1916.

NEW ZEALAND.

DEPARTMENT OF LANDS AND SURVEY.

STATE NURSERIES AND PLANTATIONS

(REPORT ON).

Presented to both Houses of the General Assembly by Command of His Excellency.

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REPORT.

SIR,— Department of Lands and Survey, Wellington, 1st May, 1916.

I have the honour to forward herewith the annual report of the Forestry Branch of this Department.

The matters of chief interest in connection with last year's operations and future proposals may be summarized as follows:—

TREES RAISED AND AREA PLANTED.

During the year ending on the 31st March, 9,122,000 trees were raised at the four State nurseries. During the same period 5,485,450 trees were sent out to the various State plantations and 410,050 to outside places.

In the six plantations in which there was still planting-land available a total area of 2,677 acres was planted. This is the largest area yet planted in one year.

PRISON LABOUR.

No work was done by prison labour in the South Island. At Rotorua the average number of prisoners employed was 34·61, being rather larger than during the previous year; but work could have been found for more men had they been obtainable. The total value of the work done at Rotorua by prison labour during the last twelve months was £3,502 8s. 3d., which brings the total value of tree-planting work done (since 1904–5) in the North Island by prisoners to £41,366 12s.

EXPENDITURE.

The expenditure for the year was £30,413. Of this £8,000 was derived from the Consolidated Fund, £1,000 from the vote for State assistance in tree-planting by farmers, and the balance of £21,413 from the sales of timber.

WEATHER-CONDITIONS.

The weather experienced in both Islands during spring and summer was drier than even in the previous year, and at some of the stations there were considerable losses with the young trees.

STATE ASSISTANCE TO FARMERS IN TREE-PLANTING.

The Government's proposal to assist farmers in tree-planting was authorized by section 69 of the Reserves and other Lands Disposal and Public Bodies Empowering Act, 1915, and the sum of £1,000 was voted by Parliament to cover expenses in connection with raising and supplying the trees. Price-lists, application-forms, and regulations governing the matter have been issued for general information. Though the scheme was not put into operation until late in the season, 285,539 trees were distributed to 128 applicants, from whom £535 17s. 6d. was received to cover the cost of raising the trees and delivering them to the nearest railway-station. When the advantages of the scheme become fully known it is expected that a very large number of farmers will apply for trees. In addition to the great value on farms of shelter plantations, the increasing scarcity and enhanced prices of fencing and firewood timber are every year making it more necessary for farmers to plant trees to produce these requisites.

It is not, of course, expected that the planting of trees by farmers for farm purposes will add appreciably to the supply of timber that will be required for building and construction purposes. This supply, if we are not to be dependent on foreign countries, must be provided by the State, and possibly to some extent by public bodies, who may find it an advantage to grow timber-trees on water-catchment areas.

PLANTATION THINNINGS AND PRESERVATIVE TREATMENT.

It is satisfactory to report that a fair market was found for thinnings from the larch plantations at Rotorua, whilst at Hanmer thinnings from a Monterey pine plantation were satisfactorily disposed of. Owing to the present comparative abundance of native timbers suitable for mining props and sleepers, and the extremely easy terms on which these timbers can be obtained from State lands, the mining companies are generally disinclined to take larch thinnings. The supply of suitable native timbers is, however, fast decreasing, and it probably will not be long before thinnings from the plantations will be much sought for by the companies. Thinnings from pine plantations (being all sapwood), however, will not be suitable for mining or fencing purposes, and to make them suitable they will have to be treated by one of the antiseptic processes that have been fully tested in Europe and America. So far in all countries impregnation with creasote has been proved the most efficacious of all preservative methods of treatment, and, as the enhanced price of this material in Europe and America prohibits its profitable use in this country, it may be advisable that a bonus should be offered for its manufacture in this Dominion.

Grazing Sheep on Fire-breaks.

The experiment made last year of grazing sheep on the fire-breaks in the South Island plantations having proved so successful, more sheep were obtained, with the most satisfactory results, as not only was the cost of maintenance of the fire-breaks reduced, but a very handsome profit was made from the lambs and wool. When money is available it is proposed to further increase the number of sheep, as in addition to the fire-breaks there are some of the plantations in which a limited number of sheep could be advantageously grazed. It is also proposed to extend the scheme to the North Island plantations.

Shortage of Suitable Labourers.

In both North and South Island there was great difficulty in getting a sufficiency of suitable labour. This difficulty was, of course, caused by so many men having enlisted in the Expeditionary Forces.

Employment of Discharged Soldiers.

During the coming year it is hoped to employ discharged soldiers in the State nurseries and plantations. By doing this not only would regular employment be found for the soldiers, but it would then be possible to keep up to the past average the area planted for the year, even if it should not be possible to make an advance towards that area which should be planted to balance the annual decrease in our indigenous forest.

Importance of providing for Future Supplies of Timber.

On the assumption that native milling-forests yield an average of 15,000 superficial feet of sawn timber per acre for the whole Dominion, it will be seen that the 360,000,000 superficial feet (approximate) that we are now consuming are depleting our timber reserves to the extent of 24,000 acres per annum. This does not, of course, mean that to compensate for this we should plant 24,000 acres yearly, as, though there are as yet no reliable data by which to estimate the return of timber that may be expected in this country from the chief trees that are now being planted, the returns that these trees give in other countries warrant the conclusion that in this Dominion they will yield much more than 15,000 feet of sawn timber to the acre. On the other hand, most of the trees in the plantations will not have reached a size large enough for profitable sawing until many years after our native supplies have been exhausted. This Dominion will then be dependent on foreign supplies of timber at high prices, and perhaps, more serious still, this supply may be cut off by the occurrence of war. In this connection it may be stated that in England the price of timber has gone up more than 200 per cent. since the war, and is still on the rise. In Italy (a country which is very largely dependent on its foreign supplies) the rise in the price of sawn timber during the last year has been 300 per cent. The United States are threatened with a very serious shortage of wood-pulp for paper-making, as Canada is about to prohibit the export of pulp to any country except Britain, whose supplies from the Baltic States have recently been stopped. Statistics show the value of the timber imported into this country during 1915 was about £400,000. All the timber imported would grow in this country just as well as in the countries from which it was brought.

Experimental Plots in Otago.

To test the suitability for tree-growing of the country near Alexandra, in Central Otago, a small experimental plantation was made on a part of the Galloway Run. Owing to the drought and the attacks of grubs the experiment was not very successful; however, the locality will be further tested during the present year.

A similar experiment made at Omarama, where there is a better rainfall, has so far proved quite successful.

Reservation of Land for Future Planting.

The provision of suitable land for future planting is a matter demanding serious consideration. Most of the areas reserved for planting in both the North and South Island are filled up. There are 30,000 acres reserved at Kaingaroa Plains and about 21,000 acres temporarily reserved at Omarama and Benmore, but these areas are a mere trifle when it is remembered that a total area of about 700,000 acres of commercial forest is required to produce the probable amount of timber that will be annually required in about thirty years' time.

In France, which is certainly a country which has no land to spare for unprofitable use, there is an area of 24,021,587 acres of commercial forest. In spite of this huge supply France had to import, in 1913, 2,130,000,000 superficial feet of timber.

The suggestion of the Superintending Nurseryman at Rotorua that, instead of planting the whole area of the Kaingaroa Plains, it would be generally advisable and would ensure greater protection from fire to plant strips a mile wide, leaving between them strips of equal width for settlement purposes, is worthy of consideration.

On Poor Land Forestry more profitable than Farming.

European experience has proved that on poor land an established forest yields a higher interest on the capital invested and employs more men than does any form of farming on similar land. Whilst Crown lands are available, then, it is highly advisable that an area ample for our future planting requirements should be so reserved that it will be available when wanted without the payment of compensation.

The detailed and summarized reports of the Superintending Nurserymen are attached.

I have, &c.,

T. N. Brodrick, Under-Secretary.

The Right Hon. W. F. Massey, P.C., Commissioner of State Forests, Wellington.

SUMMARIES.

Summary of Operations in Nurseries during Year ended 31st March, 1916.

Name of Nursery.	Total Expenditure.				Trees in Nurseries.			
	Supervision and Clerical.	Permanent Works.	Tree-growing.	Total.	Estimated Trees raised during Year.	Output of Trees.		Estimated Number in Nurseries at 31st March, 1916.
						Trees sent to Plantations during Year.	Trees sent to outside Places during Year.	
	£ s. d.	£ s. d.	£ s. d.	£ s. d.				
Rotorua	355 0 0	451 18 10	3,510 16 9	4,317 15 7	2,605,000	3,445,530	183,161	9,096,450
Tapanui	357 10 0	49 2 10	1,430 15 7	1,837 8 5	3,227,600	874,970	77,039	6,500,250
Ranfurly	220 0 0	11 9 7	677 12 3	909 1 10	1,073,200	401,350	7,350	2,184,180
Hanmer Springs	170 0 0	240 10 8	1,054 0 0	1,464 10 8	2,221,200	763,600	142,500	3,650,950
Totals	1,102 10 0	753 1 11	6,673 4 7	8,528 16 6	9,127,000	5,485,450	410,050	21,431,830

Summary of Operations in Nurseries from 1896 to 1916.

Name of Nursery.	Total Expenditure.				Estimated Number of Trees raised.	Output of Trees.	
	Supervision and Clerical.	Permanent Works.	Tree-growing.	Total.		To Plantations.	To outside Places.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.			
Rotorua	3,984 16 8	10,264 9 7	46,417 18 0	60,667 4 3	58,459,543	48,189,749	1,173,344
Tapanui	3,373 10 0	5,076 4 6	22,818 5 11	31,268 0 5	21,068,539	13,327,398	855,320
Ranfurly	2,070 19 6	3,064 10 11	11,937 10 2	17,073 0 7	7,106,887	4,421,360	328,427
Hanmer Springs	1,584 1 10	3,062 9 6	10,637 5 7	15,283 16 11	14,968,862	9,006,225	507,940
Starborough*	423 13 3	2,756 17 3	6,075 16 7	9,256 7 1	3,059,610	1,965,095	1,094,515
Kurow*	205 0 0	2,004 18 5	860 4 2	3,070 2 7	172,460	..	172,460
Totals	11,642 1 3	26,229 10 2	98,747 0 5	136,618 11 10	104,835,901	76,909,827	3,132,006

* Nursery now closed.

SUMMARY OF OPERATIONS IN PLANTATIONS DURING YEAR ENDED 31ST MARCH, 1916.

Name of Plantation.	Trees.			Expenditure.									New Area planted.	Cost per Acre planted.			General Upkeep per Acre planted.		
	Number received from Nursery.	Number used to replace Losses.	Number planted on New Area.	Supervision and Clerical.			Formation, Buildings, Roads, Fencing.			Planting Operations.			General Upkeep.			Total.								
				£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	Acres.	£	s.	d.	£	s.	d.
North Island—																									
Whakarewarewa	1,418,800	234,950	1,183,850	783	8	0	542	15	7	3,106	12	11	1,373	7	11	5,806	4	5	796	5	7	8	0	3	8
Waiotapu	118,500	79,200	39,300	490	0	0	176	19	2	260	3	3	1,888	14	10	2,815	17	3	..	..			0	7	9
Kaingaroa Plains ..	1,562,425	182,175	1,380,250	510	0	0	660	4	8	1,745	0	0	365	12	2	3,280	16	10	1,117	2	4	3	0	6	7
Puhipuhi	345,310	345,310	..	25	0	0	..			..			806	0	2	831	0	2	..	..			0	13	10
South Island—																									
Conical Hills ..	733,940	481,325	252,615	270	0	0	60	16	4	436	14	8	1,380	18	8	2,148	9	8	137	3	11	6	0	8	11
Pukerau	111,860	..	111,860	165	0	0	143	4	0	208	15	4	121	16	0	638	15	4	63	4	3	5	2	8	10
Dusky Hill	21,800	21,800	..	205	0	0	..			..			226	13	10	431	13	10	..	..			0	10	2
Gimmerburn ..	..	..	..	10	0	0	..			..			24	14	8	34	14	8	..	..			0	4	0
Naseby	400,450	43,025	357,425	260	0	0	228	12	7	351	18	3	378	3	4	1,218	14	2	150	2	16	0	0	8	6
Hanmer Springs ..	763,600	28,900	734,700	360	0	0	216	7	10	1,037	1	7	545	12	8	2,159	2	1	410¼	2	18	10	0	4	5
Dumgree	..	..	..	..			..			..			24	2	2	24	2	2	..	..			..		
Galloway*	3,880	..	3,880	5	0	0	41	16	10	12	13	0	..			59	9	10	2	..			..		
Omarama*	4,390	..	4,390	5	0	0	36	15	4	9	7	2	..			51	2	6	2	..			..		
Totals ..	5,484,955	1,416,685	4,068,270	3,088	8	0	2,107	12	4	7,168	16	2	7,135	16	5	19,500	2	11	2,677¼	..			..		

* Experimental.

Summary of Operations in Plantations from 1896–1916.

