2.2	30.6	1.7	58.3
Alice Holt ...	—	—	—	—	—	—	2.9	2.6	1.4	—	—	—	—	0.3	7.2
Woolmer ...	—	—	—	—	—	—	—	—	0.7	—	—	—	—	0.4	1.1
Salcey ...	—	—	—	—	—	—	62.2	—	—	25.0	3.4	—	—	4.4	95.0
Hazelborough ...	—	—	—	—	—	—	25.0	—	—	25.0	—	—	—	—	50.0
Esher ...	18	—	34	16	52	16	6.0	4.0	50.0	15.0	—	—	6.3	6.3	—
Tintern ...	99	—	—	6	99	6	60.0	—	36.0	58.0	—	10.0	0.5	17.0	102.5
Trelleck ...	—	—	14	—	14	3	—	14.0	3.0	1.3	—	—	5.0	5.2	164.2
Dymock ...	—	—	17	1	17	1	167.8	11.6	—	9.3	—	—	—	—	18.3
Delamere ...	—	—	—	—	—	—	—	—	—	—	—	—	1.0	50.9	240.5
Hafof Fawr ...	—	—	47	3	47	3	52.0	—	—	31.0	—	—	3.0	—	86.0
Chopwell... ..	131	1	—	—	131	1	—	1.4	11.3	250.3	—	—	1.5	—	272.6
Inverliever ...	—	—	—	—	—	—	—	—	—	—	—	—	—	8.0	—
Total ...	310	4	903	99	1,213	103	589.9	363.5	473.9	776.6	29.4	22.8	137.4	117.7	2511.2

* Indicates underplanting.

The areas and trees stated in the tables on pp. 15–17 are exclusive of 1,316 acres planted in the Crown Woods which come under the technical supervision of the Commissioners and are shown separately on p. 18 but they include 86 acres planted at Craigmyle under a proceeds-sharing scheme, and 420 acres planted in Ireland and accounted for under Sub-head J (Agency Service).

Nurseries; Expenditure £30,194.—Expenditure and receipts in connection with nurseries are given in Table E 5 (b) below. Under the head “rents” expenditure in respect of nursery ground is included which has already been accounted for under acquisition of land (p. 13). Receipts are considerable, as they include £764 received for seed purchased on behalf of the nursery trade.

Table E 5 (b). *Nursery Operations.*

Year ending September 30th.	Expenditure.							Receipts.			
	Seed.	Plants.	Labour.	Materials.	Rents.	Other.	Total.	Seed.	Plants.	Other.	Total.
	£	£	£	£	£	£	£	£	£	£	£
1921.											
Headquarters ...	4,480	—	—	—	—	—	4,480	764	—	—	764
England and Wales	538	1,664	6,552	287	10	26	9,076	—	7	26	33
Scotland ...	489	1,378	11,897	1,736	226	587	16,313	11	30	103	144
Ireland ...	—	14	425	121	—	—	561	—	—	—	—
Total ...	5,507	3,056	18,874	2,144	236	613	30,430	775	37	129	941
1920.											
United Kingdom ...	1,157	50	5,418	504	—	746	7,875	—	—	—	—
Total 1920 and 1921	6,664	3,106	24,292	2,648	236	1,359	38,305	—	—	—	—

The total area under nurseries at 30th September, 1921, including those belonging to the Crown, was 607 acres, stocked with 111 million seedlings and 33 million transplants. Comparative figures for the three years 1919 to 1921 are given in the following table :—

Nurseries:

Year ending September 30th.	Country.	Seed Sown (lbs.).				Stock of Plants at 30th September (thousands).						Area (acres).
		Transplants.		Seedlings.		Transplants.		Seedlings.		Total.	Total.	
		Coniferous.	Broad-leaved.	Total.	Coniferous.	Broad-leaved.	Total.	Coniferous.	Broad-leaved.			
1921	England and Wales	3,984	3,776	7,760	13,751	2,630	16,381	36,382	2,732	39,114	324	
	Scotland	3,048	1,675	4,723	13,065	—	13,065	62,415	1,520	53,935	248	
	Ireland	606	2	608	3,738	20	3,758	17,580	316	17,896	35	
	Total United Kingdom ...	7,638	5,453	13,091	30,554	2,650	33,204	106,377	4,568	110,945	607	
1920	England and Wales	4,892	6,320	11,212	17,172	2,827	19,999	62,438	1,332	63,770	232	
	Scotland	3,593	—	3,593	4,365	1	4,366	76,610	—	76,610	90	
	Ireland	1,433	203	1,636	2,516	35	2,551	28,550	323	28,873	21	
	Total United Kingdom ...	9,918	6,523	16,441	24,053	2,863	26,916	167,598	1,655	169,253	343	
1919	England and Wales	3,465	2,000	5,465	16,660	890	17,550	35,200	2,800	38,000	217	
	Scotland	4,214	—	4,214	2,357	—	2,357	50,500	—	50,500	35	
	Ireland	498	12	510	1,431	51	1,482	17,070	—	17,070	20	
	Total United Kingdom ...	8,177	2,012	10,189	20,448	941	21,389	102,770	2,800	105,570	272	

Supply of Seed.—Resulting from the harvest of 1920, large quantities of European larch of good quality were available in the Tyrol, and the Commission's representative was able to secure an adequate supply of good origin at favourable prices. The crop of Douglas fir was also good, and seed of excellent quality was obtained from the State of Washington. On the other hand, Sitka spruce was practically a failure, and the Commissioners could not secure more than a fraction of their requirements. The Japanese larch crop was a complete failure. The supply of Corsican pine seed in Corsica was very meagre, and did not suffice to meet the requirements of the French Government. Small quantities of Calabrian pine seed were obtained from Italy and of the so-called *Pinus nigra*, which appears to be similar to the Corsican pine, from Cyprus. The supply of Norway spruce seed was ample.

With regard to broadleaved species, no acorns were available from this country and a supply had to be imported from France; beech, without producing a full mast, provided sufficient seed from the New Forest to meet the Commission's requirements.

The Canadian Dominion Forestry Branch completed the arrangements, referred to in the last Annual Report, for the extraction of Douglas fir and Sitka spruce seed, large quantities of which have since been received in this country.

The Commissioners desire to express their hearty thanks to the American Forestry Association for a gift of 50 lbs. of Douglas fir seed, to the Italian Government for a gift of 95 lbs. of Calabrian pine seed, and to the Serbian Government for their good offices in securing a small quantity of seed of *Picea Omorica*.

