ling the many little torrents which arise in the mountain ranges. It has been seen how the millable native bush of Canterbury has all disappeared, until only small patches of reserve now remain at the old milling centres and at Riccarton.

Throughout this account the difficult housing problem confronting the early settlers has been strongly stressed. Practically the whole of the sawn timber that the native bush produced was used for building purposes. Other wood-using industries are of comparatively recent origin, their birth being a consequence of the depression of the late seventies and the eighties. In these industries, until very recent times, the most widely-used timber was Kauri, which, of course, Canterbury's native bush could not supply. Other forms of utilisation were firewood, the amount of which was enormous, but quite impossible to estimate; sleepers, which were used in railway construction and fence posts. The adequate supply of the latter was always a difficulty. In 1854, of the 4,000,000 acres then comprising Canterbury, only 7000 acres were fenced, and the acute shortage of fencing material is reflected in the many Cattle Trespass Bills passed from time to time by the Provincial Government. The introduction of gorse fences later helped, to some extent, to solve this pressing problem.

From the first days of settlement timber was brought into Lyttelton from the North Island, Tasmania, and England. Kauri was the chief New Zealand wood imported for a long time, and much of this was used in building the city of Christchurch. Shingles, palings and Australian Cedar came from Tasmania, while Oak and Baltic Pine were imported from Europe. The foreign imports were subject to a tariff which was passed by the Legislative Council on 3rd July, 1851. Under it came the following items:—

Wooden boards, planks and scantling	1/– per 100 ft.
Cedar	2/– per 100 ft.
Shingles and laths	1/– per 1000
Palings	10/– per 1000

How far the imposition of this duty affected the utilisation of the bush it is difficult to judge; probably the effect was not at all great.

There is no doubt, however, that the efficient utilisation of the bush was adversely affected by the loose manner in which the timber-cutting licenses were issued. There was no provision for any control of the licensee, who could go into any part of the district to which his license referred and cut and destroy timber without check. It is true that the licenses only applied to waste lands, but these waste lands comprised a very great deal of the bush. Davie, in his report commenting on the license, said that in his opinion the bush licenses were not advisable, and that that was the unanimous opinion of all concerned in the administration of waste lands. The holders of the licenses had no permanent interest in their work, and often destroyed as much valuable timber as they brought to the market. The revenue from the issue of the licenses was insignificant.

The fires which occurred in the bush were the result of ignorance or from the absolute disregard of the possible or even probable consequences of burning long grass and scrub on adjoining land that was needed for agriculture. The scattering of the brush and tops in the bush during logging operations, coupled with the carelessness of the bush workers in leaving fires, was a fruitful cause of destruction.

The early settlers, realising the importance of the bush, transplanted seedlings from the bush to their gardens in an effort to perpetuate the chief timber trees. In practically every case no success was met with. It is, indeed, tragic to note how very little we have advanced, since those days, towards dealing with what is, after all, our main forestry problem—the regeneration of the native bush—and by the solution or otherwise of which the reputation of our trained foresters, both present and future, must stand or fall. The settlers, finding their efforts to perpetuate the bush a failure, reluctantly turned to exotic species, and it redounds greatly to their credit that long before the native bush was exhausted, the plains were dotted with flourishing plantations, mostly of Eucalypts and Pines, which were to help form, together with the native bush from the West Coast, Canterbury's future timber supply.

Acknowledgment:

The writer of this account would like to say that the account of the Oxford Bush is based upon data supplied by Lancelot Watson, Esq., of "Caldbeck," Oxford, to whom he is greatly indebted.

In that portion dealing with South Canterbury, much data was obtained from Johannes Andersen's very valuable book, "A Jubilee History of South Canterbury" and Jacobson's "Tales of Banks Peninsula," supported by much other information concerning that region.

AFFORESTATION BY THE DUNEDIN CITY COUNCIL

(W. S. Tannock.)

Introduction.—So far the chief reason for most of the tree planting operations carried out by the Dunedin City Council is the conservation of the water on the catchment areas. So I will first mention a few of the reasons for planting trees on Water Reserves.