Name of Plantation.	Trees.				Expenditure.																		Total Area planted.	Cost per Acre planted.		
	Number received from Nursery.	Number raised from Seed sown *in situ*.	Number used to replace Losses.	Total Number in Plantations.	Supervision and Clerical.			Formation, Buildings, Roads, Fencing.			Planting Operations.			General Upkeep.			Total.									
					£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	Acres.	£	s.	d.
North Island—																										
Whakarewarewa	19,630,814	109,725	3,539,143	16,201,396	5,941	13	1	6,923	14	7	28,436	6	0	16,317	15	6	57,619	9	2	7,605	4	17	7
Waiotapu	23,061,385	83,121	4,429,867	18,714,639	5,613	0	6	6,477	11	8	23,283	19	3	11,578	11	2	46,953	2	7	7,166	4	18	9
Kaingaroa Plains ..	4,839,750	..	274,925	4,564,825	1,871	2	3	4,049	6	7	4,651	2	1	941	2	6	11,512	13	5	2,259	3	4	6
Puhipuhi	2,892,352	..	1,892,352	1,000,000	1,077	9	7	1,201	16	2	3,840	11	11	5,437	10	4	11,557	8	0	1,200	5	2	0
South Island—																										
Conical Hills	10,564,476	..	1,404,780	9,159,696	2,978	9	4	2,298	0	0	14,909	7	8	10,347	3	2	30,533	0	2	3,426½	4	15	2
Pukerau	111,860	..	..	111,860	165	0	0	143	4	0	208	15	4	121	16	0	638	15	4	63	4	8	3
Dusky Hill	3,023,397	..	842,560	2,180,837	2,266	4	2	1,239	6	4	7,426	17	4	3,429	11	6	14,361	19	4	845	10	5	8
Waitahuna	42,025	..	11,500	30,525	30	9	0	61	1	1	73	8	3	63	19	4	228	17	8	11	7	10	9
Gimmerburn	936,235	..	783,339	152,896	342	16	8	514	13	11	984	4	0	842	16	6	2,684	11	1	173	5	19	0
Naseby	3,356,450	..	414,151	2,942,299	1,376	3	2	1,454	8	7	4,499	13	9	2,609	3	6	9,939	9	0	1,108	4	13	7
Hanmer Springs	8,998,400	..	1,376,989	7,626,411	2,913	18	6	4,703	11	1	12,644	1	8	4,508	11	0	24,770	2	3	2,941¾	4	17	3
Dumgree	1,679,765	..	1,110,125	569,640	931	5	0	4,198	9	3	5,762	17	2	1,572	13	4	12,465	4	9	209	*		
Galloway†	3,880	..	..	3,880	5	0	0	41	16	10	12	13	0	..			59	9	10	2	..		
Omarama†	4,390	..	..	4,390	5	0	0	36	15	4	9	7	2	..			51	2	6	2	..		
Raincliff	..	..	..	50,000	..			..			..			..			1,104	12	5	206	..		
Totals	79,145,179	192,846	16,079,731	63,313,294	25,517	11	3	33,343	15	5	106,743	4	7	57,770	13	10	224,479	17	6	27,217¼	..		

* Data not available. † Experimental.

REPORT ON THE AFFORESTATION OPERATIONS IN THE NORTH ISLAND.

(By the Superintending Nurseryman, North Island, Rotorua.)

During the past year afforestation-work has been energetically carried out, the area afforested being 1,913 acres, thus bringing the total area in the North Island under planted forest to 18,230 acres. In the Rotorua Nusery 2,600,000 trees were propagated from seed, the principal species being Corsican pine, Monterey pine, Douglas fir, yellow-pine, *Eucalyptus Macarthuri*, and *Eucalyptus resinifera grandiflora*. The number of trees raised is just about half of the normal annual production of this nursery, this being due to the necessity of curtailing expenditure in consequence of the great war now being waged in Europe. The stock of trees now in the nursery is estimated at 9,096,000. To date 58,459,000 trees have been raised, of which number 49,363,000 have been transferred to plantations, &c.

The weather experienced during the year has on the whole been good, although the hot dry weather in the month of February caused a considerable number of losses at Rotorua Nursery and also at Kaingaroa Plantation. At the other stations not only are there few losses amongst the trees planted during the winter, but the growth made is very good, this being largely due to the protection afforded by the heavy growth of bracken which came up amongst the trees.

Prison Labour.

The average daily number of prisoners employed has been slightly more than last year, and the average value of work per man is considerably greater. There is ample accommodation for twenty more prisoners at the Kaingaroa camp, and as there are abundant means of profitably employing all the men the camp will hold I would strongly urge that a special effort be made to fill the camps and maintain the number of men throughout the year. Following is the usual tabulated information concerning this class of labour :—

Summary of Prison Labour.

Year.	Waiotapu Plantation.			Whakarewarewa Plantation.			Kaingaroa Plains Plantation.		
	Average employed.	Total Value of Work.	Average per Man.	Average employed.	Total Value of Work.	Average per Man.	Average employed.	Total Value of Work.	Average per Man.
		£ s. d.	£ s. d.		£ s. d.	£ s. d.		£ s. d.	£ s. d.
1900–1	20·00*	170 0 0	8 10 0	..	..	..	..	..	..
1901–2	18·00	437 18 6	24 6 7	..	..	..	..	..	..
1902–3	22·59	904 12 11	40 0 11	..	..	..	..	..	..
1903–4	30·00	902 3 0	30 1 5	..	..	..	..	..	..
1904–5	43·00	1,562 0 0	36 6 0	11·00†	332 13 7	30 4 10	..	..	..
1905–6	42·56	2,440 8 5	57 6 9	14·19	771 8 4	54 7 3	..	..	..
1906–7	35·62	2,978 0 0	83 12 1	11·50	762 11 0	66 6 2	..	..	..
1907–8	38·64	3,878 7 6	100 7 5	15·05	1,103 5 2	73 6 1	..	..	..
1908–9	32·83	3,496 19 2	106 10 4	13·16	971 10 0	73 16 5	..	..	..
1909–10	27·81	3,164 19 2	113 16 0	10·89	789 7 6	72 10 10	..	..	..
1910–11	23·45	2,390 7 1	101 18 7	10·44	957 0 3	91 13 4	..	..	..
1911–12	17·04	1,750 5 0	102 14 3	11·16	934 19 9	83 15 7	..	..	..
1912–13	15·20	1,198 16 9	78 17 5	9·51	931 3 2	97 18 3	..	..	..
1913–14	..	..	..	11·66	1,019 17 3	87 9 4	12·36	1,113 5 0	90 1 4
1914–15	..	..	..	15·56	1,225 16 7	78 15 7	17·45	1,676 8 8	96 1 5
1915–16	..	..	..	15·38	1,717 15 11	111 13 9	19.23	1,784 12 4	92 16 1
Totals ..	..	25,274 17 6	..	..	11,517 8 6	..	..	4,574 6 0	..
Averages	30·35‡	..	68 18 9	12·72§	..	77 1 2	16·34	..	93 6 3

* One month's work. † Nine months' work. ‡ 12·08 years. § 11·75 years.

Sale of Trees to Farmers.

The scheme which was inaugurated during the year of assisting farmers in the growing of plantations and shelter-belts proved very successful, if we are to judge by the number of applications received for trees. Although the price-lists were not circulated until the month of July, eighty-five applications were received, resulting in 58,650 trees being supplied. The prices charged were sufficient only to cover the cost of growing, packing, and delivery to the Rotorua Railway-station, and the revenue received amounted to £89 9s. 3d. In the majority of cases the trees were received in a satisfactory condition; but in a few instances, where more than two days were occupied upon the journey, the eucalypts did not carry well. All the pines, with perhaps the exception of Monterey pine, can be safely transported even if the journey occupies several days; but the Monterey pine, like the eucalypts, is rapid-growing, and the soft sappy growth is liable to become heated if the plants are confined in a close case for a long period. For the benefit of farmers who cannot, owing to the distance from Rotorua, have plants safely sent it may be possible to offer seeds from which they can propagate the trees they require. If the scheme were adopted seeds would be supplied which are true to name and, as far as is possible, gathered from acclimatized trees.

Sale of Thinnings.

It is very gratifying to report that the prospects of profitably disposing of a considerable quantity of the thinnings from the plantations are much better than was at one time thought possible. During the year 400 cords of firewood and 2,500 poles for mining and fencing purposes were disposed of, the revenue received being £346 6s. Owing to the fact that only a small portion of the area thinned has been completely dealt with, it is not possible at present to submit a balance-sheet which would show the result of the transactions. The greatest amount of the material is still lying where it was felled, while some is stacked into cord-wood. Now that the market for fuel and poles is assured it is proposed to classify the material over the whole area and place it into stacks to keep it from rotting. The prices obtained for the material will cover the cost of thinning, and in all probability show a small profit over and above this. It is desirable to mention also that the freight charges which have been paid into the Railway Department as a result of these thinnings being available have amounted during the year to a very considerable sum. In addition to this the amount paid out in wages by this Department in utilizing the thinnings and by the firm who use the thinnings for drying pumice for insulating purposes was about £900. From the above figures it will be seen that the afforestation is increasing the revenue of this Department and of the Railway Department, besides providing labour for a considerable number of workmen in this district.

Firewood for household purposes is nearly always wanted in from 8 in. to 16 in. blocks, and as many inquiries have already been received for supplies, arrangements are now in hand for the procuring of a sawing plant in order to meet the demands of the market. The orders for firewood and poles now on hand and which will be supplied early in the next financial year amount to £175. Every effort will be made to maintain the business already secured and to extend it where possible.

There is no doubt but that the Dominion is already feeling the result of a diminishing timber-supply. The increase in prices during the past few years is due both to the higher wages demanded by timber-workers and to the fact that the remaining supplies are less plentiful and more inaccessible. Certain classes of firewood are now difficult to obtain, good fencing-posts are scarcer and much more costly, and farmers are now using either iron standards, concrete, or wooden posts having a comparatively short life. Large areas of new country are being settled every year, and the demand for fence-posts alone must be very great. If the few timbers which hitherto have been regarded as the only ones suitable for fencing are now unprocurable or too expensive, the difficulty could be got over by treating the softer timbers with a preservative. If creasote could be cheaply obtained the value of the thinnings from the State plantations would be immensely increased. Any soft timber sufficiently strong would, if treated with creasote, become valuable for fence-posts and like purposes, and in a few years when the trees become larger there is a probability that much of the material obtained from thinnings could be used for railway-sleepers. There is no doubt but that, if the value of creasote for preserving timbers became better known, the demand for this article throughout the Dominion would rapidly increase. If, for instance, supplies of creasote reasonably low in price were available, the Monterey pine, which is common in almost every part of New Zealand, would be increased very much in value, and a great many districts would not need to import fencing-timbers for many years to come. This would have a directly beneficial effect upon the timber problem, because by the use of this material, now regarded as worthless for fencing, the good native timbers could be made to last longer and put to uses more befitting their value. Creasote can be manufactured in the Dominion, and, considering the necessity of conserving the country's timber resources, it would seem to be advisable to assist its manufacture.

Proposals for 1916.

Assuming that funds will be available, the following planting operations are proposed for the coming year:—

Whakarewarewa Plantation.—Preparations for planting 500,000 trees are now in progress. About 400 acres will be planted with the following species: Douglas fir, Weymouth pine, heavy pine, and Monterey pine.

Waiotapu Plantation.—About 400,000 Corsican pine will be used in replacing deaths in recently planted areas. No new area will be planted.

Kaingaroa Plains Plantation.—About 2,500,000 trees will be planted on a new area of 2,000 acres, and 400,000 deaths replaced in the previous year's planting. The species to be planted are Corsican pine and heavy pine.

Puhipuhi Plantation.—The failures in trees planted last winter, amounting to approximately 20,000, will be replaced. These are *Eucalyptus resinifera grandiflora* and *Eucalyptus Macarthuri*.

General.

I have to express my appreciation of the zealous and efficient assistance given me by all officers in carrying on the work during the past year.

Attached hereto are reports on the several stations under my charge.

H. A. Goudie,
Superintending Nurseryman.

Rotorua Nursery.

Owing chiefly to the very dry weather experienced during the summer, the growth made by the young trees in the nursery is, on the whole, not quite as good as usual. Although the rainfall for the twelve months ending the 31st March, 1916, was about 16 in. greater than the previous year, the

greatest portion of this fell during the period from June to November, inclusive. The summer months were marked by a light rainfall, a high average temperature, and unusually dry atmospheric conditions.

The lined-out trees have all done well, which is largely due to the ease with which the soil between the rows can be kept scarified in order to conserve the moisture, while the trees in the seed-beds have suffered most owing to the difficulty in keeping the ground from becoming hard. The trees raised from seed during the year are all good average crops, with the exception that the Douglas-fir crop is very thick and the growth somewhat less vigorous than usual. *Pinus ponderosa* seed was procured from three sources, with the result that there are three distinct forms of seedlings. Inquiries are being made at the Forestry Bureau, Washington, with the object of localizing the various forms of this pine. The Corsican pine, as usual, has made good growth, while the Monterey pine is less vigorous but nevertheless satisfactory.

The two-year-old trees in seed-beds are all less vigorous than usual, the Douglas fir being most noticeable in this respect. The growth made by the trees is, however, satisfactory, being well ripened, thus making them well fitted for transplanting successfully. Of the experimental trees tried last year both types of the *Pinus Laricio*, variety *cebennensis* and variety *taurica*, have made very strong growth, and no difference is noticeable between the two. Both are healthy, and appear to be more vigorous than the Corsican pine. Both lots of Scots fir tried have made very poor growth, and are too small for planting permanently this year, and both are slightly affected with the aphis. The only difference noticeable so far between the two is that the Finland seed germinated better than the Norway seed.

In order to maintain the fertility of the nursery lands the vacant plots, aggregating 25 acres, were sown down with clovers and cocksfoot with very satisfactory results. It is probable that, owing to the necessity of curtailing the expenditure, this land will be allowed to remain under the clover crop for another year. In the meantime it will afford valuable grazing for the horses, and will probably give a good return in hay next summer.

As will be seen by the appended schedules, the estimated number of trees in the nursery at the 31st March was 9,096,450. The total number of trees raised since this nursery was started is 58,459,543, of which number 49,363,093 have been transferred to the plantations and other places.

The average daily number of workmen employed during the year was 25·41. Appended are schedules showing rainfall and temperature records, and particulars of trees in the nursery and those sent out during the year.

Rainfall, Temperature, &c.

Month.	Rainfall.	Number of Days Rain fell.	Temperature.		Number of Days Frosts occurred.
			Maximum.	Minimum.	
1915.	In.		Deg. F.	Deg. F.	
April	3·500	8	75	31	1
May	2·165	14	66	32	1
June	7·520	19	56	30	11
July	6·360	12	57	27	11
August	4·360	15	62	29	13
September	5·160	20	69	32	3
October	4·520	19	68	35	2
November	7·250	20	67	34	1
December	1·450	10	82	37	2
1916.					
January	2·015	13	80	40	1
February	1·310	6	82	44	..
March	3·990	13	83	40	..
Totals	49·600	169	..	..	46

Details of One-year-old Trees, sown 1915.

Name of Tree.	Number in Seed-beds.	Height, in Inches.	Amount of Seed sown.	Remarks.
Cupressus Lawsoniana	20,000	2	2 lb.	Slow growth.
Eucalyptus Macarthuri	100,000	9	3 ,,	Very good.
,, resinifera var. grandiflora	30,000	7	1 ,,	,,
Hypericum calycinum	5,000	½	2 oz.	Very slow.
Pinus Laricio	600,000	1½	66 lb.	Good.
,, ponderosa	250,000	1½	290 ,,	,,
,, radiata	100,000	5	50 ,,	Fair.
Pseudo-tsuga Douglasii	1,500,000	1	125 ,,	,,
	2,605,000			

Details of Two-year-old Trees, sown 1914.