Sub-head F.

Advances for Afforestation Purposes : Expenditure £704.

The direct expenditure amounting to £352 is in respect of the proceeds-sharing scheme at Craigmyle; the remaining expenditure represents the time and expenses of the Commission's Officers engaged in supervising that scheme and the Liverpool Corporation scheme at Lake Vyrnwy, and in investigating proposals for new schemes.

Numerous enquiries regarding the conditions governing advances by way of grant or loan were received by the Commissioners, showing that considerable interest is taken in the matter, though for the reasons given above progress is unlikely without some modification in the conditions prescribed by the Forestry Act, 1919.

Sub-head G. Education : Expenditure £13,748.

Details of expenditure are given in Table G below. The item £1,766 for salaries and expenses of the Commission's officers represents part time of the Education and Publications Officer

and of the Divisional Officers, who have delivered lectures in various parts of the country, and also of the Professor of Forestry in the Royal College of Science, Dublin, whose salary and expenses are met under an arrangement inaugurated by the Development Commissioners.

Table G. Education : Expenditure (Table IIa, Col. G).

Year ending 30th Sept.	Salaries and Expenses of Officers (allocated)	Apprentices' Schools.						Grants to Institutions.	Total.
		Salaries and Expenses of Lecturers.	Purchase and Rent of Land and Buildings.	Net Allowances to Apprentices.	Stores and Equipment.	Fuel, Light and Sundry Expenses.	Total.		
1921	£ 1,766	£ 3,033	£ 2,247	£ 2,514	£ 953	£ 1,993	£ 10,740	£ 1,242	£ 13,748

Apprentices' Schools : Expenditure £10,740.—The apprentices' schools were four in number, being situated at Parkend (Forest of Dean), Burley (New Forest), Chopwell (County Durham), and Beauly (Inverness-shire). Sixty men received training at these schools during the year.

In addition to the above instruction, training was provided at Birnam in Perthshire and at Brockenhurst in the New Forest for thirtysix disabled soldiers, the Ministry of Labour co-operating with the Forestry Commissioners for this purpose.

Two short courses each of a fortnight's duration were held in the Forest of Dean, one for landowners and land agents and the other for foresters, but the attendance at these classes was somewhat disappointing, being seven in each case.

Grants to Universities and Colleges : Expenditure £1,242.—Grants were paid during the year to the University of Cambridge, Bangor University College and Armstrong College, Newcastle. Outstanding grants due to the University of Oxford and the North of Scotland and West of Scotland Agricultural Colleges were paid after the close of the forest year.

Degree and Diploma courses were provided at the Universities of Oxford, Cambridge, Wales (Bangor), Edinburgh and Aberdeen. The Diploma course at the Royal College of Science in Dublin was continued. At Armstrong College and at the North of Scotland and West of Scotland Colleges, forestry lectures were delivered to students taking the Agricultural classes.

An Inter-departmental Committee was appointed in October, 1920, to prepare a scheme for giving effect to the Resolutions of the British Empire Forestry Conference (held in London in July, 1920) with regard to a Central Institution for training forest

officers. The Committee consisted of the following members :— Lord Clinton, Forestry Commission, Chairman ; Viscount Novar ; Mr. P. H. Clutterbuck, India Office ; Major R. D. Furse, Colonial Office and Professor J. B. Farmer.

After taking evidence from the existing centres of forestry education in the United Kingdom and also from forest officers in the Colonial Services and other experts, the Committee found that it was desirable to modify in some respects the original proposals of the Empire Forestry Conference. Their main conclusions may be summarised as follows :—*

1. A training institution termed the Central Institution should be set up at Oxford and incorporated with the University.
2. The Institution should be governed by a Board appointed as to one half by the Departments or Government concerned, and as to the other half by the University.
3. The Director of the Institution should be the Professor of Forestry in the University, and should at the commencement be assisted by a staff of three permanent lecturers. The annual cost of the permanent staff should not at the outset exceed £4,000 per annum.
4. The Forestry Commission, Colonial Office and the India Office should select candidates for their respective services from among men who have taken their degree in forestry at any of the existing Universities whose curriculum is approved by the Board of the Central Institution. These candidates should then be sent for a final course of training to the Central Institution.
5. Owing to the length of training involved it is not proposed to require intending candidates to take an honours degree in pure or natural science before studying forestry, but special facilities should be provided to attract honours men into the services.
6. The Institution should be the centre of research in relation to forest production and should be associated with any other centres which deal with research into forest utilisation.
7. Special or supplementary courses should be provided at the Institution for the benefit of forest officers on furlough and others who may wish to take advantage of such courses.

These proposals have been remitted to the Government of India and the various Colonial Governments for consideration, but sufficient progress had not been made during the year under report to enable active steps to be taken towards inaugurating the scheme.

* For full details see Cmd. Paper No. 1166, "Report of the Inter-departmental Committee on Imperial Forestry Education," printed by H.M. Stationery Office. Price 2d.

Sub-head H. Research and Experiment : Expenditure £7,737.

Details of expenditure are stated in Table H below :—

*Table H.**Research and Experiment : Expenditure (Table I Ia, Col. H).*

Year ended Sept. 30th.	Salaries and Expenses.		Instruments, Stores, &c.	Labour, Seed and Sundry Expenses.	Grants to Institutions.	Total.
	Direct Payments.	Allocated Charge.				
1921	£5,322	£442	£244	£985	£744	£7,737

The item £985 includes the cost of seed and labour on large-scale nursery experiments and will in due course give a return in plants ; it also includes the cost of labour employed in thinning and demarcating sample plots.

During the year, six of the Commissioners' staff have been engaged exclusively on research and experimental work, and have been assisted by field parties in measuring permanent sample plots.

It has been thought desirable to give a somewhat extensive review of part of their work, not because the results are in any sense final but with the hope that the mere statement of the problems and the methods of approaching them may stimulate interest in planting and perhaps bring to the notice of the Commissioners similar work which is being undertaken on private estates.

Production.—Further progress has been made with the establishment of permanent sample plots ; in addition to those already established, 37 plots have been measured, of which 17 are in England and 20 in Scotland. The total number of sample plots under observation at 30th September, 1921, was 79.