Their needles make a soft, mossy deposit on the ground that is ideal for holding moisture, and the trees themselves prevent drying winds from getting at the surface of the ground. The result is that little streams that meander through the forest to join the main water-race are kept at a practically even volume all the year round. When a heavy rain-storm comes there is no surface mud and litter washed away to defile the water-race, and consequently it does not have to run to waste while the water clears. Moreover, in the use of the ground by the trees there is no stock present to defile the streams of water running from these areas, and even the rabbit is netted off as carefully as possible. Noxious weeds disappear, and thus, by the influence of trees, the whole area is made into an ideally wholesome and serviceable catchment region.

During the year 1923 the beneficial effects of clothing the catchment areas with trees were very evident in two distinct and opposite directions. During the early months of 1923 Dunedin suffered from several severe floods. The streams flowing from the tree-clad slopes did little or no damage, whereas those which came from slopes that had been denuded of their original covering did considerable damage.

During the dry summer that followed, when the flow from creeks arising in open pastures was greatly reduced, those flowing from the plantations were well maintained, and along the upper side of the water-race at Whare Flat, where trees have been planted, there was a fine little stream in every gully.

Location of Plantations:

The council plantations are located in five separate districts. These Reserves are:—

The Land Surrounding Ross Creek.—This creek, with its many little tributaries, forms the main source of the supply for the Ross Creek Reservoir. These plantations are about three miles from the city. The trees are from 10 to 20 years of age.

The Leith Valley Plantations are situated on the catchment area surrounding Sullivan's Dam. The land planted is in most cases fairly steep, but the trees have done very well in this Reserve. They range in age from five to twenty-two years. These plantations are about six miles from the town.

Flagstaff Plantations.—These are situated on the Flagstaff Creek Water Reserve, which is about five miles from Dunedin. Planting operations were begun on this area eleven years ago, and were completed last year. The trees planted at Flagstaff are: **Pinus radiata, Corsican Pine,** and **Oregon Pine,** with English Beech and Alders planted in spots where there is plenty of moisture.

The Whare Flat Plantations surround the Silverstream water-race. The area planted is 300 acres. The City Council owns 9000 acres in this neighbourhood, and there is nothing to prevent the whole of it being planted some day. Planting in this district was started fourteen years ago. The land is, for the most part, hilly, and is very well suited for growing Larch.

The Youngest Plantations are at Waipori. This is the centre of Dunedin's hydro-electric power scheme. The area to be planted is 10,000 acres.

Last year a commencement was made, 300 acres being planted. This Spring it was expected they would cover another 1000 acres with trees. The country is undulating tussock land, much drier in Spring than the other areas planted, so that they have had to adopt Autumn pitting and Spring planting. Experimental plots have been tried near the Power House, and have done well, showing that the country is well suited for growing trees. Prior to being purchased by the City Council for planting most of the land on the catchment areas belonged to small farmers who, in many cases, made a very poor living out of their farms, most of the land being quite unsuited for agricultural work. Before planting operations were commenced, quite a large percentage of the catchment areas consisted of bare hillside or patches of partly-burnt Manuka, broom or gorse, far from an ideal type of surface for water catchment.

Climate:

In Dunedin the forester has not to trouble a great deal about extremes in temperature. Dunedin has a fairly moist, equable climate. During the past twelve years the average rainfall in Dunedin has been 36.20 inches.

Species Planted:

The main kinds of trees planted by the Council during the last five years have been:— **Pinus radiata, Corsican Pine, Douglas Fir, Pinus ponderosa, Cupressus macrocarpa.**

As the plantations have developed the Council have become more convinced than ever that **Pinus radiata** is the fastest growing species, and the most suitable for exposed positions and rough country, and for smothering gorse and other weeds. As one-year-old seedlings can be put out, it makes a cheap tree. Many of the **Pinus radiata** in eleven years have atttained a height of 50ft.

Douglas Fir is the most valuable species grown. Its growth in height is very little short of **Pinus radiata,** and it is very healthy, but it can only be planted in warm, well-drained, sunny positions. It is valuable for providing a close canopy, which completely suppresses all undesirable growth.

Other species are planted to utilise special positions and soil conditions, but in future the chief work will be with Pinus radiata and Douglas Fir and Macrocarpa.