Name of Tree.	Number in Seed-beds.	Number in Nursery Rows.	Height, in Inches.	Remarks.
Cupressus Lawsoniana	6,000	..	6	Fair.
Pinus Banksiana	1,000	..	2	Poor.
,, Laricio	4,500,000	500,000	3	Fair.
,, ,, var. cebennensis	50	..	4	Good.
,, ,, var. taurica	2,000	..	4	,,
,, ponderosa	60,000	..	6	Very good.
,, radiata	..	135,000	18	,,
,, strobus	28,000	..	1½	Fair.
,, sylvestris (Norway seed)	15,000	..	1½	Poor.
,, ,, (Finland seed)	12,000	..	1½	,,
Pseudo-tsuga Douglasii	200,000	150,000	8–12	Good.
Sequoia sempervirens	1,000	..	12	,,
	4,825,050	785,000		
	5,610,050			

Details of Three-year-old Trees, sown 1913.

Name of Tree.	Number in Nursery Rows.	Height, in Inches.	Remarks.
Cupressus Lawsoniana	400	10	Good.
Pinus Murrayana	6,000	3	Fair.
,, ponderosa var. scopulorum	800,000	3	,,
,, strobus	75,000	5	Good.
	881,400		

Details of Trees transferred to Plantations, &c., 1915–16.

Where sent.	Name of Tree.	Number.	
Whakarewarewa Plantation	Castanea sativa	70,000	
	Cryptomeria japonica	950	
	Pinus radiata	991,800	
	,, taeda	20,700	
	Pseudo-tsuga Douglasii	335,350	
			1,418,800
Waiotapu Plantation	Larix europea	52,500	
	,, leptolepis	450	
	Pinus ponderosa var. scopulorum	13,200	
	,, radiata	13,500	
	,, strobus	38,850	
			118,500
Kaingaroa Plains Plantation	Castanea sativa	15,000	
	Larix europea	15,000	
	Pinus Laricio	179,875	
	,, ponderosa	536,625	
	,, ,, var. scopulorum	394,975	
	,, radiata	2,300	
	Pseudo-tsuga Douglasii	418,650	
			1,562,425
Puhipuhi Plantation	Eucalyptus Andrewsi	100	
	,, Consideniana	100	
	,, globulus	450	
	,, Macarthuri	238,000	
	,, Muelleriana	160	
	,, piperita	100	
	,, resinifera	15,000	
	,, ,, grandiflora	91,000	
	,, Sieberiana	400	
			345,310
Run No. 24, Rangitikei	Assorted forest-trees	495	
Prisons Department, Waimarino	,,	70,000	
,, Point Halswell	Pinus radiata	40,000	
National Park, Waimarino	Assorted shrubs	156	
Tauherinikau Military Camp	Pinus radiata	9,600	
Schools, domains, and hospitals	Assorted shrubs	4,754	
Sold to farmers	,, forest-trees	58,651	
			3,628,691

Whakarewarewa Plantation.

(Assistant Forester, D. J. Buchanan.)

During the past year the planted area was increased by approximately 796 acres, making the total area now under trees 7,605 acres. In addition to this, 85 acres on which the *Eucalypti* were not making satisfactory progress were replanted, making the total area planted during the season 881 acres.

Trees to the number of 1,418,800 were dealt with: 1,183,850 being planted on new area, 234,000 to replace failures in the former year's work, and 950 were used for experimental underplanting. For the planting of new area the species used was *Pinus radiata* and Douglas fir, and the replanting of *Eucalyptus* areas was carried out with Spanish chestnut and *Pius taeda*. Favoured by moist atmospheric and soil conditions during the spring, the young plants quickly became established, and suffered no serious set-back from the dry weather which prevailed during the summer months. The results obtained with all species are excellent, and 5 per cent. will easily cover the number of failures. All the area planted was very rough country, much of it consisting of high steep faces with outcrops of rock, and the whole covered with a dense growth of bracken and small native timber. The winter months being very wet made the work of clearing much more difficult and expensive by entailing more labour in heaping the scrub for burning off than would be necessary in dry weather. Land such as this on which the native growth is very heavy requires to be well cleared before planting, otherwise the difficulty of keeping down the growth of bracken, &c., amongst the young trees is considerably increased.

The average cost of clearing per acre was £1 17s. 8d. Pitting cost on an average 11s. 10d. per thousand, ranging from 8s. 9d. for *Pinus radiata* to 23s. 7d. for Spanish chestnut; the pits for the latter—which were large plants—being open, and 2 ft. in depth, and were prepared on land on which there was a heavy growth of bracken. With the planting of the different species the cost also varied considerably, the whole working out at 11s. 8d. per thousand. The roughest part of the area was planted with Douglas fir, and as they were mostly large-sized plants the distributing of the trees for planting added appreciably to the cost of the work. After being sledged for a considerable distance a great proportion of the plants had to be packed on horseback, and in a number of places had to be carried long distances by the men before they reached the ground on which they were to be planted. For the carting of trees through the blocks, a total length of 244 chains of narrow road was formed, 129 chains being done by free labour at a cost of 26s. 2d. per chain, and the remainder by prison labour. Subsequently about two miles of road was widened to 14 ft. by prison labour, and it is intended later on to improve the remainder of it, as this will be one of the main roads through the plantation.

Contrary to expectations, a considerable quantity of larch thinnings has been disposed of during the past year. A pumice-drying company which commenced operations within a mile of the thinned block have taken out some 400 cords of firewood, and 2,000 16 ft. poles were disposed of for mining-purposes. In addition to this, smaller quantities of firewood and poles have been sold to local residents, and, as many inquiries are now being received regarding fuel and poles for farm purposes, it is expected that a much greater quantity of thinnings will be utilized during the coming year.

The sum of £840 was spent in general maintenance-work, chiefly clearing growth amongst trees, planting blanks, thinning larch, maintenance of fire-breaks, and fire-ranging duties. Owing to the small number of men employed during the past summer it has been impossible to successfully cope with the growth of bracken amongst the young trees, and an area of fully 400 acres on which practically the whole of the growth is very heavy has still to be dealt with. The maintenance of fire-breaks, which has cost a sum of £270, has been carried out by cutting, burning, and ploughing. About two-thirds of the total area under fire-breaks is ploughable, and the remainder has to be cleared by hand at least once a year. Were the ploughable internal fire-breaks sown down in grass, a considerable reduction in labour and expense in maintenance would result, and the grazing of sheep might prove a profitable undertaking. The replacing of failures amongst *Pinus radiata*, which formed the bulk of last season's planting, and amongst which, owing to the dry season, there were somewhat more than the average number of deaths, was done chiefly by free labour, and was carried out at an average cost of 15s. 8d. per thousand. The daily average number of men employed was 25·11.

Prison Labour.—An average daily number of 15·35 men performed work to the total value of £1,717 15s. The work consisted of road-formation, clearing, pitting, and planting new area, and general maintenance-work, all of which has been carried out in a highly satisfactory manner. For the coming season's operations a new area of 390 acres is now being cleared, and when this has been planted the whole enclosure will have been completed.

When the planting season is over there will probably be from three to four months' work in improving roads and in general maintenance-work, which means that after the end of 1916 there will be no further work within reach of the camp on which the prisoners can be profitably employed. It will, therefore, be necessary to shift the prison camp on to a new site by January, 1917.

Generally speaking, good rate of growth has been maintained by the older trees throughout the plantation. The *Eucalypti*, Douglas fir, and pines have done equally as well as in any former year, and the same may also be said of the larch growing on the higher ground. On the flats, however, the larch were subjected to somewhat severe frosts in the early summer, and as dry weather set in soon afterwards the trees lost a considerable amount of foliage and made little height-growth. This is especially noticeable in the oldest block, the thinning of which has been followed by two dry seasons.

Proposals for 1916.—Within the present enclosure there is still an area of about 190 acres to be planted, which will be undertaken by free labour. Prison labour will be employed in planting an area of 390 acres, which has still to be fenced, and 150 acres of which remains to be cleared. For the planting of these blocks trees to the number of 710,000, approximately, will be required, and will consist chiefly of Douglas fir, *Pinus ponderosa*, *Pinus strobus*, *Pinus radiata*, and *Eucalyptus Macarthuri*.

Following is a summary showing area in trees, &c. :—

Summary showing Area of Whakarewarewa Plantation (7,605·54 Acres in Trees).

How occupied.	Acres.
Larch	2,557·80
Pines	3,006·60
Blackwood	79·00
Eucalypti	1,468·70
Walnut	9·70
Spruce, *Picea, Pseudo-tsuga*	413·40
Birch	5·80
Alder	8·94
Poplar	1·20
Chestnut	54·40
Roads, tracks, and fire-breaks	483·23
Land unsuitable for planting, including swamps, creeks, horse-paddocks, residence reserves, and water-main reserve	1,490·23
Unplanted land	544·80
	10,123·80

Waiotapu Plantation.

(Assistant Forester, J. Mason.)

Afforestation operations have been carried out under much more favourable weather-conditions than have prevailed for the past two or three years. Rain fell on 151 days, with a total fall of 40·51 in. While this is considerably below the average, there was an abundant rainfall during the spring months, enabling the young plants to become established before the dry summer weather set in. Unseasonable frosts were fairly frequent, but not sufficiently severe to do any damage.

All the new plantings were of an experimental nature, and of the 118,500 trees received from the nursery 39,300 were utilized for this purpose. The Japanese larch were planted out on a new area at 8 ft. apart. The test is not altogether a fair one, as the only land available is poor, both as regards soil and shelter. The trees, which were a fine sturdy lot, have made very little growth, but are looking healthy enough. Weymouth pine to the number of 38,850 were used in underplanting larch and birch which had previously been thinned to about 8 ft. apart. It is, of course, too early to express an opinion as to how far this species will succeed as an underplant after the first thinning of larch, and it will probably be found necessary to wait until the second thinning is made before underplanting can be undertaken on an extensive scale. The best results were obtained on two small blocks where the larch were originally planted at 16 ft. apart with birch in between. The death-rate is practically nil where the underplanting has been carried out under the larger trees. Where the larch had been thinned without underscrubbing the pines have not done so well, but even then the losses are comparatively few. Good results were obtained from the trees planted to replace failures in former plantings; rabbits were responsible for some of the deaths in larch, but this must be expected where the young plantings adjoin fairly large trees, owing to the amount of cover afforded. The dry weather accounted for a number of deaths in the young Monterey pine, and it will be necessary to go over this area again.

The established trees have all made a good showing. The season's growth was in no way exceptional, but the absence of severe unseasonable frosts enabled the more tender species to make an uninterrupted growth. Larch and Corsican pine growing on tussock country, and Douglas fir, have probably never done better than during the past season.

Of the trees planted experimentally from time to time, the results obtained must be considered highly satisfactory, especially with those planted in later years when the available land was poor and sparsely covered with tussock and light fern, affording little or no shelter for the young trees. A few remarks regarding these trees may now prove interesting.

Acacia melanoxylon, planted in 1903, has made little or no headway excepting where sheltered by neighbouring pines, and appears to be entirely unsuitable for this locality.

Cupressus Lawsoniana is a splendid shade-bearer, and should prove to be useful for underplanting. At present it is in mixture with *Pinus ponderosa* and with *Pinus Jeffreyi*, but these mixtures are not a success, as they allow for the development of heavy side branches on the pines.

Pinus Coulteri, planted in season 1904, have made good healthy growth, showing an average height of 23 ft.

Pinus sylvestris, planted in 1904, and alongside the last-named pine, were completely killed out by the pine-aphis.

Plantings of *Pinus rigida* were made in 1904 and in 1907, and in each case splendid results have been obtained, the crops being both even and healthy; the younger trees being on an average 13 ft. high and the older 18 ft.

Two plantings of *Pinus Lambertiana* have been made, but in the open tussock country they have failed completely. Under favourable conditions the greatest height-growth for ten-year-old trees is 19 ft.

Pinus Murrayana has proved itself to be a remarkable grower, averaging 20 ft. after having been planted nine years, and in good seasons has shown an increase of over 4 ft.

Pinus resinosa in the younger state is subject, in isolated cases, to attacks by aphis. At nine years it is perfectly healthy, and averages 1 ft. height-growth for each year planted.

Pinus excelsa are a poor uneven lot, and have been repeatedly cut back by the frost.

Thuja plicata were planted in 1906 on poor soil on an exposed situation, and do not average more than 4 ft. Where sheltered and in good soil there are specimens up to 14 ft. high. As this is a shade-bearing tree it would probably prove a success as an underplant.

Three plantings of *Pinus Jeffreyi* have been made, the fourteen-year-old trees being 22 ft. At all stages they have proved to be frost-hardy, resembling *Pinus ponderosa* in this respect, but have not made the same height-growth as that species.

Pinus ponderosa, variety *scopulorum*, is fairly frost-hardy, but in the early stages is a comparatively slow grower. For five years the average growth is 2½ ft.

In sheltered situations the *Pinus teocote* continue to make strong headway, but have been killed outright in frost areas.

Pinus patula, *Pinus Massoniana*, and *Pinus Montezumae* are all making a splendid show. *Pinus Montezumae* made about 2 ft. of new growth during the past season, and will probably give the lead to the others in a few years' time. The aphis has almost entirely disappeared from *Pinus Massoniana*.

Pinus pinaster are fairly numerous in places. Evidently the seed was mixed with that of *Pinus austriaca*. The trees are healthy, with a height-growth equalling that of *Pinus ponderosa*.

An area of 135 acres of larch was thinned to about 8 ft. apart, costing from £1 0s. 3d. to £1 16s. 4d. per acre. On 34 acres the poles were carried out and stacked on the fire-breaks. The cost of this work varies according to the length of time the trees have been cut, as dry larch weighs only a fraction of freshly cut timber. A block of larch, in mixture with redwood, was thinned, and the redwood have already responded to the improved conditions and have made a splendid new growth.

A survey has been made of two areas of land adjoining the plantation which were set apart for afforestation purposes. These have been subdivided into blocks suitable for planting, and a camp will probably be established on the larger area in the near future. The available plan of the planted area is on too small a scale to include much detail, and it has been necessary to survey some of the blocks preparatory to preparing plans drawn to a 10-chain scale. The plantings on some of the older blocks are very complicated, and an accurate plan is necessary for the proper working of the plantation.