The following table shows the number of plots of each species :—

	<i>Species.</i>				<i>No. of Plots.</i>
European larch	27
Scots pine	12
Norway spruce	4
Douglas fir	15
Japanese larch	8
Corsican pine	2
Sitka spruce	4
Thuja gigantea	1
Hardwoods	6
					—
					<u>79</u>

Over 80 per cent. of the sample plots measured to date have been established in privately owned woods, and the Commissioners desire to express their thanks to the owners concerned for the facilities which have been afforded.

The Commissioners attach considerable importance to this work, which, though costly in the first instance, will provide in due course much-needed data as to the rate of growth and best methods of thinning plantations of different species. During the year special attention has been paid to the establishment in the same wood of comparative sample plots which have been thinned with different degrees of intensity. The plots will be re-measured every five years or so.

Nursery and Plantation Work.—In England these experiments have been seriously interfered with by the drought, which was responsible for several failures. The nursery experimental work was centralised at Rapley nursery, near Bagshot, in Windsor Forest; experiments in Scotland were carried out at Birnam, Craibstone, Beaully and Seaton nurseries. Special investigations into seed germination and the death of seedlings due to excessive sun heat were also conducted at Oxford.

1. Experiments designed to compare the production of seedlings in the nursery with the germinative capacity of the seed as ascertained in the Seed Testing Station gave results which cannot be taken as typical for a normal year, but illustrate, nevertheless, the general rule that with certain species only a comparatively small proportion of good seeds actually produce plants. The reasons for this are being investigated more closely. A counted number of seeds of five species was sown at Rapley nursery in drills at intervals of a fortnight from 15th March onwards. The following table shows the somewhat remarkable differences in germination according to the date of sowing :—

Date of Sowing.	Percentage Number of Seedlings Produced (Germination Test = 100).				
	Silver Fir.	Sitka Spruce.	Norway Spruce.	Douglas Fir.	European Larch.
March 15th ...	51	23	Not sown.	14	Not sown.
April 1st ...	39	13	11	1	22
„ 15th ...	26	40	74	13	61
„ 30th ...	16	4	62	1	30

The above counts were made on 15th June; later counts showed that after that date many seedlings died owing to the drought, but that the above ratios for the respective dates of sowing remained approximately constant in each species.

2. The effect of treatment of seed by soaking for various periods before sowing was investigated at Rapley nursery. The results are shown in the following table. The seed was sown on

30th April, and the seedlings counted at regular intervals, the figures in the table give the count on 15th June.

Period of Soaking.	Percentage Number of Seedlings Produced (Germination Test = 100).			
	Silver Fir.	Sitka Spruce.	Norway Spruce.	European Larch.
Control unsoaked ...	26	4	43	9
Soaked 2 days ...	26	3	54	35
„ 7 „ ...	32	11	65	48
„ 14 „ ...	32	16	57	35
„ 21 „ ...	19	1	24	13

It is evident that soaking for seven to fourteen days increased the germination of the four species tried; soaking for so long a period as twenty-one days appears to be injurious.

3. Experiments on sowing coniferous seed in autumn as compared with sowing in the spring were carried out at Craibstone and Beaully nurseries in Scotland, using Scots pine, European larch, Japanese larch, Douglas fir and Sitka spruce. The autumn sowings were very successful in the case of all species except the two larches, which were frosted during germination. The beds survived heavy winter frosts and both a higher germination and much larger plants were obtained than from the spring-sown seed (batches of the same seed were, of course, used for the two sowings). The seed sown in the autumn was undamaged by birds or mice.

4. Extensive experiments on pre-germination were carried out at Rapley nursery and also at Oxford. Pre-germination consists in the partial germination of the seed by artificial methods before sowing. The Rapley results were on the whole negative, *i.e.*, pre-germination did not appear to have increased either the number of seedlings produced or improved their quality, but at Oxford, where the pre-germination was carried out under carefully controlled temperature conditions in electrically-heated incubators, the pre-germinated seedlings were both larger and more numerous than those produced from seed which had not been treated.

5. In view of the drought, experiments were made in irrigating seedbeds. Daily applications of water at the rate of 10 gallons to 400 square feet of seedbed proved quite insufficient to produce normal germination, while many of the seedlings which did appear died off later in the season. Whether this loss was due to lack of moisture or to direct sun heat is uncertain. Researches on the Continent have shown that sun heat may be an important source

of loss in coniferous seedbeds in an exceptionally hot summer, and observations made, during the season under review, at Rapley and Oxford showed that the two types of damage recorded on the Continent could be readily identified. In the one type the stem (hypocotyl) becomes contracted just above the soil level, with the result that the upper part bends over and dies. In the other type the first leaves (cotyledons) brown off and die just as they are growing through the surface layer of the soil. The work done abroad seemed to indicate 54°C. (129°F.) as about the critical temperature at which spruce and Scots pine seedlings succumb, but experimental investigations at Oxford showed that contraction of the hypocotyl of spruce seedlings could be induced by exposure for half an hour to a temperature of 45° to 46°C. (113° to 115°F.). In Scots pine the results were less regular, but the critical temperature appeared to lie well below 50°C. (122°F.). Temperatures of 120°F. and over at soil level are often recorded in this country, and it is probable that losses due to insolation are more frequent than is generally realised. Overhead shelter will obviate losses from this cause.

6. Experiments conducted at Rapley nursery have proved the great value of overhead shelter to seedbeds during a dry season. Several different types of shelter were tried such as canvas, jute cloth, lath gratings giving different intensities of shade, and split-chestnut fencing, all of which were laid on staging raised about a foot from the ground. It was found that the lath grating with one inch laths spaced half-an-inch apart and chestnut fencing gave the best results. Seedbeds covered with these two types of shelter gave a practically full germination, while in the unsheltered beds the crop was almost a complete failure. Lath gratings with the laths set one inch apart were less satisfactory than either of the above forms of shelter, while the remaining types, though an improvement on the unprotected beds, gave poor results. High shelter also was tried, birch branches being supported some six feet above the soil level so that men could work underneath. This form proved cheap and fairly effective. Apart from the efficiency of the protection given, durability and ease of handling are important points in assessing the value of a given type of shelter, and several seasons' trial will be required before any definite conclusion can be drawn. The experiments proved generally that for certain species (*e.g.*, Sitka spruce) shelter is more effective than watering in drought years.