The age of the different kinds of trees for planting are: Douglas Fir, P. ponderosa, P. laricio, Menzies (sitka), Spruce, two years (one year in the seed beds and one year lined

out). The Pinus radiata and Cupressus macrocarpa are one-year seedlings planted straight from the seed bed.

Planting:

Planting is carried out at distances varying from 6ft to 9ft, according to the kind of tree, the soil and the situation. It has become more evident every year, as the plantations develop, that too close planting is wasteful, and entails a considerable amount of thinning before the thinnings are of much value; fortunately, the City Council have, so far, been able to use or sell all thinnings; these thinnings have been found very useful for rails, stakes for street trees, temporary sheep fences, and also for rustic work. The areas planted were sometimes very rough, there being an accumulation of burnt and partly-burnt scrub. If the trees were planted much closer than 9ft. it would have been necessary to clear the whole surface, but as it was the crew simply slashed lines 9ft apart and planted in these lines, the remaining scrub acting as a shelter for the young trees. The trees planted by this method were **Pinus radiata.**

Care of the Plantations:

The work of pruning, thinning and clearing the gorse and other undesirable weeds from the plantation is carried on during the winter months, when other forestry operations are at a standstill. Each year a different section of the plantations is gone through, the men carrying out the work of pruning, thinning and clearing at the same time. The tools used for this work are an axe, slasher and bill hook.

In thinning only the completely suppressed and malformed trees are being removed; the others will go on for a few more years, when the thinnings will be large enough to use for scaffold poles, fencing posts and other purposes.

During the process of pruning all double leaders and lower branches are removed. In the majority of the plantations on Flagstaff and Whare Flats this operation of clearing and pruning is the first work done in the plantations since they were planted ten or eleven years ago.

Fire Protection:

The question of fire protection does not present a very grave problem, as the plantations are situated for the most part on hilly country that receives a large amount of moisture all the year round. Certain precautions have, however, been taken.

Look-outs:

In the plantation areas three houses occupied by foresters are situated on the three best positions for detection. These houses are in telephone communication with headquarters in Dunedin, and within half-an-hour a fire-fighting force of forty men, collected from the staff of the City Reserves Department, can be on the spot. During the fire season six men are resident on the plantations.

Fire Lines:

These divide the plantations up into 100-acre blocks.

Fire Breaks:

These are of deciduous trees, such as Silver Birch and English Beech, and are used chiefly along the roadside. These act as fire breaks, and in the winter they lose their leaves and so do not keep the sun off the roads. The plantations are kept clear of inflammable material; all gorse along the roadside is kept down by grubbing, and the grass kept cut. The public are kept out of the plantations, except the Ross Creek area, within which is situated a favourite picnic ground, but special places have been built for boiling the billy, and on public holidays a man is on duty watching that no fires occur. Many little creeks run through most of the plantations, and these are taken full advantage of in the fire protection scheme. The chief dangers of fires are from the public roads that run alongside some of the plantations, and from fires starting on land adjoining the plantations. The land in many cases is covered with inflammable material such as gorse. Fortunately, within the last few years most of this land has been purchased by the Council, and is now being cleared and trees planted. The plantations, a year after they have been cleared and thinned, are free of all inflammable material, and as far as ground fires are concerned, all danger is over after the first ten years.

Nursery Work:

All the trees are grown at present in the Nursery in the Botanic Gardens, Dunedin, but in future, when planting operations are in full swing at Waipori, it may be better to establish a nursery there. Now that they plant out such small trees, the cost of transport is not great, and the advantages of a central nursery, which is always under personal supervision, are very considerable.

The tree nursery is situated in a position well sheltered from the prevailing south winds by a belt of Pinus radiata. The soil is composed of organic matter overlying clay, with an average of 12 inches of black soil. The ground is trenched for the seed beds, in the Autumn, and left rough fully exposed to the weather during the winter. Sowing is done in rows in flat drills about 12 inches wide and 18 inches apart, thus allowing room for weeding and cultivating between the rows. The seed is covered with about half-an-inch of soil. The soil used for covering the seed is a light loam which has been mixed with apterite. This mixture is then covered with sacks and left standing for ten days to allow the fumes of

apterite to do their work. The sacks are put on the top of the soil to keep the fumes in.