As a result of the reduction in the expenditure, only maintenance-work could be undertaken during the summer months. For obvious reasons special attention was paid to the boundary fire-breaks, and these are probably safer now than they have been for a number of years. The fire-breaks were kept in order by ploughing and disking, and where possible were widened 5 chains by cutting and burning off the growth outside the boundary-fences. As the trees become older it will probably be necessary to further extend these breaks, especially where the adjoining land is covered with fern and manuka. For a further insurance against fire underscrubbing a quarter of a chain wide will be proceeded with round the different blocks, the boundary having first consideration. After the dead branches have been carried out and burnt, the danger from fires entering the plantation will be considerably reduced. The underscrubbed areas will be widened when necessary.

An experimental burning of charcoal was made with 7 cords of larch wood. This timber is, however, too light to make a profitable charcoal.

About 15 tons of hay was harvested in good condition. Rabbits were kept in check by trapping and poisoning. This work is now being undertaken by the Fire Ranger during wet and broken weather, a thorough poisoning being given periodically. The new arrangement will probably answer the purpose quite as well as having a man permanently employed as rabbiter, and at a less expenditure. The average number of men employed during the year was 16·03. A record of rainfall and temperature is attached, and also a summary showing area of plantation and how occupied.

Rainfall, Temperature, &c.

Month.	Rainfall.	Number of Days Rain fell.	Temperature.		Number of Days Frosts occurred.
			Maximum.	Minimum.	
1915.	In.		Deg. F.	Deg. F.	
April	1·45	7	73	20	14
May	1·53	10	64	23	17
June	6·94	20	61	19	14
July	5·16	12	59	17	17
August	3·53	13	67	17	16
September	3·93	18	69	22	9
October	4·12	18	76	27	3
November	6·96	22	77	30	3
December	1·00	6	81	27	7
1916.					
January	1·13	8	82	25	4
February	0·76	7	85	34	..
March	3·00	10	83	28	1
Totals	40·51	151	..	..	105

Summary showing Area of Waiotapu Plantation (7,166·80 Acres in Trees).

How occupied.	Acres.
Larch	3,310·85
Pines	3,663·50
Eucalypti	180·50
Birch	11·95
Roads, tracks, and fire-breaks	312·30
Land unsuitable for planting, including swamps, creeks, horse-paddocks, and residence reserves	298·20
Total	7,777·30

Kaingaroa Plains Plantation.

(Assistant-Forester, R. MacRae.)

Trees to the number of 1,380,250 were planted during the year on a new area of 1,117 acres, thus bringing the total area under trees at this station to 2,259 acres. For replacing deaths in the previous year's planting 182,175 were used, but this does not represent the total failures, owing to the fact that there was an insufficient number of Corsican pine available to replace all deaths. These, however, will be replaced during the next planting season. Of the trees planted during the year, *Pinus ponderosa* has made the best growth. *Pinus ponderosa scopulorum* has, on the other hand, made very poor growth, although the death-rate in both kinds is very low—about 3 per cent. The Douglas fir have on the whole done remarkably well, and although the failures amount to about 11 per cent., these occurred chiefly among the smaller-sized seedlings. The larger transplants have succeeded best. Considering the unfavourable weather-conditions during the summer months the growth made by all the trees is very satisfactory. Many of those planted two years ago are now showing up above the tussock and scrub, and from now on the progress will probably be rapid.

An experiment was made of sowing seed of *Eucalyptus Macarthuri in situ*. Spots to the number of 36,000 were prepared at 8 ft. apart by turning over the sod and pulverizing the soil, and on each of these places a pinch of seed was sown. The germination was excellent, but owing to the drying effects of the sun and wind the seedlings, without exception, perished. The nursery which was established here for lining out seedling trees has proved most satisfactory. The plants become acclimatized before they are planted in their permanent positions, and in addition to this a great saving in cartage has been effected. It is intended to line out about two million small seedlings here next spring.

For the coming planting season the prisoners have prepared 2,400,000 pits. The planting of these will be done with rock-pine and Corsican pine chiefly. Owing to the large number of trees which have to be planted it is very necessary that the number of prisoners at the camp should be greatly increased. Failing this it will be necessary to establish a camp for free men at an early date.

The average number of free men employed during the year was 4·41, and prisoners 19·23. Following is a record of rainfall and temperature for the year, also summary showing area of plantation and how occupied:—

Rainfall, Temperature, &c.

Month.	Rainfall.	Number of Days Rain fell.	Temperature.		Number of Days Frosts occurred.
			Maximum.	Minimum.	
1915.	In.		Deg. F.	Deg. F.	
April	2·77	7	73	28	8
May	2·06	10	64	31	3
June	5·95	17	59	24	14
July	5·34	13	62	21	12
August	4·62	13	63	26	9
September	4·40	18	68	27	4
October	4·31	19	76	31	2
November	7·52	21	78	35	..
December	1·16	6	82	31	1
1916.					
January	1·23	8	84	34	..
February	2·28	9	84	43	..
March	3·00	12	81	37	..
Totals	44·64	153	..	..	53

Summary showing Area of Kaingaroa Plantation (2,259·519 Acres in Trees).

How occupied.	Acres.
Pines	1,892·807
Pseudo-tsuga Douglasii	340·176
Chestnut and Larch mixture	26·536
Roads, tracks, and fire-breaks	290·198
Unplanted land	30,805·283
	33,355·000

Puhipuhi Plantation.

On the whole very good results have been obtained amongst trees planted last winter and spring, although the death-rate, which is about 10 per cent., is somewhat higher than it was during the previous year. *Eucalyptus resinifera grandiflora* has fully demonstrated its fast-growing capabilities, the growth of the leaders in last year's planting average fully 6 in. Six different species of eucalypts were planted experimentally. In all about 1,300 trees were used, including *Eucalyptus globulus*, *E. Andrewsi*, and *E. Sieberiana*. The species named have made good growth, but all the others are complete failures.

Trees to the number of 345,310 were received from Rotorua Nursery, but of this number 49,110 were lost owing to delay in transit, the loss in this respect being much less than during the previous year. Of the trees planted, 106,200 were used upon areas previously planted with totara, 40,000 were used for replacing blanks in 1914–15 planting, and 50,000 in replacing failures in the 1915–16 planting. The planting was carried on from June to September inclusive, and the death-rate was greatest amongst those planted in June. Planting cost at the rate of 10s. per thousand.

Vigorous growth has been made by the older trees, some of which have made as much as 1 ft. vertical growth for the season. Pruning was necessary over about 400 acres of eucalypts which had been partly destroyed by fire in 1913. This work cost on the average 4s. 7d. per acre. The clearing and burning-off of 974 chains of boundary and cross fire-breaks cost at the rate of 3s. 7d. per chain. A great proportion of the fire-breaks are now widened out to 2 chains, and will average all through 1½ chains in width. In extending the width of the boundary breaks and clearing cross-breaks it was necessary to cut through fern of several years' growth, thus increasing the cost above normal. Gorse is becoming troublesome, and has cost this season £7 13s. to clear. Every effort will be made to exterminate this plant, which has spread with alarming rapidity over much valuable land in the Whangarei district.

The average number of men employed during the year was 5·78. A record of rainfall and temperature is attached.

Rainfall, Temperature, &c.

Month.	Rainfall.	Number of Days Rain fell.	Temperature.		Number of Days Frosts occurred.
			Maximum.	Minimum.	
1915.	In.		Deg. F.	Deg. F.	
April	3·53	8	70	40	..
May	4·66	13	66	32	2
June	5·00	21	62	32	1
July	6·99	14	60	32	6
August	10·37	17	62	34	..
September	9·70	13	68	34	..
October	7·68	13	70	38	..
November	2·61	8	76	40	..
December	1·05	5	84	38	..
1916.					
January	9·06	9	86	38	..
February	4·51	7	80	48	..
March	8·32	11	80	48	..
Totals	73·48	139	..	..	9

Run No. 24, Rangitikei.

The preliminary work in connection with the afforestation of this sand-drift area was commenced during August last, and although the progress made has been somewhat slow, there has been sufficient work accomplished to demonstrate the possibility of eventually controlling the sand-drift by means of plantations of timber-trees. While a large portion of this land has been fixed by natural and artificial agencies, there is a constant danger of inundation by drifting sand, owing to the uneven nature of the sandhills along the coast-line or western side. As a preliminary, therefore, to the actual afforestation-work it is necessary to create an even foredune by erecting sand-catching fences in the hollows between the sandhills. This work has been in progress continually since August, with the result that on about three miles of the coast-line sand-catching fences have been erected. The material used for these fences was got principally from the beach, which is littered with driftwood. Gorse and scrub have also been used, and, while being more easily handled and better suited for the purpose, the supplies are scarce and have to be carried for some distance. The results obtained are satisfactory. In some places the fences have caused an accumulation of sand 7 ft. and 8 ft. in depth, thus partly stopping the wind-channels and preventing much of the second line of sandhills being blown inland. As soon as the fences became buried with sand others were erected on the top of the drift and it is believed that if this process is continued the dune will in a reasonably short time attain the desired gradient to permit of the planting of marram-grass.

On a suitable place behind the sandhills an area of about 6 acres was planted with marram-grass. The portion first planted has done very well, but the later planting suffered greatly by the wind and dry weather, and cannot be considered a success.

A small experimental planting was made with twenty-six kinds of trees, and although the site chosen was on fixed sand the failures have been very great. The species which have done best are *Pinus radiata*, *Pinus densiflora*, *Pinus ponderosa*, and *Pinus austriaca*. The failures are due in many instances to the lateness of the planting and to the severe winds and dry weather following the planting. Further experiments will be made with the species which have failed by making an autumn planting in 1916. A broadcast sowing of seed was also made, and although the seed germinated well in every case, the wind and dry weather eventually killed out all the seedlings.

One man has been continually employed, and on occasions has had assistance.

The expenditure for the year ending 31st March, is as follows: Sand-reclamation work, erection of fences, &c., £160 3s.; supervision and clerical, £25: total, £185 3s.

REPORT ON AFFORESTATION OPERATIONS IN THE SOUTH ISLAND.

(By the Superintending Nurseryman for South Island, Tapanui.)

In presenting this annual report on afforestation operations throughout the South Island I have endeavoured to convey, in as concentrated a form as consistent with the importance of the subject, information that will enable you to comprehend the exact state of affairs. A glance at the meteorological charts supporting the brief reports on the various stations will convince one of the unusually trying time experienced in the raising of young trees. During the autumn, winter, and summer periods the lack of natural moisture rarely influences our work adversely if sufficient rains at fairly regular intervals are experienced throughout the spring months. An intensely dry spell extending over July, August, and September, however, so retarded the rooting process of seedlings that the prospects of even a reasonable percentage eventuating appeared unlikely. Fortunately the ensuing months were all that could be desired from a tree-raiser's point of view. Although the reduction in the working staff at a critical period permitted weed-growth to become prominent, and in fact even get beyond control for awhile, the timely employment of temporary workers saved the position, and the expected results both in quantity and type at least compares favourably with previous seasons' records. Perhaps it is noteworthy to record the experience of strong winds in a much lesser degree than ordinarily, and this fact alone will provide sufficient reason for the almost phenomenal development of certain trees specially commented upon from time to time throughout this report. What promised to be an interesting experiment with gums and poplars near Coalgate was marred by the late frosts of November, when grain crops in Canterbury were so much affected. The pines planted demonstrated their extreme hardiness; but very few of the half-hardy eucalypts recovered after their tender spring foliage had been blackened, and even *Populus deltoides* suffered severely, or was killed.

Dearth of Suitable Labour.

Since the outbreak of war the difficulty in securing suitable men for carrying on the afforestation-work has become more pronounced, and in the several districts where State tree-planting is in progress the exodus of men for the front also created a labour shortage in the farming community. The enforced unexpected release of a number of our employees during the latter part of spring, however, enabled farmers generally to improve matters by procuring the services of these temporarily disengaged men. With the advancing season's continued enlistments the labour proposition becomes still more acute, and it is indeed problematical if sufficient suitable workers will soon be available to carry through the Department's projected tree-planting scheme without interfering with those engaged in farming pursuits. Returned soldiers are being given preference when now engaging workmen; but it will be readily understood that the preliminary pitting-work on the exposed rough country now being operated upon is sufficiently arduous to tax even the sturdiest workers, particularly during winter and spring months, and the general employment of discharged soldiers at tree-planting work in wet districts cannot reasonably be recommended. Should occasion demand, however, the lighter duties of weeding, hoeing, &c., in nurseries, and easier forms of planting and maintenance-work on plantations, might with advantage be assigned to those worthy volunteers desirous of filling outdoor occupations.

During the year the daily rate of payment t workmen generally was increased from 8s. 6d. to 9s., whilst the status of seven long-service members of the staff was improved by the inclusion of their names on the official roll. Such consideration was much appreciated throughout the service.

Reservation of Land for Tree-planting.

In adherence to the proposals outlined in the previous year, inspections were made of several extensive areas with a view to their resumption or acquirement for afforestation purposes. In the Otago District provision has been made for the reservation of 21,091 acres in the following localities: Omarama, 6,230 acres; Benmore, 12,179 acres; Galloway, 1,000 acres; Greenvale, 1,682 acres: whilst other runs with leases terminating in the near future will be reported upon from an afforestation point of view as convenience permits.

For some years past the Mackenzie County Council have been operating upon a number of local Government plantation reserves, and, wishing to be relieved of the afforestation-work, and being hopeful of a more vigorous planting policy throughout the county, the Council intimated their desire for the Department to formulate a scheme and undertake the afforesting of those reserves which were considered suitable for the purpose. After inspection it was found that the block of 564 acres adjoining Lake Pukaki was the most convenient for working, and it is likely that a start will be made on this area at no distant date. Full data on the widely separated reserves has not yet been secured; but it is probable that through their isolation it will be expedient to uplift the reservation and devote the land to other purposes. Areas of private lands in Canterbury were examined, but no decision regarding their acquirement has yet been arrived at.

The importance of land-selection for forestry-work should not be underestimated. Even enthusiasts in our work are apt to deal too lightly on the question and advocate through the medium of public bodies and journals the afforesting of land from which success cannot rationally be expected. It is, indeed, a wiser policy to plant a less acreage annually on suitable country than prosecute the work with extreme vigour under unsuitable conditions. The advantage accruing from making still further provision for plantation-extension work in districts destitute of timber will be apparent, whilst little monetary loss should result from this act, as any areas so reserved could be temporarily rented in such a form as to attract prospective lessees.

Tree-raising Work.