7. Experiments on protection of seedbeds from frost were carried out at Craibstone, Beaully and Birnam nurseries in Scotland. Losses from frost-lifting are far more serious than is generally appreciated. The preliminary conclusions to be drawn from the experiments may be briefly stated as follows:—

- (a) Frost-lift varies greatly in its incidence; it is prevalent in some nurseries, but not in others, and may be confined to a particular section in a given nursery.

- (b) The winter water content of the soil and the degree and frequency of occurrence of the frosts appear to be the most important factors. Lack of drainage increases the risk of serious damage ; in nurseries where frost-lift is severe the subsoil should be examined for the presence of a pan, and if present, the pan should be broken up by subsoil ploughing.
- (c) The density of the seedlings in the bed and the methods of sowing play a not unimportant part in connection with damage by frost-lift. A thin crop of seedlings is much more liable to damage than a dense crop and drill sowings suffer proportionately more than broadcast sowings.
- (d) All coniferous species are liable to frost-lift during the first winter ; the heaviest losses usually occur in Douglas fir and Sitka spruce.

The nature and amount of protection required against frost-lift will depend partly upon the degree to which the nursery area in question is subject to damage, partly upon the species and partly upon the density of the seedlings and method of sowing. When the danger is considerable—as it is in most parts of this country—shelter will be required for thin crops of all species, and also for all crops, whether thin or dense, of Douglas fir and Sitka spruce, the two species most susceptible to frost-lift. Thin crops of these two species require in addition to overhead shelter the application of moss or humus to the beds. These measures refer mainly to seedbeds during the first season after sowing ; except in nurseries where frost-lift is exceptionally severe damage to two-year seedlings is uncommon.

8. Experiments relating to the problem of weeds in seedbeds were carried out both in England and Scotland ; treatment of the soil with chemicals led to no conclusive results. On the other hand, the nature of the soil covering was found to have considerable influence on weed growth. Sand from a sand pit, subsoil taken from a depth of 18 inches below the surface, surface soil and finely divided compost were used. The seedbeds were subsequently weeded, the time taken to weed the different sections being recorded and a measure thus obtained of the efficiency of the four types of covering from the point of view of weed growth. If the length of time required to weed the sections covered with surface soil is taken as 100, the relative figures for the other types of covering are as follows :—sand, 38 ; subsoil, 63 ; compost, 168. The figures show that by using sand or subsoil to cover the seed a considerable reduction in the amount of weeding is effected. The high figure for the compost indicates the large amount of weed seeds which are introduced in manure.

A large-scale experiment was carried out in Seaton nursery to determine whether drill or band-sown beds were cheaper to weed than broadcast beds. In the broadcast beds all the weeding was done by hand, but in the drill-sown beds, after the first hand weeding, narrow hand hoes were used between the drills. In the band-sown beds, the bands in which were 8 inches wide and 8 inches apart running the whole length of the bed, the first weeding was again done by hand, but for subsequent weedings between the bands a Planet Junior wheel hoe was used. The following table shows the result :—

Method.	Cost of Weeding per sq. yd.			
	1st Weeding.	2nd Weeding.	3rd Weeding.	Total.
Broadcast ...	Pence. 1·06	Pence. 0·44	Pence. 0·25	Pence. 1·75
Drill ...	0·97	0·50	0·26	1·73
Band ...	1·15	0·40	0·31	1·86

There was thus no appreciable difference in the cost of weeding during the first year for the three methods of sowing.

9. Investigations were started in Scotland to determine whether the season at which Scots pine cones are collected affects the germination of the seed extracted from them. Cones were collected from five woods on the Beaufort and Altyre Estates in the months of September, October, February and April. The cones were taken from the same trees at each date of collection, and all the cones were extracted on the same date in April. The operation was carried out at Beaully in Inverness-shire, and the temperature kept considerably lower during extraction than is usual in ordinary commercial practice, never rising above 104°F. The germination of the seed was tested at the Edinburgh Seed Testing Station. The result of the tests gave no evidence of any effect attributable to date of collection. A general collection of cones was also made in the same woods on the Beaufort Estate, and the cones sent to a nurseryman for extraction. The seed extracted commercially gave a germination of only 45 per cent., as compared with the average figure of 75 per cent. given by the experimental seed. Samples of both lots of seed were also sown in Beaully nursery, and it was found that the seedlings produced from the experimental seed were much superior as regards size and colour to those produced from the seed of the general collection. If, as seems probable, the difference is due to the lower temperature at which the experimental seed was extracted, a modification of the commercial practice of extracting Scots pine

seed is indicated. It is proposed to continue this line of investigation.

10. Experiments on the root-pruning of seedlings prior to lining out in the nursery were continued from the previous year, but results are not yet available. A large number of plants of different coniferous species were root-pruned in various ways at Rapley and Oxford, but the drought took a heavy toll of the more severely pruned plants.

11. As regards plantation work a number of planting experiments were started during the year in England and Wales and Scotland; the principal experiments related to problems of spacing-distance of conifers, the use of seedlings in place of transplants, the season of planting spruce in the north of Scotland, the treatment of heather-clad peaty land and the conversion of coppice areas to coniferous forest. A considerable amount of information has also been obtained from existing plantations and it is hoped to secure more.

Peat.—An investigation on peat soils in relation to tree growth was commenced by Mr. E. V. Laing in Edinburgh in 1921. Most of the work done up to the end of September has been of a preliminary character. A careful study of existing literature on the subject has been made, and some field and laboratory work carried out. Two areas in the West of Scotland, Corrour in Inverness-shire and Inverliever in Argyllshire have been selected as suitable centres for the field work and an initial study made of the roots of trees growing on peat, while a botanical and sylvicultural survey of the areas has also been accomplished. Experimental work in the laboratory dealt with the concentration of dissolved substances in water flowing through peat and on the toxic action of heather upon spruce plants growing among it.

Insect and Fungus Pests.—Research on the Douglas fir seed fly (*Megastigmus spermotrophus*) proved that the insect lays its eggs in the young cones when these are still in the earliest flowering stage, subsequently the grubs bore into and totally destroy the contents of the seed. A special investigation into the occurrence and biology of *Chermes cooleyi* was begun in November, 1920. The life history of the insect had previously been studied in Vancouver, but very little was known about it in this country. Within recent years it has appeared in considerable numbers on the Douglas fir and it was feared that serious damage might be done to that tree as well as to the Sitka spruce on which in British Columbia the insect also occurs. Fortunately the results of the present investigation appear to prove that the destructive gall-form on Sitka spruce does not exist in this country, and that, although attacked, Douglas firs do not succumb to the pest. To prevent the insect's further dispersal, measures for dealing with infected nursery stock have been devised. The Commissioners intend shortly to publish a full report on the subject.