Covering:

Instead of seed frames plain wire-netting is used. The netting is pegged down on either side, thus forming a hoop over the top. As soon as the seedlings are up and past all danger from birds, the wire-netting is rolled up and stored away ready for use the next year.

Weeding:

Is carried out from time to time. Sorrel is the most prevalent weed.

Wrenching:

In the Autumn, after good rains, the seedlings are wrenched by prying them up with a spade on either side, and tramping them down again.

The conditions aimed at in the nursery are a soil rich in organic matter, free as possible from weeds and insect pests, sufficiently deep and well cultivated to provide good drainage, and close enough to secure capillarity. As most of the trees are planted straight from the seed beds within twelve months of seed sowing, it is important to secure rapid growth and satisfactory root development.

In growing Macrocarpa the seed is sown broadcast in prepared beds. As soon as the seedlings are large enough to handle they are lifted and pricked out into shallow boxes filled with a light brown loam; seventy-two seedlings are put into each box—nine rows of eight. These boxes are placed in the greenhouse and kept there till well established, and then they are placed out in an open, sunny position to harden off in preparation for planting. This has proved a most successful method of growing Macrocarpa, very few failures being recorded amongst those planted out. The redwoods are raised from cuttings. The poplars are increased by means of cuttings made from pieces of well-ripened twigs nine to ten inches in height. The base of each cutting is cut across just below a node. These cuttings are then lined out in rows about two inches apart and buried about two-thirds of their length in the ground.

Average cost of seedlings, last year, was £1 per thousand.

The following is a list of trees raised from seed:—

Pinus radiata	145,600
Douglas Fir	104,200
Pinus ponderosa	13,000
Cupressus Macrocarpa ..	21,300
Larch	1,000
Poplars	280
Total	285,380

The trees are transported to the plantations by means of a small Ford truck.

Mixed Planting:

Not very much mixed planting has been tried. At Whare Flat a small patch of Norway Spruce and Oaks was tried. The Norway Spruce has, for the most part, failed, but the Oaks among them are doing satisfactorily.

In an area where Douglas Fir and Larch were planted together it is noticeable that the larch was too strong for the Douglas Fir, and has, in most cases, crowded it out and overtopped it.

The plantations have, so far, been very free from disease. The only trees suffering were the Menzies, Norway and American Spruce. These were attacked some years ago by aphis, and have now almost recovered, but no more spruce have been planted for years.

Planting on the Sandhills:

Along the coast at Ocean Beach and St. Clair fairly extensive sand-dune planting has been done. P. radiata was the tree planted, and it is making fine, healthy plantations.

Concluding Remarks:

The area of trees planted to date is 3000 acres. The ultimate aim is 30,000 acres, which is the area estimated to be necessary to supply the timber needs of Dunedin. At present there is a strong agitation by the Dunedin Chamber of Commerce for the planting of all the poor hill land round about Dunedin. Dunedin has thousands of acres of bare, hilly land surrounding the city, which is of very little use for agriculture. The proposal is that all these areas should be planted with trees. This would result in the City Council getting control of Signal Hill, Flagstaff and Mt. Cargill.

The plantations have already suppressed such undesirable growths as broom, gorse and manuka scrub; they have reduced the rabbit nuisance to a minimum; have greatly increased the efficiency of the water catchment areas; and increased greatly the beauty of the landscape, healthy plantations taking the place of bare hillside or patches of burnt and partly-burnt manuka scrub, gorse, and broom.

CLUB AND SCHOOL JOTTINGS.

FORESTRY CLUB.

At the first ordinary meeting, held on May 14th, 1926, Mr. Foweraker, the retiring president, outlined the work of the past year, and read encouraging letters received about "Te Kura Ngahere."

The following new members were welcomed into the Club:—

R. J. McLaren, who was educated at Timaru High School. Some months of nursery work in the State Forest Service at Hanmer led to his meeting with several of the present students there, and opened up the possibilities of forestry as a profession. He is taking a three-year Ranger course.