Contrary to expectations, much success has been achieved in the raising of seedlings, some 6,522,000 of which, as per schedule appended, are estimated as representing the results of the season's sowing. From 270 lb. of seed the excellent return of nearly three and a half million *Pinus Laricio* trees is recorded, whilst equally satisfactory results have accrued from the sowing of 230 lb. of *Pinus radiata* seed, from which 1,414,000 sturdy plants were the outcome. Perhaps the outstanding germinating failure was *Pinus Benthamiana*, although the *Pinus ponderosa* seed was also much below the average in quality, a fact that was demonstrated by testing prior to the general sowing. Each nursery is now well stocked with hardy varieties that experience shows are mostly suited for general afforestation purposes on the areas available, and, provided that sufficient funds are forthcoming, a great increased output from next year can be looked for. In consequence of the high death-rate which occurred with *Pinus radiata* during last season's transplantation-work, special treatment was given this variety, with extremely satisfactory results, and in no previous year have such well-grown pines been raised. The seedlings were lifted from seed-beds, classified, and lined out with as little delay in the operation as possible. Although an extremely hardy tree when established, much care is necessary in the handling of the Monterey-pine seedlings, and usually our efforts to make preparation during the winter period for the transplanting of the species by lifting and temporarily lining-in have been too frequently accompanied by premature heating, partial decay, or other results that subsequently prohibit their successful transfer to lines. A particularly attractive lot of about 100,000 *Pinus ponderosa* might also be specially commented upon. These trees possess characteristics hitherto not shown by others grown under the same name, and by their distinctly robust development would indicate their suitability for planting on the less favourable portions of our planting-areas. Some thousands of various species of eucalypts were lined out in a similar manner to pines, and after dying back threw out strong shoots from below the surface. Unfortunately the excessively dry weather during the months of greatest sap-activity absolutely prohibited the adoption of wrenching measures, and consequently the trees have almost outgrown the size suitable for convenient handling. However, they will all be utilized for special purposes this year. Since the initiation of afforestation-work in the South Island some 28,720,078 trees of between one and four years have been used in extending State plantations, whilst an additional 2,958,662 have benefited the domains, public institutions, and farmers.

Plantation-work and General Comments on Tree-growth.

The total expenditure allocated to the general maintenance of the established plantations and extension-work reached £6,766 4s. 3d., an amount slightly in advance of that expended in the same direction during the previous year. Some 764¼ acres was afforested in addition to replanting areas over which climatic and other influences had so adversely affected the trees as to merit this treatment. During the twenty years' planting operations on 8,987¼ acres in the South Island some £96,837 4s. 4d. has been expended, as detailed in the preceding summary. From the short reviews on the various stations by local officers in charge it will be seen that generally tree-growth has been at least equal to that recorded previously. Emphasis must again be made upon the larch occupying uncongenial situations generally. The young forests during the few years immediately after planting possess a most attractive and healthy appearance, and buoy one up with rosy expectations until the pole stage is reached, when the young stand, from a combination of causes unknown when planting is undertaken, contract mysterious forms of premature defoliation; and although the "leaders" even now continue to develop with almost youthful vigour the gradual decline of the European species is anticipated. As alluded to in the last report, no further planting of European larch is contemplated until the opinion above expressed is either discounted or borne out by later observations. Recently formed pine plantations are growing remarkably well, and with the general application of the increased spacing-distance much greater progress can in future be looked for.

Extension of Grazing Proposition on Fire-breaks.

Recognizing the possibilities of curtailing cultivation-work on fire-lines and making the breeding of sheep a remunerative proposition, the grazing scheme on plantations has been gradually extended with comparatively little outlay, and although perhaps the 430 departmental sheep are quite insuffi-

cient to keep coarse herbage completely in check, it is reasonable to expect that, should the ratio of success attained from the past two seasons' breeding operations be repeated over the coming period of like duration, our flock will have assumed sufficient proportions to permit the total discontinuance of fire-break cultivation-work over certain plantations. Undoubtedly the excellent returns from the venture during the year were due to some extent to the abnormal season; but it has now been amply demonstrated that the judicious pasturing of our young forests in no way affects the progress of trees, as the animals keep almost entirely to the fire-barriers where pasture is sweeter, and excepting when sheltering are rarely found in the interior of the planted compartments. Since the initiation of the scheme some £201 16s. 8d. has been expended in the direct purchase of wethers and breeding-ewes, and for this outlay our season's credit on transactions amount to £493, inclusive of £99, being the season's proceeds from wool sold.

Improvement of Fire-barriers.

The importance of strengthening our weakest spots along the fire-barriers is not being lost sight of. Originally the value of providing each plantation with effective intersecting and marginal fire-lines appears to have been underestimated, and realizing this position it was deemed necessary to face an unexpected expenditure in widening and extending protective breaks at each plantation. At the present time a safety unit of from 250 to 300 acres is arrived at, each block being surrounded by unplanted spaces varying in width from 66 ft. to 132 ft. according to the contour of the country, aspect, and other conditions. In operating upon rough hills abounding in rocky outcrops it is extremely puzzling to solve the fire-break problem. Where horse-work is impracticable the expenditure necessary to annually remove tussock and other coarse vegetation from a 2-chain barrier amounts to almost a prohibitive figure, and in such cases a discreet lessening in width is the only alternative.

Unfortunately the year's operations were marred by the destruction through fire at Hanmer Springs of about 30 acres of plantation about fourteen years old, consisting principally of *Pinus austriaca*. The fire originated on an adjoining property, and it was only by the timely and sustained efforts of the fire-fighters that a very much larger loss was averted. The depots containing fire-fighting apparatus installed about a year before proved of immense value and justified the small expenditure devoted to their establishment. Negotiations are now proceeding for the recovery of compensation from the owners of the land on which the fire originated.

During the year an approximate £205 was expended in the cultivation (both horse and manual) of some 310 acres of fire-lines; but, as already alluded to, the utilization of sheep was the chief means of keeping this item within reasonable bounds.

Trees for Farmers and Public Bodies.

Notwithstanding the little publication given to the fact of the Department's decision to supply farmers with a limited number of trees for specified purposes at cost price, some eighty applications for over 300,000 trees were received. This number greatly exceeded anticipations, although it was possible eventually to comply with the requests of forty-three applicants, including public bodies, who were supplied with 226,889 trees, valued at £446 8s. 3d. From communications received it would appear that a very fair measure of success has attended the individual planting, although in rabbit-infested districts still greater attention requires to be devoted to the eradication of the pest before the best results accrue. Undoubtedly *Pinus radiata* is in greatest demand for shelter-planting in districts where the minimum temperature does not affect the species; but *Populus fastigiata* and *P. deltoides* have also been much sought after from Central Otago residents. For planting on higher altitudes both *Pinus Laricio* and *P. ponderosa* were used with success, and there is no doubt that both these varieties have become established favourites among tree-planters aiming at the production of useful timber for general requirements.

In addition to the experimental work now being undertaken by the Department in various places, several farmers kindly consented to test in their districts the suitability of the different species of the *Pinus* and *Eucalyptus* genera. Such experiments involved no departmental outlay, while providing those undertaking it with interesting data on arboriculture. Of the *Pinus* family perhaps *Pinus Banksiana*, *P. Murrayana*, and *P. Taeda* are so far showing to the best advantage; but *Pinus sylvestris* in every situation tried proves a veritable harbour for the insect pest (Chermes), and does not merit further trial beyond a test above the 2,000 ft. level. Success with the eucalypts has not been general, and of the five species tested—*Eucalyptus viminalis*, *E. Macarthuri*, *E. sieberiana*, *E. piperita*, *E. Muelleri*—the two former gums have clearly demonstrated their superiority in hardiness and adaptability to trial-conditions.

In compliance with a request from the Public Works Department for our co-operation in establishing plantations in the vicinity to the recently erected power-house at Lake Coleridge, a scheme was drawn up and carried out under the supervision of a representative of this branch. From the outset it was believed that the combination of wind violence and severe frosts encountered in the Rakaia Gorge would make the complete success of operating with various trees problematical, and, although expectations have been borne out to some extent, the outcome of the season's work is indeed gratifying, and has stimulated the desire of the Public Works officials for an immediate extension of the afforestation scheme. Present indications tend to show that of the varieties planted *Pinus Laricio* and *P. ponderosa* will thrive with ordinary attention, whilst *Pinus radiata* on becoming established retains its distinction of being the fastest-growing tree under almost any conditions. Many of the trees for the coming year's planting will be taken from the small successful nursery established on the estate, and this arrangement would dispense with the possibility of a repetition of last year's occurrence in an enforced delay in delivery and subsequent heating of many of the trees. Included in the next programme of work is the improvement to the immediate surroundings of the power-house and town-

ship, and the enthusiasm of the Engineer in charge—Mr. A. R. Blackwood—will surely be rewarded in the near future by not only the presence of efficient shelter and valuable forest, but the gradual conversion of the whole surroundings from its natural bareness to an attractive spot.

Thinning of Plantations.

In our southern plantations indications are not yet sufficiently distinct to merit wholesale thinning operations being practised, and in districts where there is ample scope for the disposal of small-sized poles for fencing-stakes, fuel purposes, &c., it is not considered a wise policy to introduce the axe until natural domination is evident generally. Our year's light thinning-work was devoted principally to a small area of 20 acres at Hanmer Springs Plantation, where some 240 cords of firewood were cut from 3 acres *Pinus radiata*, 2 acres *Pinus muricata*, 9 acres *Betula alba*, 6 acres *Alnus glutinosa*, at a total labour cost of £119 14s. 6d., inclusive of haulage and stacking. Of this quantity some 48 cords were sold locally at £1 per cord, and there should be little difficulty experienced in disposing of the remainder of the fuel at an equally remunerative price. The net profit on this initial thinning transaction amounts to 10s. 2d. per cord. The *Pinus radiata* block was originally planted for shelter purposes at 4 ft. apart, and after twelve years' growth the trees have reached a height of about 35 ft., with an average girth, breast-high, of 15 in. In removing about 1,100 stems we have now 800 of the more finely developed boles per acre at a spacing-distance that will permit both girth-development and stability. To foster the expansion of laterals on the *Betula alba* marginal belts the removal of over one-half of the trees was effected, and already the wisdom of this act is apparent. There can be no doubt that our original spacing-distance—4 ft.—although in accordance with Continental practices, was excessively close for any variety planted. The fast-growing *Pinus radiata* need not even under the most disadvantageous conditions be spaced nearer than 6 ft. or 7 ft., whilst greatest success might be expected from planting other species at from 4 ft. 6 in. to 6 ft. apart. In continuation of the thinning proposition it is to be hoped that tests in timber-creasoting will be attempted in the State plantations during the approaching winter.

Willow-growing.

The importance given to willow-growing on the Continent, backed up by profitable returns from incontestable statistics, convinced me that our rural industry might be promoted by judiciously cultivating the species of the *Salix* found most suitable for local demands. Although many private tree-growers possess several varieties of the willow, and are in the position to tender valuable information regarding its cultivation, it very frequently happens that much doubt is expressed regarding the correct nomenclature of the genus. Having discussed the matter during my recent tour with Dr. Henry, of Dublin, this gentleman was instrumental in procuring for the Department the following cuttings, which have since been lined out at Tapanui and give every promise of success: twenty-four *Salix alba* (var. *caerulea*, thirty-six *Salix hippophaefolia*, thirty-six *Salix triandra* (black mauls), thirty-six *Salix triandra* (stone rods). The *Salix alba* var. *caerulea* is the true cricket-bat willow, and the value of the wood may be gauged from the fact that in England it is not unusual for cricket-bat makers to pay as high as £100 for a single specimen. The excellence of the timber for making wagon-floors, tool-handles, or for any purpose where strength combined with elasticity is required is universally known, and surely merits well-directed experiments and subsequent extensive planting of the species both by private enterprise and the State. *Salix hippophaefolia* is one of the basketmaking varieties that possess unique characteristics, inasmuch as it is believed to be the only variety with great absorbent powers. It is absolutely superior to all others when growing under sewage conditions, and for this purpose alone should prove to be immensely valuable in the Dominion. *Salix triandra* is one of the finest and mostly used willows for basketmaking, and is admirably adapted for preventing erosion along the banks of watercourses. Although basket-making is carried on fairly extensively throughout the Dominion, recent interviews with gentlemen connected with the industry show that rods of a very inferior quality are often received, and of course greatly influence the value of the manufactured article. There certainly appears to be ample scope for fostering the basketmaking industry, which, however, can only be accomplished by specializing in the cultivation of the more valuable willows. During the current season arrangements are being made to form willow "stools" on selected nursery areas, to facilitate and expedite propagation of the species, and in addition a few plants will be distributed throughout the Island to interested gentlemen willing to co-operate with the Department in acquiring data relating to the growing of the partially neglected *Salix* genus.

Experimenting with Poplars.

It is gratifying to be able to refer to the improved rate of progress made by the fringing poplar-belts on plantations. Hitherto only a very limited measure of success was attained with either *Populus deltoides* or *P. fastigiata* on high altitudes; but by cutting the young tree down to within an inch of the previous year's wood and subsequently disbudding eventuating shoots the result justifies the optimistic opinion formed of the possibilities of these fire-resisting trees.

The advantage accruing from the possession of reliable knowledge pertaining to fast-growing trees of from medium to good quality cannot be overestimated, and the decision to exhaustively test the growing capabilities of hardy poplars under contrasting conditions is worthy of adoption also in other genera, few species of which have been systematically experimented with. Dr. Henry has for years past been engaged in research work associated with the production of distinctly new trees by hybridization, and his labours have been rewarded by raising poplars entirely different in habit and rate of progress to the parent trees. Whilst in Dublin the professor kindly detailed his methods, and showed me the new artificially made specimens, the vigour of which completely outclassed their neighbours—themselves hitherto being recognized as exceedingly rapid growers. A consignment containing 276 cuttings of the following twelve varieties of poplars was received from the Kew Botanical Gardens,

England, and carefully planted out: *Populus Eugenii*, *P. tremula*, *P. alba*, *P. canescens*, *P. nigra*, *P. monilifera*, *P. angulata*, *P. regenerata*, *P. robusta*, *P. Petrowskyana*, *P. serotina*, *P. Maximowiczii*. The cuttings arrived somewhat late in the season, but were in good condition, and were freely producing rootlets throughout their length. Every care will be devoted to the wintering of the trees, although, should early frosts occur, a certain proportion of failure must be calculated upon. Similar treatment regarding stooling-ground and distribution to that outlined for willow-growing will be adopted in this case.