Further progress was made with the survey of British forest insects—work which was begun in 1919. During the past year particular attention was paid to bark-beetles, which have proved extremely destructive in our woods. Experiments on the pine weevil *Hylobius abietis* were continued with the object of finding out the best measures to adopt in reducing the damage done by this insect. These resulted in demonstrating the efficacy of bark-traps as compared with hand-picking and showed that decoy billets and pit-traps tended to prevent the migration of the weevil from its breeding ground. Although progress was made in the investigation it is evident that much still remains to be discovered and the experiments are being carried to a further stage.

Some attention has also been paid to chermes on silver fir. Minor investigations have been made regarding the pine and spruce aphides, the pine wood-boring beetles and insects harmful to poplars.

Two post-graduate students obtained permission to work under the direction of the Entomologist at Kew. Mr. D. J. Atkinson carried out research on the bark-beetle *Tomicus laricis* prior to his taking up duties in India as an Assistant Field Entomologist in the Indian Forest Service. Mr. R. C. Fisher studied at Kew for three months in the summer, when he worked on the poplar sawfly, *Cladius viminalis*.

Planting Procedure.

In view of the high costs of labour and material, the Commissioners appointed a "Co-ordination Officer" to study methods and procedure in planting operations with special reference to securing economy in the employment of labour. The whole problem is somewhat complex, as initial cheapness does not always mean cheapness in the long run. The first cost of planting can readily be reduced, for example, by wider spacing, the use of smaller plants and simpler methods of putting the plant into the ground, but deaths, increased weeding costs and a slower rate of growth may turn the apparent gains into a loss.

In the investigation extensive use was made of the time-study method, which the following example illustrates. It was found that an unsatisfactory gang of planters, whilst planting steadily, dealt with plants at the rate of three in two minutes, or 90 per hour per man, and that each man was on the average planting 450 trees in the nominal (8-hour) working day. They were therefore doing, in effect, five hours' useful work per day, the remaining three hours being lost time. Upon further examination it was found that the three hours were occupied as follows :—

Lost time per man per day :—

(i) Walking to and from meals ...	40 minutes.
(ii) Walking time (between finish of one line and commencement of next)	30 „
(iii) Time (additional to (ii)) spent in setting pickets to assist in keeping lines straight	30 „
(iv) Delays at beginning and end of lines	30 „
(v) Various delays (waiting for plants, resting, smoking, talking, &c.) ...	50 „
	3 hours.

The above items were then attacked singly and waste eliminated so far as possible ; *e.g.*, a portable shelter allowed the men to take their meals near their work, they were trained to work without pickets, and so on.

Having thus secured that the maximum time is spent in useful work, it remains to secure that operations are carried out at the highest possible speed compatible with good work. Time-analyses by means of a stop watch reveal the percentage time spent on each phase of an operation, and can be employed to ensure that increased speed is not obtained merely by scamping any one phase. An example from an analysis of planting work illustrates this point. In most planting operations there are four phases :—The removal of the turf, the opening of the ground, the insertion of the plant, and the firming ; then, after the time spent in taking up a position for the next plant, the cycle recommences. The following times for the best and worst men of a gang judged by the quality of their work are interesting :—

TIMES PER PLANT : (Seconds).

	Surface Preparation.	Opening Notch.	Inserting Plant.	Firming Plant.	Walking.	Total.
Best Man ...	9.4	5.7	5.3	4.9	15.7	41
Worst Man ...	7.0	6.1	3.2	2.8	21.9	41

It is obvious that the worst man was taking his time between plants, and therefore had to scamp the planting work in order to keep pace with the gang. Observations of this kind over a hundred or more plants also enable different planting methods to be critically compared. In doubtful cases, *e.g.*, whether it is better to remove turf at time of planting or previously, time-analysis figures can be used to determine the relative cost.

The main operations reviewed have been nursery work, planting and preparation of ground (for planting).

Organisation for Planting.—Under the methods of planting commonly adopted by the Commissioners, and under average conditions, the best results are secured by dividing the planters into small self-contained units, of five to ten men under a responsible leader or “ganger,” with boys (two or three per gang) to keep the men supplied with plants. The latter then give their full and undivided attention to the actual planting; the boys fetch bundles of plants from small dumps (one every two or three acres) established in advance, and supply plants to the planters as required, meanwhile carefully protecting the bundles so that the roots do not become dry. Except in the early stages of an operation, all cumbersome aids to accurate alignment and spacing are dispensed with. Inexpert labourers, if well led, rapidly learn to keep the rows sufficiently straight and to keep the error in the number of trees per acre below 5 per cent.; the expenses of greater accuracy can only be justified when a corresponding reduction in weeding, cleaning, or extraction costs is anticipated. The planting organisation most generally adopted is that in which the planters advance in echelon; a good man leads the gang, judging his direction and spacing from a line of planted trees, which he parallels, other workers following behind, each man one row further over than and one plant behind his neighbour. If the ganger is on the rear flank of the gang he can supervise and control the work of each member.

Size of Plant.—The Commissioners commonly employ small transplants (three or four years old) and the resulting advantages, such as fewer failures and lower cost of plants and planting, are considered to counter-balance any additional costs involved in the preparation of ground and in the subsequent tending of the plantation. It is noteworthy that in one area, where very steep hillsides are being planted, the cost for distribution of plants, from nursery to planters, was reduced from 6s. per acre to 6d. per acre by the substitution of small for large plants, the smaller plants having, if anything, succeeded better than the larger.

In clearing ground for planting the tendency for men on day work is to overdo the clearing. It is found that men generally work best in gangs of from three to six, working in parallel swathes, and burning (if weather is favourable) as they cut. It is essential that workers appreciate, and work to (without exceeding) that precise degree of clearing judged necessary, in consideration of the size of plants to be used, and similar factors.

Spacing of Plants.—The faster-growing species, in good situations, are generally spaced six feet apart, spacings of from five to five and a half feet predominate, whilst in poorer situations, and with Scots pine or Common spruce, four to four and a half foot spacings are usual. It has been considered that, with the

wider spacings, any loss in the quality of the timber is offset by the reduction in initial expense and in the cost of early thinning operations.

