

felling and extraction methods, &c. Such problems can be solved not by the observation of broad results in extensive areas of forest, or in small patches of forest growth, but by intensive management by forest technicians of definite areas, so that results may be expressed in terms of cost, yield, &c., per acre per annum. All the conditions must as far as possible be under control, and for this purpose sample plots and experiment stations have been established.

Forest Experiment Station.

Forest experiment stations are as necessary to forestry in New Zealand as are experimental farms to agriculture. Both basic industries, forestry and agriculture, utilize land for the production of raw material necessary for our existence, for to our modern civilization wood is almost as essential as food and clothing. "Forest experiment station and experimental farm both show the means for producing maximum crops of the desired kinds; both aim at the greatest production of wealth per unit of effort and per unit of land." The need for a second forest experiment station in the North Island is urgent. Both stations will show what tree species to plant, what are the best methods of controlling felling, of disposal of slash, of fire-control and of grazing, and what rate of growth and yield can be obtained from forests managed on a regular sustained-yield basis. At the 5,000-acre forest experiment station at Mahinapua, Westland, the most important timber region in the South Island, preliminary works have been completed prior to the commencement of intensive forest management. Situated about seven miles from Hokitika, on the main Hokitika-Ross Road, the land was originally clad with heavy bush, afterwards worked out by sawmills, leaving extensive patches of second growth suited for experimental purposes. The land is not suitable for settlement. During the year 900 acres have been securely fenced to exclude cattle, 140 chains of creeks cleared of debris, drains have been made, and a shed for storing tools and also a cottage have been erected. Fencing-posts and strainers were cut on the area. A complete forest map on which the working-plan will be based was prepared for a portion of the area.

Demarcation of Sample Plots.

During the past year fourteen more sample plots were demarcated in the Rotorua, Wellington, and Canterbury-Otago conservation regions, bringing the total number to twenty-seven. Measurements taken early in 1923 on a plot of *Pinus radiata*, at Tapanui, now seventeen years old, show the average annual volume increment (inside bark) since 1915, to be 398.62 cubic feet per acre. This remarkable rate of growth is exceeded in the North Island, and shows soft-wood growing in New Zealand to be a much more profitable investment than in Europe, where the average annual increment of Scots pine for the same period is in the neighbourhood of 140 cubic feet per acre for soil of the best quality.

The experimental interplanting with exotic trees which was made in 1919 in two indigenous forest sample plots at Mamaku now shows some definite results. The species giving most promise are, in the order named, Lawson's cypress, silver fir, Douglas fir, Californian redwood, and Weymouth pine—more especially the first two. Redwood and Weymouth pine have done well only where the canopy is more open. Norway and Sitka spruces and *Cupressus macrocarpa* show very poor results. Further planting will be done during the coming season with *Thuja gigantea* and *Pinus radiata*.

All the results, both positive and negative, obtained from sample plots will be of immense value in the preparation of forest working-plans by the Service when these are commenced for our indigenous bush. Observations are recorded not for one district alone, but for various districts with their differing rainfall and other climatic factors, and these records should be sought after with avidity by private planters, as they form the very foundation of every considered planting plan.

Sand-dune Reclamation Experiment Station.

At the sand-dune experiment station at the mouth of the Rangitikei River, formed in 1921 for the intensive study of this nationally important problem of reclaiming the 300,000 acres of New Zealand sand-wastes, invaluable results have already been obtained, although the experiments are not yet completed. A meteorological station was installed so that it will be possible scientifically to correlate conditions with those in other sand-dune areas when the fixation of the latter is attempted. It is upon the formation of that essential barrier to further drifting—the littoral sand-dune, the first and principal step in reclaiming seaside sand-dunes—that experimental work has been concentrated during the past year. The basis of these experiments was the experience gained from similar works in other countries; but owing to the great cost of erecting palisade fences, the timber for which would have to be brought from a distance, and to the inefficacy of log walls, due to the particularly severe westerly winds, a cheap type of fence has been made of manuka scrub obtained locally, and this fence has proved more successful than the expensive palisade type. A less successful fence was one constructed of flax-blades and two fencing-wires, this type being reasonably efficacious and cheap, as flax is obtained in far greater quantities in the locality than manuka. During the year 300 lb. of marram-seed were harvested, 60 acres were planted with marram-grass, and 52 acres of sand-flats were sown with marram-seed. Broadcast sowings of pine, broom, and marram seed in mixture has been commenced, the sand surface being strewn with rushes. Experiments are to be conducted during the coming planting season with a light disc plough, which it will be possible to use on at least half the area to be planted. This will greatly reduce planting-costs. Sowing of tree-seeds on prepared spots has been begun, the most successful species being *Pinus radiata*, with *Pinus pinaster* second. Of the trees planted experimentally