Trial Plantations at Galloway and Omarama.

The importance of securing data relative to the suitability of certain arid localities for the growth of trees of commercial value was strongly emphasized in last report, and in adherence to the departmental decision experiments on a comparatively small though sufficiently extensive scale for the purpose were undertaken at both Galloway and Omarama, Otago, with widely differing results. The tests were based upon official knowledge blended with criticisms and suggestions received from local tree-planting enthusiasts; and, although a recent personal inspection of each plot has been impossible, information has been received to the effect that the experiments have been of much educational value, and will surely tend to simplify future management when undertaking such work on a large scale.

Galloway Plantation.—About 1,000 acres were reserved for afforestation purposes from the recently subdivided Galloway Run, and an enclosure of 2½ acres, consisting of a uniform undulating surface, made for tree-testing purposes. Some 3,880 trees of the following—*Pinus Laricio*, *P. ponderosa*, *P. austriaca*, *P. radiata*, *P. muricata*, *P. Taeda*, *P. patula*, *P. Banksiana*, *P. sylvestris*, *P. Montezumae*, *Cupressus macrocarpa*, *Larix leptolepis*, *Populus deltoides*, *P. fastigiata*, and *Eucalyptus* varieties—from Ranfurly and Tapanui nurseries, were secured and planted under fair conditions. An inspection of the plantation by the late Under-Secretary and myself some two months after planting revealed a highly satisfactory state of affairs; but subsequently a succession of strong north-westers and a complete absence of rainfall for nearly two months has demonstrated the extent of failure that might be expected when operating upon such arid, wind-swept country during particularly dry seasons. Nor can the aridity and exposure be solely responsible for the partial failure, as on preparing the pits for the reception of trees it was discovered that the ground was infested with a grub resembling the well-known destructive grass-grub, but which, although closely allied to the genus *Odontria*, proved to be *Lewisiella modesta*, a recently discovered species. It is more than likely that in the absence of vegetation on the almost bare hillside and valley where the test is being conducted the grubs have eaten with avidity the tender tree-rootlets, a conclusion that will surely influence any future extensive planting in situations where the pest abounds. It might also be interesting to allude to the cement-like substratum that was frequently necessary to pierce in sinking post-holes and preparation of planting-holes. The result of the experiment, upon which £59 9s. 10d. was spent, will not be considered final, and during the coming spring the area will be filled up with specially robust *Pinus ponderosa* and *P. Laricio*, the two varieties now showing to most advantage.

Omarama Plantation.—A precisely similar test to the above one was conducted at Omarama, where 6,230 acres were earmarked for tree-planting during the recent subdivision of the run. Fortunately heavy rainfall with more frequent precipitations was experienced here than in the Kurow district, and the result of the experiment indicates that little difficulty will be experienced in establishing forests of fast-growing exotic trees in the locality. Moreover, the nature of the surface, over which no preliminary clearance is essential, permits rapid ground-preparation. Of the trees planted, as per schedules shown hereafter, pronounced success has been obtained with the *Pinus ponderosa*, *P. Laricio*, *P. austriaca*, *P. muricata*, *P. radiata*; whilst, contrary to expectations, poplars, larch, and gums, after showing much promise even as late at November, failed to survive the dryness of the following two months. There can be no doubt, however, that poplars will thrive under the existing conditions, and a further test of this and other trees will accordingly be conducted during the current year. An expenditure of £51 2s. 6d. was devoted to this experimental plot.

Milling of Selwyn Plantations.

Perhaps the inclusion herewith of condensed information relating to the milling operations, &c., conducted by the Selwyn Plantation Board, to which body I act as adviser, will prove of general interest to those contemplating similar work in the Canterbury Province. During the currency of an unusually severe north-westerly gale in October, 1914, several of the Board's plantations were practically ruined, and efforts have been directed principally this season in lessening the financial loss thereby incurred by judiciously converting the uprooted and broken timber into suitable sizes for building and other useful purposes. Some 328,450 superficial feet of timber was milled from the *Pinus radiata* logs. Owing to the haulage difficulties consequent upon irregular falling, heavy branching tops, &c., the cost of conversion by contract reached an average of 9s. 6d. per 100 superficial feet, a figure somewhat in excess of anticipations. The building material in all required sizes is sold at 12s. per 100 superficial feet, thus leaving only a small margin of profit. It is likely, however, that if logs were railed direct to the city mills for conversion the proposition would be more financially sound. The demand for this rough pine timber for building purposes, however, is insufficient at the present moment to merit the wholesale milling of plantations that can reasonably be allowed to stand awhile, and undoubtedly the best use to which timber from badly grown trees can be put is case-making, construction of outbuildings, &c. Throughout Canterbury well-seasoned *Pinus radiata* timber is now being used to some extent in the construction of dwellings; but it is improbable that our highly esteemed indigenous woods will be superseded for many years by this fast-growing exotic pine, which is now receiving so much attention from the State and private planters generally. The rougher portions and tops of pine logs were split into firewood by contract at 8s. per cord, of which some 250 cords were disposed at a total profit of £12 10s. Although not in keen demand for fuel

purposess, a fair market for a reasonable quantity of the wood might be expected, particularly in districts distantly situated from railway communication. The commercial outlook of general afforestation should not be judged by the results instanced above, as, in the first place, planting was conducted principally for shelter purposes at wide spacing-distances, to the detriment of the production of good boles, and, secondly, the necessity of having to dispose of a large quantity of timber irrespective of market conditions. Although the *Eucalyptus* plantations were not damaged to such an extent by the gale, a small sawing contract of mixed gums was let on royalty at 2s. per 100 superficial feet. This material is being used to much advantage in local gate-making and bridging. As might be expected, the *Eucalyptus* firewood is easily sold at 14s. per cord on the ground, and thus showing a profit of 6s. per cord over and above splitting and stacking expenses.

Notwithstanding a comparatively dry season the planting of 75,000 *Pinus Laricio*, 54,150 *P. ponderosa*, and 55,000 *P. radiata* at Ardlui Road reserve was attended with a very fair measure of success under the direct supervision of the Board's able overseer, Mr. D. McIlwraith. In addition, experiments were undertaken with *Populus deltoides* and seedling *Eucalyptus viminalis*, *E. Macarthuri*, *E. sieberiana*, *E. piperita*, *E. Muellerii*, and after success seemed assured a late frost destroyed every vestige of young foliage on the tender trees, and only a small proportion of these have since made a recovery. The experiment is to be repeated this season, when a more favourable issue is hoped for. Probably 140,000 trees will be supplied to the Board this year from Tapanui and Hanmer Springs Nurseries.

Concentration of Records and Surveying Plantations.

Record-keeping.—Towards the end of the year an official inspection of the district offices was made and a reorganization of record-keeping decided upon. It was considered that by relieving the Nurserymen in charge at Ranfurly and Hanmer Springs of the bulk of their clerical work more time would be at the disposal of these officers to carry on their more important outside duties. All imprest work and concentrated records are now kept at Tapanui, and although the office-work is increased by this new departure the introduction of specially prepared printed forms will simplify matters. Every effort will be made to carry on the office routine with the present assistance.

Surveying Plantations.—Good progress was made with the surveying of plantations, and although Ranger Leonard has completed all preliminary work in connection with Dusky Hill, Conical Hills, and Naseby Plantations, the plans unfortunately are still in an unfinished state. It is hoped, however, ere the presentation of the next report that the tabulation of records and preparation of working plans for each station will be completed, although the ascertaining of detailed expenditure on some of the earlier-planted blocks will surely be an intricate proposition. With the advancing years the compilation of reliable statistics associated with young forests becomes more perplexing, and the surveying of our Hanmer Springs Plantation should be looked upon as an urgent matter. Although much detailed information is retained there for use in the drafting of the working-plans, a satisfactory statement cannot be furnished until each block of trees is accurately defined.

General.

A gradually increasing amount of work inseparable from an expanding branch is being ably undertaken by all officers, to whom I desire to express my appreciation.

It is also desirable to place on record the names of the following employees who have joined the Expeditionary Forces: A. Barrett, R. Beresford, J. Brown, G. Burnside, E. Collins, N. Collins, W. A. Fraser, R. Gregory, S. King, P. Knowles, D. J. Lowry (killed), N. Morton, L. Rainton, C. Risk, R. Risk (died of wounds), H. J. Screen, F. Smith, J. H. Tregerthen, J. R. Tye, W. Woods.

R. G. Robinson,
Superintending Nurseryman for the South Island.

Tapanui Nursery, Otago.

(Nursery Foreman, W. T. Morrison; area, 173 acres; altitude, 500 ft.; established, 1897.)

An unusually favourable season for nursery-work was experienced during the past year, and the result generally of operations has been most satisfactory. With the exception of an exceedingly dry spell during August the rainfall was rather above the average, and an abundance of sunshine with good showers well distributed throughout the year, thus doing away with the necessity of watering seedlings—quite an unprecedented occurrence in our experience here. The dry spell in August caused a good deal of anxiety in regard to transplanting operations; but subsequent growth in almost all cases has been good, owing to timely showers occurring at the critical period. A marked feature of the season's work has been the phenomenally good results from the transplanting of seedling *Pinus radiata*, which has usually been attended with a considerable percentage of loss. Probably the late lifting and immediate transfer of seedlings from beds to lines was responsible for this improvement. The trees are a good healthy lot, and the proportion of deaths will likely not exceed one in twenty.

Raising of Seedlings.—Seed-sowing operations were commenced on the 13th October and completed on the 1st November, the actual time occupied being seven days, intervening wet weather delaying the work. The resulting crop of seedlings is rather above the average, and all have made excellent headway. *Pinus radiata* has made rather too vigorous growth for successful transplantation, and it will be necessary in following sowings of this variety to delay the operation till about the latter part of November. A second sowing made in January has met with equal success, and although the seedlings are small the result will augment the previous sowing by almost 500,000 plants. An excellent crop of nearly two million *Pinus Laricio* eventuated from 125 lb. of seed, whilst equally good results were obtained from smaller sowings of the other species tabulated below. The

total number of seedlings raised reaches 3,227,600, and, consisting almost exclusively of pines, must be regarded with much satisfaction.

Transplanted Trees.—Some 994,500 trees were lined out, this number being rather lower than that usually dealt with, the reduction being mainly due to having given up the growing of *Larix europaea*, for which the substitution of *Pinus Laricio* has not yet compensated for the loss a season or two ago. All lined-out trees have made satisfactory growth, and it is again pleasing to record that there has been no damage done by the grass-grub. The *Pinus ponderosa* transplanted two years ago have developed into perhaps the finest type of trees ever raised locally, and the *Pinus Laricio* put into lines at the same time have also developed into excellent trees for permanent planting. Several species of eucalypts were experimented with. Almost complete failure was apparent on their removal to lines; but towards the latter part of the season a large percentage made a good recovery and have since put on abnormal growth. Some 11,000 *Populus deltoides* cuttings were made during the winter period and rooted in lines for early removal to plantations.

Preparation of Ground.—All vacant nursery breaks were ploughed and sown down with oats in the spring, and, while a considerable amount of crop has been harvested from these, it is anticipated that the subsequent ploughing-in of the stubble will be beneficial in forming humus and breaking up the soil.

Horse-feed.—Some 26 acres of land were sown down in oats, which was harvested under excellent conditions, yielding about 45 tons of well-headed sheaves, part of which will be threshed and the remainder chaffed. The usual amount of rye and clover hay was also cut and stacked, and the horses should be well provided for until the following season.

Miscellaneous.—Owing to the curtailment of expenses and the reduction of staff no new works were undertaken, efforts being confined to the general weeding and maintenance of fences and all necessary repairs, &c.

Expenditure for the year amounted to £1,837 8s. 5d., and it is expected that the output of trees for the coming season will amount to 700,000.

Rainfall, Temperature, &c.

Month.	Rainfall.	Number of Days Rain fell.	Temperature.		Number of Days Frosts occurred.
			Maximum.	Minimum.	
1915.	In.		Deg. F.	Deg. F.	
April	1.92	20	75	27	7
May	3·32	13	63	24	15
June	2·96	11	55	22	26
July	1·91	12	61	23	17
August	0·58	6	62	25	16
September	1·40	12	75	23	7
October	3·82	15	76	28	3
November	4·29	15	82	30	3
December	2·64	14	78	35	..
1916.					
January	3·05	20	89	34	..
February	2·67	12	87	36	..
March	3·15	13	85	31	2
Totals	31·71	163	..	..	69

Details of One-year-old Trees, sown 1915–16.

Name of Tree.	Number in Seed-beds.	Amount of Seed sown.	Remarks.
		Lb.	
Pinus Laricio	1,950,000	125	Well-grown plants.
,, ponderosa	80,000	65	Strong plants; poor germination.
,, radiata	700,000	105	Excellent crop.
,, muricata	50,000	8	Strong plants.
,, Banksiana	25,000	2	,,
,, pinaster	8,000	3	,,
,, Taeda	600	1	,,
Larix leptolepis	300,000	12	Germinated well.
Pseudo-tsuga taxifolia	60,000	5	,, evenly.
Cupressus macrocarpa	10,000	2½	Fair.
		Oz.	
Thuja gigantea	12,000	2	,,
Eucalyptus Macarthuri	25,000	4	Good results.
,, viminalis	7,000	4	,,
Total	3,227,600		

Details of Two-year-old Trees, sown 1914–15.

Name of Tree.	Number in Seed-beds.	Number in Nursery-lines.	Remarks.
Pinus Laricio	2,220,000	10,000	Excellent progress has been made by all seedlings and lined-out trees.
,, ponderosa	..	240,000	
,, Benthamiana	..	16,000	
,, radiata	..	300,000	
,, pinaster	..	10,000	
,, scopulorum	..	10,000	
,, muricata	..	3,000	
,, Taeda	..	2,500	
,, Thunbergii	..	1,200	
Larix leptolepis	..	2,500	
Picea sitchensis	10,000	..	
Pseudo-tsuga taxifolia	30,000	..	
Cupressus macrocarpa	400	3,000	
Sequoia gigantea	300	..	
Eucalyptus Macarthuri	..	2,000	
,, viminalis	..	1,000	
Populus deltoides (cuttings)	..	11,000	
Totals	2,260,700	612,200	
	2,872,900		

Details of Three-year-old Trees, sown 1913–14.