Method of Planting.—Under existing conditions it appears that the use of the cheaper planting-methods such as dibbling and notching (with spade or mattock) results in a saving on labour-costs which more than equals such gain from enhanced growth, or reduction in subsequent tending costs, as might result from a more elaborate planting method; the main exceptions to this rule occur in places where, if a better planting-method be adopted, the cost of preliminary preparation of ground can be correspondingly reduced. In many cases the percentage of failures attributable to inefficient planting has been negligible and better results could hardly have been achieved, no matter what planting method had been used, whilst in others the increased cost of a better planting-method would not have been justified by the resultant reduction in beating-up costs. Experience has emphasized the importance of conducting carefully arranged experiments to determine for each area the most suitable planting-method and the precise pattern, shape, and weight of tool to be used, and of instructing planters in their use. Many of the tools on the market are not suitable for efficient planting work, while custom often stands in the way of introducing tools more suitable than those locally in use.

Nurseries.—In nursery work savings have been effected by employing the best of existing tools, by the introduction of labour-saving devices, and generally by the more careful handling of plants. The advantages, both as regards quality and quantity of work, of the transplanting lath for lining-out in suitable soils, have been amply demonstrated, the use of wheeled cultivators is now almost universal, and the use of the plough is increasing. As in the case of clearing ground for planting, there is frequently a tendency to overdo certain nursery operations such as weeding.

Piece Work.—The above remarks refer mainly to estates where day-labour is used; experience shows, however, that almost all forest work can more economically be done “piece-work” or contract. This especially applies to fencing, preparation of ground for planting, and the lining-out of seedlings; even notch-planting has been successfully done by piece-work and it appears that if the work is efficiently supervised its quality does not suffer, but, on the contrary, may even be improved; this may be attributed to the workers’ additional care, lest they should be made to rectify unsatisfactory work without remuneration.

Sub-head J.

Agency and Advisory Services : Expenditure £18,226.

Agency Services : Expenditure £13,300.—Under this head is included expenditure in respect of areas in Ireland acquired by the Department of Agriculture and Technical Instruction for

Ireland either by Parliamentary Votes or through the Development Fund. The direct expenditure amounted to £9,557, and the allocated expenditure £3,743.

Advisory Work: Expenditure £4,926.—The expenditure under this head is represented by the time and travelling expenses of the Commissioners' officers engaged in giving technical advice to forest owners (including the Crown woods under the technical supervision of the Commissioners). Municipal authorities and private owners who have applied to the Commissioners have received assistance in connection with schemes of management, the planting of forest land, the formation of nurseries and the treatment of existing woods as regards forest protection and thinning.

It is considered that this advisory work is of much importance as it enables the Commissioners to keep in touch with owners of woodlands, and much useful work is being done in promoting forestry on public lands and private estates throughout the country. Particular mention may be made of the advice given as to protection against destructive insects and fungi, the number of requests for information of this kind having increased considerably during the year under review.

Sub-head K. Special Services : Expenditure £3,850.

Under this head is included the cost of publications, census of woodlands, the Consultative Committees, exhibits at Agricultural Shows and similar items. Details of expenditure are given in Table K below :—

Table K.

Analysis of Special Services. (Table IIA, Col. K.)

Year ending Sept. 30th.	Consultative Committees' Expenses.	Portion of Education Officer's Salary chargeable to Publications.	Special Enquiries.	Allocated Charges of Staffs of Asst. Commissioners and Divisional Officers.	Total.
	£	£	£	£	£
1921	267	660	132*	2,791	3,850

* Census of Woodlands and Exhibits at Agricultural Shows.

Publications.

The publications issued by the Commissioners during the year ended 30th September, 1921, were as follows :—

Leaflet No. 2.—*Chermes cooleyi*, giving a brief account of this chermes as it occurs on the Douglas fir in this country.

Leaflet No. 3.—Pine Shoot Beetle (*Myelophilus piniperda*). The life history of this insect is given, together with measures of prevention and remedy against attack.

Leaflet No. 4.—Black Pine Beetle (*Hylastes ater*). This is one of our most destructive bark beetles; a description is given of methods recommended for combating the pest.

Leaflet No. 5.—Conifer Heart Rot (*Fomes annosus*). A common cause of decay in the timber of larch and spruce trees.

Leaflet No. 6.—Honey Fungus (*Armillaria mellea*). A root parasite destructive to conifers.

Leaflet No. 7.—Chermes attacking spruce and other conifers. The damage caused by various species of chermes is described and measures which may be taken to keep them under control are indicated.

British Yield Tables.—These tables are reproduced for field use from Bulletin No. 3 of the Forestry Commission.

First Annual Report of the Forestry Commissioners.—Being the report for the year ending 30th September, 1920.

Report of the Inter-departmental Committee on Imperial Forestry Education. (Cmd. 1166.)

The Commissioners desire to acknowledge the assistance rendered by the Royal Scottish and Royal English Arboricultural Societies in the distribution of leaflets.

Census of Woodlands.

The proposal to make a census of the woodlands in the United Kingdom is part of a larger plan of determining as accurately as possible the forest resources of the British Empire, which was decided upon at the Imperial Forestry Conference in 1920. As regards the United Kingdom it is particularly desirable that the full extent of the fellings made during the war and of the remaining timber, and the rate at which felled areas are being replanted, should be determined. Censuses made in the past, while interesting, have failed to carry conviction owing to the uncertainty of the degree of accuracy with which they were conducted.

The questions of the classification of woodlands adopted and the method of procedure were discussed with the Ministry of Agriculture, the Land Valuation Department and the

Consultative Committees, and the following classification was decided on :—

CENSUS OF WOODLANDS.

	Age Classes.					Total.
	1 to 10 Years.	11 to 20 Years.	21 to 40 Years.	41 to 80 Years.	Over 80 Years.	
	Acres.	Acres.	Acres.	Acres.	Acres.	
I. ECONOMIC OR POTENTIALLY PRODUCTIVE						
Conifers						
Mixed Conifers and Hardwoods ...						
Hardwoods ...						
Total ...						
Coppice, and coppice with standards			
Scrub
Felled, and /or devastated
II. UNECONOMIC (INCLUDING AMENITY WOODS, SHELTER BELTS, PARK TIMBER, &C.).						
Total	

The procedure has been on rather different lines in different parts of the United Kingdom. In England and Wales sub-committees of the Consultative Committees have undertaken to carry out an experimental census of two counties in each country. A similar method has been adopted in Ireland. In Scotland the work is being done by the Commission's officers and local correspondents.