Name of Tree.	Number in Nursery-lines.	Remarks.
Pinus Laricio	69,500	All sturdy trees, sufficiently advanced for permanent planting.
,, ponderosa	169,000	
,, austriaca	120,000	
,, radiata	27,000	
Pseudo-tsuga taxifolia	4,000	
Fraxinus excelsior	8,250	
Various trees and shrubs	2,000	
	399,750	

Trees transferred from Nursery to Plantations, &c., 1915–16.

Where sent.	Name of Tree.	Number.	
Conical Hills Plantation ..	Pinus Laricio	379,575	
	,, ponderosa	8,300	
	,, austriaca	95,000	
	,, radiata	247,575	
	Alnus glutinosa	1,500	
	Eucalyptus Macarthuri ..	1,600	
	Populus deltoides	390	
			733,940
Pukerau Plantation	Pinus Laricio	23,925	
	,, ponderosa	35,775	
	,, austriaca	13,125	
	,, radiata	19,100	
	,, muricata	7,325	
	,, patula	250	
	,, Banksiana	1,525	
	,, sylvestris	100	
	,, strobus	1,475	
	,, Montezumae	160	
	,, Murrayana	75	
	Picea excelsa	2,200	
	Cupressus macrocarpa	650	
	Alnus glutinosa	1,675	
	Eucalyptus Macarthuri ..	1,500	
	,, viminalis	1,500	
	Populus deltoides	1,500	
			111,860

Trees transferred from Nursery to Plantations, &c.—continued.

Where sent.	Name of Tree.	Number.	
Dusky Hill Plantation	Pinus Laricio	2,500	
	,, radiata..	19,300	
			21,800
Galloway Plantation	Pinus Laricio	1,100	
	,, ponderosa	800	
	,, radiata	350	
	,, muricata	250	
	,, pinaster	10	
	,, Taeda	100	
	Larix leptolepis	200	
	Eucalyptus (vars.)	200	
	Populus deltoides	400	
	Various trees	20	
			3,430
Omarama Plantation	Pinus Laricio	1,100	
	,, ponderosa	1,100	
	,, austriaca	200	
	,, radiata..	500	
	,, muricata	250	
	,, patula	6	
	,, Banksiana	6	
	,, sylvestris	6	
	,, Montezumae	6	
	,, Taeda	100	
	Cupressus macrocarpa	12	
	Larix leptolepis	200	
	Eucalyptus (vars.)	200	
	Populus deltoides	250	
	Various trees	4	
			3,940
Selwyn Plantation Board ..	Poplars	100	
	Assorted gums	125	
			225
Public Works Department, Lake Coleridge..	Assorted forest-trees		40,000
Department of Agriculture	Assorted pines		600
Alexandra Borough Council	Assorted forest-trees		200
Templeton Prison Camp	,, ...		1,350
St. Kilda Borough Council	,, ...		248
Mackenzie County Council	,, ...		13,000
Cromwell Development Company.. ..	,, ...		2,250
Waikakahi Domain Board	,, ...		114
Farmers	,, ...		19,052
Total	.. ..	..	952,009

Conical Hills Plantation, Otago.

(Assistant Forester, W. J. Dunnet; area, 3,672 acres; altitude, 400 ft. to 1,050 ft.; commenced operations, 1903.)

From the meteorological records kept at this station it will be seen that only 24·66 in. of rain fell on 143 days. The highest shade temperature was registered in January and February, it being 88°, whilst in June the minimum of 10° of frost was reached. Strong winds were experienced during the latter part of September, but did not injure to any extent the very vigorous growth that was hastened by the extreme mildness of August and September months.

Of the 733,940 trees received from Tapanui, some 582,875 were used to replant areas throughout the plantation on which larch and hardwoods had failed to succeed. Several comparatively large blocks of trees have been allowed to remain for two or three years in the hope of success eventually being the outcome; but it is very evident that should severe frosts cause injury to young trees of the larch type the probability of a satisfactory recovery is remote. Generally an excellent growing record throughout is noticeable this season, particularly amongst all pine compartments. The *Pinus austriaca*, which have hitherto been somewhat affected by the aphis, appear to be gradually throwing

off the pest, and are now developing at a much greater rate than in the past. The *Pinus radiata* having now become established are showing to advantage in even the most elevated positions Seedling pines of this variety do not seem to strike readily, and it has been decided to complete the planting of the area available at this station with about 90,000 two-year-olds. In sheltered positions a growth of from 18 in. to 24 in. has been made by the Douglas fir; but nothing like the same headway characterizes the *Picea sitchensis* even under the most congenial conditions. Better results have accrued from transplanting of the poplars than in any previous year; but it is wiser to defer an opinion on the probable success of this marginal tree until another year's growth has passed. Another trial with the eucalypts will be necessary to ascertain the possibility of using this hardwood for hill planting: so far the results are not really encouraging. Additional fire protective measures were introduced. The exterior boundary barrier has been widened by chipping tussocks and other coarse vegetation after the consent of the owners or lessees had been obtained. It was necessary to open out a new fire-line on the area most recently operated opon, and carry on the usual horse cultivation-work where through an insufficient number of sheep the grass has reached the seeding stage. The grazing proposition here has proved of inestimable value in keeping barriers in an effective state.

Telephonic communication was installed between my house and the main central buildings on No. 2 block, and this convenience permits work to be conducted with greater facility. Patrol and caretaking duties by employees were faithfully maintained, and it is pleasing to record that no conflagration of any kind has marred the year's operations here. Two small huts were removed to the Pukerau Plantation, and the usual maintenance labour conducted satisfactorily.

A sum of £2,148 9s. 8d. was expended in the various works during the year, thus increasing the total expenditure at this station to £30,533 0s. 2d.

Rainfall, Temperature, &c.

Month.	Rainfall.	Number of Days Rain fell.	Temperature.		Number of Days Frosts occurred.
			Maximum.	Minimum.	
1915.	In.		Deg. F.	Deg. F.	
April	1·52	16	76	30	7
May	2·09	10	64	28	18
June	1·52	12	50	22	26
July	1·63	11	60	25	22
August	0·19	4	62	26	22
September	1·20	12	74	26	7
October	3·89	15	70	32	2
November	2·74	13	80	32	2
December	2·65	13	78	34	..
1916.					
January	1·66	15	88	38	..
February	2·72	10	88	39	..
March	2·85	12	86	31	3
Totals	24·66	143	..	..	109

Pukerau Plantation, Otago.

(Plantation Foreman, H. Howe; area, 628 acres; altitude, from 700 ft. to 1,400 ft.; commenced operations, 1915.)

This area, comprising two untenanted sections of the Conical Hills Estate, is situated about five miles directly west of Conical Hills Plantation and about midway between Pukerau and Arthurton Railway-stations. The country is of an undulating nature with an easterly aspect, and eminently suitable for afforestation purposes notwithstanding the prevalence of rocky outcrops on the higher levels. During the past year an insufficient area was available at the Conical Hills enclosure to contain trees locally raised, and a block of about 90 acres here was securely fenced and planted with 111,860 trees outlined in schedule appended. The extermination of rabbits was a difficult proposition; but eventually the block was considered sufficiently free from the pest to merit operating upon, although the presence of deep underground runners throughout the whole of the newly acquired area made the complete extinction of rabbits quite impossible, and the results of the coming season's planting will more than likely be influenced by this fact. Contrary to the usual custom, trees were planted at varying distances according to the variety operated and humidity of the position. Generally, however, *Pinus Laricio* and *P. austriaca* were spaced at 4 ft. 6 in., *P. ponderosa* at 5 ft., and *Pinus radiata* at 6 ft. to 7 ft., and in each case more success resulted than was forecasted from the necessary hurried preparation.

General.—As the whole of the block should be planted during the ensuing year, provision only for a temporary camp was made, and for a small expenditure four huts and eight well-constructed boarded tents were erected in a convenient position adjacent to the main thoroughfare. Protection against the prevailing south-westerlies was afforded by constructing a scrub breakwind near to the buildings, and the camp must now be considered as reasonably comfortable. Much work will require to be undertaken here in fencing and subsequently planting the whole enclosure in one season, particularly if the shortage of labour continues. No meteorological records are being kept at this station, as it is believed that the conditions almost exactly coincide with those experienced at the Conical Hills Plantation. The main fire-break of 2 chains in width will follow one of the main spurs from the highest point, thus dividing the area into two blocks of slightly over 300 acres each, about our usual safety unit. A marginal fire-barrier of about 66 ft. has been marked off round the enclosure, and poplars will constitute the few outer lines.

An expenditure of £638 15s. 4d. was directed upon operations here, giving employment to an average of 4·5 men throughout the year.

Dusky Hill Plantation, Otago.

(Plantation Foreman, F. Benfell; area, 845 acres; altitude, 400 ft. to 800 ft.; commenced operations, 1898.)

Very uniform progress is being made by trees growing at this station. There is nothing of an outstanding nature to report, but efforts will be devoted during the approaching winter to undertake a small amount of thinning, where such a procedure will prove financially remunerative and beneficial to the dominating trees. The larch continue to make the usual headway, although towards the latter part of summer rapid defoliation of the laterals became conspicuous. It is hoped that circumstances will permit next season the compilation of a special report on investigations into the whole question of larch growing and conversion. Little improvement in the rate of development of the Piceas has been the outcome of the favourable growing season, and should these trees not give indications of responding to the shelter gradually being provided there seems to be no option but to replant the area so occupied with pines. The European birch (*Betula alba*) were much affected by the aphis, and this insect in many cases caused complete defoliation early in the growing season. Fortunately, however, only a very small number of these trees have been planted out. Some 19,300 *Pinus radiata* were planted in situations where the Norway spruce is not thriving, and such works as cleaning around trees, tree-pruning, clearing tracks, and caretaking have been carried on by the one man employed. Much improvement to the marginal fire-lines was effected by widening, and the plantation may now be regarded as much more secure from any encroaching fires. Very good results emanated from the grazing of the fire-lines with sixty-six ewes, and the numerical increase of the flock has been decided upon.

The expenditure for the year amounted to £431 13s. 10d.

Ranfurly Nursery, Central Otago.

(Nurseryman in Charge, A. W. Roberts; area, 49 acres; altitude, 1,400 ft.; established, 1896.)

The total rainfall for the year was 15·62 in., which fell on ninety-seven days. Frost occurred on 183 nights, the minimum temperature being 18°. The maximum temperature was 90° in January. As will be seen by a glance at the meteorological records for the past year, the months of April to September were exceedingly dry, only 3·82 in. being recorded. Owing to the sparse rainfall for these months the work of lining out trees was not very promising. However, lining out was commenced and good weather was experienced for a time; but during the latter part of the work a succession of north-west gales prevailed, and this, together with the fact that most of the hands were inexperienced at the work, greatly influenced results, which have not been as successful as anticipated. *Pinus austriaca* seems to have suffered; but the strongest of these were transferred to the plantation and were evidently affected by the operation. *Pinus ponderosa*, *P. Benthamiana*, and larch, however, have done well; but the height-growth is not up to the usual standard. All seeds sown, except *Pinus Benthamiana*, have germinated well, and a crop of 1,073,200 has resulted from 196½ lb. of seed. *Pinus radiata*, sown in drills without any covering or protection of any kind, have attained a height of 8 in. to 10 in. for six months' growth. All these will be too large before the second year, and they will be severely wrenched and the strongest transferred to the plantation. Seed-sowing was commenced on the 24th August and completed on the 18th September. Owing to the lack of funds the expenditure has been reduced as far as possible, only two hands being employed during the past three months. The total number of trees sent to the plantation was 401,350, and to other places, 7,350, making a total of 408,700 trees. As it has been decided to discard larch from all future plantings, the output for the incoming season will be about 400,000. The output for the following year should reach 800,000.

All tools and buildings have been kept in order; but it will be necessary to paint all buildings in the near future. Shelter-breaks, roads, general weeding, and hoeing have been carried out satisfactorily during the season.

The total expenditure for the year is £909 1s. 10d., and the total since initiation £17,073 0s. 7d.

The average number of men employed for the year was 4·57.

Rainfall, Temperature, &c.

Month.	Rainfall.	Number of Days Rain fell.	Temperature.		Number of Days Frosts occurred.
			Maximum.	Minimum.	
1915.	In.		Deg. F.	Deg. F.	
April	0·48	7	72	21	19
May	0·70	8	67	18	29
June	0·97	9	58	18	30
July	0·50	6	59	18	27
August	0·26	4	62	18	27
September	0·91	6	70	21	22
October	2·28	13	76	28	8
November	2·02	12	78	25	8
December	0·91	6	82	30	5
1916.					
January	2·15	7	90	30	5
February	2·40	10	83	35	..
March	2·04	9	81	29	3
Totals	15·62	97	..	..	183

Details of One-year-old Trees, sown 1915–16.

Name of Tree.	Number in Seed-beds.	Seed sown.	Remarks.
		Lb.	
Pinus Laricio	588,000	95	Very even crop.
,, ponderosa	201,600	40	Good even crop.
,, Benthamiana	100	4	Poor crop.
,, radiata	114,800	35	Strong plants.
,, muricata	37,500	½	Good even crop.
,, pinaster	1,500	½	Strong plants.
,, Taeda	100	½	Sturdy trees.
Larix leptolepis	97,000	16	Fair crop.
Pseudo-tsuga taxifolia	19,500	4	Very good crop.
Cupressus macrocarpa	7,400	1	,,
Populus fastigiata (cuttings)	4,200	..	Strong plants.
,, deltoides (cuttings)	1,500	..	,,
Total	1,073,200		

Details of Two-year-old Trees, sown 1914–15.

Name of Tree.	Number in Seed-beds.	Number in Nursery-lines.	Remarks.
Pinus Laricio	450,000	..	Strong plants.
,, ponderosa	300,000	..	,,
,, Benthamiana	..	12,000	,,
,, radiata	7,840	25,200	,,
,, muricata	600	..	,,
,, pinaster	3,000	..	,,
,, Taeda	40	..	Poor plants.
Pseudo-tsuga taxifolia	500	..	,,
Populus fastigiata	..	1,000	Strong plants.
,, deltoides	..	2,700	,,
Totals	761,980	40,900	
	802,880		

Details of Three-year-old Trees, sown 1913–14.

Name of Tree.	Number in Nursery-lines.	Remarks.
Pinus ponderosa	113,000	Strong plants.
,, austriaca	108,000	Fair plants.
Larix europaea	79,600	Strong plants.
,, leptolepis	7,000	,,
Alnus glutinosa	500	,,
Total	308,100	

Trees transferred from Nursery to Plantations, &c., 1915–16.

Where sent.	Name of Tree.	Number.	
Naseby Plantation	Pinus Laricio	77,600	
	,, austriaca	96,450	
	,, ponderosa	93,375	
	Larix europaea	120,900	
	,, leptolepis	5,000	
	Alnus glutinosa	5,525	
	Salix viminalis	1,600	
			400,450
Omarama Plantation	Pinus Laricio	200	
	,, ponderosa	200	
	Populus fastigiata	50	
			450
Galloway Plantation	Pinus Laricio	200	
	,, ponderosa	200	
	Populus fastigiata	50	
			450
Taieri Lake Domain	Larches and pines		5,500
Farmers	Assorted forest trees		1,350
Total			408,700

Naseby Plantation, Central Otago.

(Plantation Foreman, T. O. Screen; area, 2,850 acres; altitude, 2,450 ft.; commenced operations, 1900.)

The rainfall for the year ending 31st March amounted to 21·20 in., falling on 107 days. This is the lowest rainfall yet recorded at this station. Records extending over a period of five years show an average of 27·51 in. on 125 days. The dry weather had little or no ill effect on the older trees, and a good growth has been established. In trees planted during the last two seasons a check is noticeable, however, the height-growth being lower than usual. The larch received a rather severe check in December, when 8° of frost was recorded on the 20th. The pine blocks appear to be healthy and entirely free from disease. Trees to the number of 400,450 were received from the Ranfurly Nursery. Of this total, 357,425 trees were planted on new area of 150 acres, and 43,025 were used to replace failures in the previous planting. Tree-planting was commenced on the 25th August, and completed on the 15th October, very dry weather being experienced throughout. Owing to the shortage of funds a reduction of expenses was found necessary, and only two employees were retained from the 20th October. After completing 64 chains of permanent fencing, which was then in course of erection, these employees attended to the necessary maintenance-work of the plantation. In February a number of the hands were re-engaged, and, working under the contract system, have prepared sufficient pits for the spring planting. Working in conjunction with the County Engineer and road staff, the horseman and team assisted in grading two and a half miles of road on the southern boundary of the plantation. This will facilitate the future distribution of trees and fencing-material. All fire-breaks have received the annual cultivation, an improvement being effected at the plantation by removing two lines of rowans, and thus widening the fire-break.

The total expenditure for the year is £1,218 14s. 2d., and the total to date, £9,939 9s.

The area planted for the season is 150 acres, making a total of 1,108 acres to date.

Rainfall, Temperature, &c.

Month.	Rainfall.	Number of Days Rain fell.	Temperature.		Number of Days Frosts occurred.
			Maximum.	Minimum.	
1915.	In.		Deg. F.	Deg. F.	
April	0·65	6	68	20	25
May	1·70	9	62	14	27
June	1·00	9	54	14	29
July	0·56	7	58	17	25
August	0·33	5	64	16	25
September	0·88	7	68	20	12
October	3·17	12	75	24	10
November	2·43	13	77	24	8
December	1·17	9	79	29	5
1916.					
January	1·73	8	90	25	5
February	5·60	11	83	30	1
March	1·98	11	80	28	3
Totals	21·20	107	..	..	175

Gimmerburn Plantation Reserve.

(Nurseryman in Charge, A. W. Roberts; area, 425 acres; altitude, 1,200 ft.; commenced operations, 1903.)

During the year the work of keeping down rabbits, cutting thistles and oaten sheaf have been the only works carried out at this station. The stacks of oaten sheaf were cut, and resulted in a return of 1,814 bags, of which 1,260 were satisfactorily disposed of, and the remainder carted by our own team for use on nursery and plantation. The whole cost of cutting, bags, coal, &c., was defrayed out of the sale of the same. The net return to the Department was £190 7s. 1d., which was paid into the Public Account. The weight of chaff carted for our own use was 22 tons, so that it will be seen that the transaction was a payable one to the Department. The trees on the reserve have made satisfactory growth; but the work of keeping down rabbits is a little difficult, as there is no one permanently on the reserve. The unplanted portion of the reserve is still let to Mr. Paterson during the pleasure of the Department.

The expenditure for the year amounts to £34 14s. 8d., and the total to date to £2,684 11s. 1d.

Hanmer Springs Nursery, Canterbury.

(Nurseryman in Charge, W. G. Morrison; area, 40 acres; altitude, 1,225 ft.; established, 1902.)

Rain fell on 107 days during the year, the total precipitation being 26·57 in. The highest shade temperature was 92° registered on the 19th January, and the lowest was 12° on the 17th July. Frosts were recorded on 110 nights during the year, being four more than were recorded during the previous year. In perusing the weather records it is readily seen that the weather-conditions prevailing throughout the year were not normal and tended towards unusual dryness, there being a decrease of over 11 in. in rainfall compared with the previous year, which was also dry compared with other years. It is thus apparent that conditions were against obtaining the best results.

Tree-growing.—Although general conditions were against the successful raising of trees at this station the results obtained were fairly satisfactory. Seed-sowing was taken in hand early in October and was completed on the 19th of that month. The results were satisfactory, and 2,221,200 seedlings, detailed as per schedule, have made excellent headway. Lining out was commenced on the 10th August and was completed on the 30th September, a total of 1,369,550 trees being transferred to the nursery lines. The subsequent growth has not been so satisfactory as that of previous years, partly owing to the dry season and partly to weed-growth, which it was impossible to keep in check owing to the curtailment of labour during the main growing months. Three-year-old trees have made good headway and were not affected by weed-growth. It is anticipated that about 800,000 trees will be available for transfer to plantations during the coming season. Trees to the number of 906,100 were transferred to plantations and Domain Boards, &c., during the year, as detailed hereunder. The total number of trees in stock on the 31st March was 3,832,950.

Horse-feed.—About 60 acres was put down in crop during the spring, the results being very satisfactory, and about 50-odd tons of sheaf stacked. All chaffcutting for the station was done by contract at a cost of 12s. per ton, sufficient only being cut for immediate use. A small area was put down in carrots for winter use. Two small stacks of clover hay were also harvested. The total cost of horse-feed operations for the year was £158 3s. 1d., including cost of seed, freights, &c.

General.—All vacant areas on the nursery were put down in oats, the crop being harvested and stubble ploughed under. Much benefit to subsequent tree crops should thus accrue. To provide for next season's transplantation a paddock of about 6 acres was fenced and worked up thoroughly. It is considered necessary to give all lining-out ground a dressing of lime, as sorrel is becoming very trouble-

some on these areas. A much-needed improvement was effected to the water-service by connecting same to the township main. A greater pressure is now available at the house and stables, and gives greater security against fire.

The expenditure for the year amounted to £1,464 10s. 8d., the total expenditure to date being £15,283 16s. 11d.

The daily average of men employed during the year was 6·53.

Rainfall, Temperature, &c.

Month.	Rainfall.	Number of Days Rain fell.	Temperature.		Number of Days Frosts occurred.
			Maximum.	Minimum.	
1915.	In.		Deg. F.	Deg. F.	
April	0·58	3	74	25	9
May	2·60	10	67	24	14
June	2·07	9	59	22	16
July	0·47	7	65	12	21
August	1·90	8	65	14	20
September	1·26	6	71	17	16
October	2·03	12	80	26	8
November	4·67	10	82	24	4
December	2·56	9	86	31	1
1916.					
January	2·05	13	92	35	..
February	2·50	8	84	35	..
March	3·88	12	88	32	1
Totals	26·57	107	..	..	110

Details of One-year-old Trees, sown 1915–16.

Name of Tree.	Number in Seed-beds.	Amount of Seed sown.	Remarks.
		Lb.	
Pinus Laricio	900,000	50	Fine crop.
,, ponderosa	200,000	17½	Sturdy plants.
,, Benthamiana	700	2½	Poor crop.
,, radiata	600,000	90	Fine crop.
,, muricata	250,000	20	Good crop.
,, Taeda	2,500	½	,, plants.
,, pinaster	3,000	¾	Sturdy plants.
Larix leptolepis	200,000	10	Poor plants.
Pseudo-tsuga taxifolia	50,000	2½	,,
Cupressus macrocarpa	8,000	1½	Fair crop.
Thuja plicata	7,000	2	Good plants.
Total	2,221,200		

Details of Two-year-old Trees, sown 1914–15.

Name of Tree.	Number in Seed-beds.	Number in Nursery-lines.	Remarks.
Pinus Laricio	400,000	..	Sturdy plants.
,, ,, ...	..	290,000	,,
,, ponderosa	..	169,000	,,
,, Benthamiana	..	3,300	Good plants.
,, radiata	..	80,000	,,
,, muricata	..	10,000	Medium plants.
,, Taeda	..	2,000	Good plants.
,, pinaster	..	4,000	,,
Pseudo-tsuga taxifolia	..	13,000	Poor plants.
Cupressus macrocarpa	..	1,200	Fair plants.
Thuja gigantea	..	1,800	Sturdy plants.
Sequoia gigantea	..	1,500	,,
Totals	400,000	575,800	
	975,800		

Details of Three-year-old Trees, sown 1913–14.

Name of Tree.	Number in Nursery-lines.	Remarks.
Pinus austriaca	353,000	Strong trees.
,, Laricio	5,000	,, plants.
,, ponderosa	74,000	Very fine growth.
,, muricata	10,000	Strong trees.
,, scopulorum	5,700	Medium plants.
Pseudo-tsuga taxifolia	6,000	Poor plants.
Betula alba	250	Good plants.
Total	453,950	

Trees transferred from Nursery to Plantations, &c., 1915–16.

Where sent.	Name of Tree.	Number.	
Hanmer Springs Plantation ..	Pinus Laricio	344,625	
	,, ponderosa	199,875	
	,, radiata	169,325	
	Larix europaea	13,000	
	,, leptolepis	20,850	
	Eucalyptus Macarthuri ..	12,200	
	,, viminalis	3,700	
	,, Muelleri	25	
			763,600
Public Works Department	Larch and pines	..	34,500
Selwyn Plantation Board	Pines	..	75,500
Mackenzie County Council	Larch and pines	..	31,500
Mackenzie Domain Board	Pinus radiata	..	1,000
Total	..	..	906,100

Hanmer Springs, Plantation, Canterbury.

(Plantation Foreman, A. J. Boydell; area, 3,668 acres; altitude, 1,225 ft.; commenced operations, 1901.)

Afforestation operations are generally attended with success at this station, and the past season has been no exception to the rule. The phenomenally dry winter, spring, and summer experienced throughout the greater part of the Canterbury Province did not affect to any great extent the Hanmer Plains and immediately surrounding district, although at times a heavy rainfall would have been highly beneficial. Even in the driest season Hanmer is practically immune from the serious effects of drought, coming as it does within what is familiarly known as the north-west shower area. It would, however, be wrong to convey the impression that the drought was entirely escaped, as a rather heavier percentage of deaths is noticeable among the newly planted trees than is usually recorded in a normal season.

Tree-growth.—The usual uniform growth has taken place among all varieties of established trees, and the various blocks are looking remarkably well. Some trial plantings of eucalypts proved a complete failure, owing to the prevalence of heavy north-west winds for a long period immediately subsequent to planting. Under normal conditions, however, these trees would probably prove a success. The growth among trees planted during the season has been above the average; but the death-rate has been heavier than usual, especially *Pinus radiata*, probably owing to the unusually dry spring. A late frost in October cut back the tender leaders of the Douglas fir, Sitka spruce, and larch; but these trees subsequently recovered and are now looking quite healthy.

Tree-planting.—Tree-planting was commenced on the 24th May and was completed on the 23rd September, the total number of trees planted for the season being 763,600, at a cost of £348 5s. 10d. Of this number, 28,900 were used to replace failures in the preceding season's planting. Under the new system of spacing the trees were planted at distances varying from 4 ft. to 6 ft. apart. The area planted for the year was 410¼ acres, making a total area to date of 2,941¼ acres under forest, containing 7,626,411 trees. This completes the planting of the ground now available with the exception of a small block adjoining Jollie's Pass, which it is anticipated will be cleared, fenced, and planted during the coming season. The temporary curtailment of operations during several months following the completion of tree-planting consequent on the shortening of hands has had the effect of placing this station in a partial state of unpreparedness to cope with the coming season's output of trees from the nursery. With the recent readjustment of labour, however, and some speeding-up, a successful season may be looked forward to.

Pitting.—Pits to the number of 443,975 were dug during the year, at a cost of about £1 per 1,000.

General.—The clearing and burning-off of scrub, &c., on the Jollie's Pass block, and clearing the area recently destroyed by fire on No. 1 plantation, was carried out at a cost of £148 9s. 2d., a total of 67 acres being thus dealt with. The heavy cost of clearing can be attributed to the extremely heavy growth on the areas operated on. The distribution of trees to the planting-areas cost £10 2s. 9d. for the year, the number of trees handled being 763,600. Of the many works included under the heading of general upkeep the principal were—ploughing, chipping, and widening of fire-breaks; thinning *Pinus radiata*, birch, and alder plantations; grubbing out noxious weeds such as gorse, briers, broom, &c.; checking spread of rabbits and hares; removing tussock growth, &c., from boundary-fences to minimize danger from fire. The growing of horse-feed for the year cost £50 14s. 8d. Some £129 13s. 4d. was expended in the purchase of material for fencing Jollie's Pass block, which work is now well in hand. The grazing of seventy-five ewes on the fire-breaks has proved a success, and the scheme is worthy of extension. A regrettable outbreak of fire occurred on No. 1 plantation, caused by sparks from a fire on adjoining property being carried into the plantation by a sudden change of wind. The alarm was given at once, however, and all available employees were soon on the spot, ably assisted by a large number of the townspeople, who were deserving of great credit for the prompt manner in which they responded to the call for assistance and the able way in which they set about combating the fire. By strenuous efforts the fire was confined to about 30 acres of Austrian pine, which was completely destroyed. Thinning operations were completed during the year, a large portion of the felled timber being sold for fuel at £1 per cord, the sum of £48 being realized.

The total expenditure for the year was £2,159 2s. 1d., the expenditure to date being £24,770 2s. 3d.

The daily average of men employed throughout the year was 11·69 men.

***Approximate Cost of Paper.*—Preparation, not given; printing (1,050 copies), £22 10s.**

By Authority: MARCUS F. MARKS, Government Printer, Wellington.—1916.

Price 9d.]