The Commissioners desire to thank the gentlemen who are taking part in the census.

Forestry Exhibits at Agricultural Shows.

Forestry exhibits were prepared by the Commissioner's officers for use at the agricultural shows of the Royal English Agricultural Society at Derby and the Bath and West of England Society at Bristol.

Consultative Committees.

The Consultative Committee for England held three meetings during the year, the Committees for Scotland and for Wales each met four times and the Committee for Ireland twice. A number of sub-committee meetings were also held.

The Chairman of the Commission and other Commissioners have from time to time attended meetings of the Committees.

During the year the following matters have been referred by the Commissioners to the Committees for their advice and assistance :—

1. The collection of statistics as to the area and constitution of the woodlands of the United Kingdom.
2. Publications and propaganda.
3. Protection of woodlands from fire.
4. Utilisation and marketing of home-grown timber and other forest products.
5. Schemes in relief of unemployment.

Members of the Committees have been in frequent communication with the Assistant Commissioners regarding areas suitable for planting schemes and other matters, while the following additional subjects were considered by some of the Committees and suggestions thereon forwarded to the Commission :—

Railway rates for timber.

Shelter belts.

Higher forestry education.

In June representatives of the Committees attended a conference with Commissioners regarding the collection of forestry statistics. Some members of the Committees have paid visits of inspection to certain of the Commission's areas.

The Commissioners regret to report the death during the year of Mr. W. A. Haviland, a member of the English Committee, and Mr. James A. Duthie, a member of the Scottish Committee. The Earl of Granard, a member of the Irish Committee, resigned on the 25th of April, 1921.

The following additional members were appointed during the year :—

Name.	Date of Appointment.	Committee.
Capt. Sir Beville Stanier, Bart., M.P. (since deceased) ...	2nd April, 1921 ...	England.
Christopher H. Turnor, Esq. ...	23rd April, 1921 ...	England.
Alexander Robson, Esq. ...	22nd April, 1921 ...	Scotland.
H. L. Bland, Esq., D.L. ...	23rd June, 1921 ...	Ireland.
R. Treseder, Esq. ...	5th February, 1921 ...	Wales.

Sub-head L : Receipts £29,149.

Details of receipts for 1920 and 1921 are given in Table L.

Table L—Receipts. (Table II. Col. L.)

Year ending 30th Sept.	Interest on Investments.	Sales of Land, Buildings, &c.	Rents.	Forest Produce.	Agency and Advisory Services.	Other Receipts.	Total.
1920	£ 2,458	£ 315	£ 118	£ 8,693	£ —	£ 645	£ 12,229
1921	10,748	—	3,891	10,262	1,511	2,737	29,149
Total	13,206	315	4,009	18,955	1,511	3,382	41,378

Relations with other Departments.

The Commission's officers have continued to exercise supervision over technical work in all the important Crown forests, with the exception of Windsor Woods. The position, which remains as described in the last Annual Report, is admittedly unsatisfactory to all parties.

The Commissioners are continuing to finance operations on the properties acquired by the Development Commission in Ireland, and to meet further forestry expenditure which formerly fell to that Commission. For reasons explained in the last Annual Report, this arrangement is also unsatisfactory and requires amendment in respect of finance.

The Department of Agriculture and Technical Instruction continued to act as Agents for the Commission for forestry work in Ireland.

The Drought of 1921.

From the tree planter's point of view the outstanding feature of the year 1921 was the drought. Meteorological statistics show that measured in terms of the average annual rainfall, the precipitation for 1921 showed considerable variation in different parts of the country. Generally speaking the west of Scotland received from 100 to 120 per cent. of the average; in the rest of Great Britain the figure was well below the average, but increased in England from S.E. to N.W. and in Scotland from E. to W. It will thus be seen that the greatest deficiency in the rainfall occurred in the districts where even in ordinary years the rainfall is low. In comparison with the normal precipitation of 20 to 25 inches in the south-east several stations recorded only 12 inches, and a few even less than 10 inches in the year. With the exception of a small area in the Pennines there was a deficiency in nearly all parts of England and Wales of more than 40 per cent., there having been no such records for about seventy years. The rainfall in London for example was the lowest for a century and a half. In many

previous seasons there have been spells of dry weather which have done damage, but the remarkable character of 1921 was the persistency of drought conditions extending from the beginning of February until November. The average monthly rainfall for the twelve months of 1921 at the stations nearest to the areas on which losses of plants occurred are as follows :—

	Inches.
January ...	4·03
February ...	0·30
March ...	2·36
April ...	1·16
May ...	1·81
June ...	0·36
July ...	0·91
August ...	2·97
September ...	1·64
October ...	1·66
November ...	2·50
December ...	2·61
Total	22·31

Spring planting, on which the Commissioners mainly had to rely suffered severely. The soil was already dry by the end of April and received on the average during the next three months, when the young plants needed moisture for active growth, only about three inches of rainfall. Such rain as fell in August was too late to save the plants. Not only was there remarkably little precipitation throughout the year, but the temperature was also maintained at a very high level, the heat being accompanied by drying winds which greatly increased evaporation and put a further strain on plants struggling against the drought. At Kew, for example, from July 9th to 20th the thermometer registered over 85° on eight days, and on three days 90° or more, and every month except November had a mean temperature in excess of the average. Conditions over a great part of England were particularly trying during the critical months of early summer, namely, April to July, while the drought of June appears to have been quite unprecedented in its intensity.

As regards Scotland, the Western Highlands did not experience prolonged drought, but the season was unusually dry elsewhere, especially in the south-east. The average loss in plants however was small, being only about 5 per cent., and in fact it was noticed that in many parts of Scotland the accession of heat in midsummer had a favourable effect on tree growth.

In Ireland the drought was not pronounced, the precipitation being at least 80 per cent. of the normal and sufficient during the summer to maintain tree growth in most districts.

In England and Wales, where the full force of the drought conditions was felt, the death-rate among newly planted trees

was very high indeed, 3,725,000 (35 per cent.) died out of the 10,559,000 planted. Of these deaths it is estimated that no less than 2,632,000, or 25 per cent. of the total number planted, are directly attributable to drought, the mortality among the different species used being as follows :—

Japanese and European larches	...	49	per cent.
Douglas fir	... ..	32	„
Corsican and Scots pine	... ..	26	„
Norway and Sitka spruces	... ..	9	„
Other species, including hardwoods	... ..	8	„

In many cases the young trees failed to develop at all, as they did not take root in the dry soil ; more frequently, however, they made a start, but owing to the long continuance of drought they withered away. Forest nurseries were less severely affected than might have been expected, but even there the germination of seed was much delayed or proved a failure. Seedlings lined out from crowded seedbeds also died in large numbers, but transplants of the previous year did not suffer to any extent where the soil was kept properly cultivated.

In forming plantations failure or success has depended more on the type of plant used (*i.e.*, on age and size), than on any other factor. Seedlings proved less resistant to drought than transplants ; this applied particularly to Douglas fir and Scots pine. Small transplants of all species accommodated themselves to circumstances better than any other class of plant, the resistant qualities of two-year-one-year Scots pine being especially noticeable. The loss among plants from overgrown nursery stock was not so high as might have been expected. An interesting experiment in the direct sowing of Maritime pine seed was made at Rendlesham, Suffolk, where 30 acres were successfully sown, the quantity of seed used being at the rate of 1½ lbs. per acre.

As regards the effect of different methods of planting there is evidence that with heavy soils the mortality was greater where the notching system was adopted owing to a tendency of the notches to open and expose the roots.

The results in regard to species are given above, and it will be noted that the spruces which are usually recognised as most susceptible to drought have suffered less than other conifers. Three-fourths of the deaths among the larches occurred on two estates where conditions were singularly unfavourable.

Plantations formed on clayey soils suffered more severely than others, owing to the contraction of the soil. At Apethorpe, for example, the clay dried to such an extent that it fissured in all directions. Some of the cracks measured as much as six inches wide and three feet deep and completely engulfed plants. Deep sandy soils, on the other hand, yielded better results, owing no doubt to moisture being supplied by capillary action from considerable depths. As might be expected, areas with

a southern aspect were much more seriously affected than those facing north or east. The protection afforded by bracken, broom, coppice shoots and the like saved many young plants from injury. It was observed, however, that weed growth of this kind had to be removed after midsummer, otherwise the shade was harmful in its effects.

Judging from reports which have reached the Commissioners it is feared that the losses on private estates equal those on the Commission's areas. It is highly improbable, however, that a summer of such an extraordinary character is likely to occur again for many years to come ; moreover, the experience of the Commission proves that much may be done to minimise the evil effects of drought by the use of the right type of plants and by taking due care at the time of planting. It is satisfactory to note that the Commission's plantations formed in the previous year have not suffered from the drought to any appreciable extent.

(Signed) LOVAT (*Chairman*).
 F. D. ACLAND.
 CLINTON.
 L. FORESTIER-WALKER.
 T. B. PONSONBY.
 R. L. ROBINSON.
 W. STEUART-FOTHRINGHAM.
 J. STIRLING-MAXWELL.

A. G. HERBERT (*Secretary*),
 22, Grosvenor Gardens, S.W.

June, 1922.

IMPORTS OF TIMBER, WOOD MANUFACTURES AND PULP OF WOOD.

Details of imports are stated in the table below, in which the quantities and values for 1920 and 1921 are compared with the averages for the two 5-year periods 1909-13 and 1914-18. The decreases in quantities for the year 1921 are particularly striking.

Description.	Quantities (thousands).				Values (thousands).			
	Average 1909- 13.	Average 1914- 18.	1920.	1921.	Average 1909- 13.	Average 1914- 18.	1920.	1921.
				TIMBER.				
				Loads.	£	£	£	£
HEWN-HARD—								
Mahogany ...			52	38			1,839	795
Walnut ...			2	} 36			47	} 788
Oak ...			20				488	
Teak ...			6				308	
Other sorts ...			34				793	
HEWN-SOFT (Fir, Pine, Spruce, &c.)	542	129	229	131	1,353	583	2,745	1,019
SAWN-HARD—								
Mahogany ...			16	6			687	168
Walnut ...			4	} 168			113	} 3,683
Oak ...			65				2,016	
Teak ...			51				2,770	
Other sorts ...			147				3,631	
SAWN-SOFT—								
Deals and planks			2,725	} 2,058			31,481	} 13,580
Boards ...			791				9,643	
Other sorts ...			413				4,773	
PLANED OR DRESSED—								
Floorings ...			285	} 236			4,021	} 2,041
Matchings ...			41				588	
Other sorts ...			56				891	
OTHER DESCRIPTIONS—								
Pit props ...	2,944	1,673	2,004	1,297	3,510	4,425	9,369	3,224
Staves ...	161	71	156	51	795	648	3,641	1,409
Sleepers ...		130	218	322		602	2,345	3,252
Veneers and Panel wood ...			1	1			86	56
Not elsewhere specified ...	6,557*	3,550*	4	2	21,903*	24,362*	70	24
Total unmanu- factured timber	10,204	5,553	7,320	4,346	27,561	30,020	82,145	30,039

* These figures apply mainly to sawn softwoods. It is not possible to differentiate according to the various categories enumerated above owing to a change in the Board of Trade classification for 1920 onwards.

Description.	Quantities (thousands).				Values (thousands).			
	Average 1909- 13.	Average 1914- 18.	1920.	1921.	Average 1909- 13.	Average 1914- 18.	1920.	1921.
			WOOD MANUFACTURES.					
Furniture & cabinet ware	—	—	—	—	416	115	926	441
Builders' woodwork (window frames, doors, &c.) ...	—	—	—	—	180	62	294	405
Chip boxes ...	—	—	—	—	—	—	11	} 4,076
Tool handles ...	—	—	—	—	—	—	340	
Domestic woodware (bread-platters, trays, washboards, &c.)	—	—	—	—	—	—	321	
Not elsewhere speci- fied	—	—	—	—	2,099	1,821	6,739	
Total manufactured timber	—	—	—	—	2,695	1,998	8,631	4,922
			PULP OF WOOD.					
Pulp of wood ...	Tons. 859	Tons. 682	Tons. 1,094	Tons. 591	4,058	7,915	29,501	12,631