

SAND-DUNE RECLAMATION.

By J. L. HARRISON-SMITH.

Foreword.

Though the reclamation of sand dunes is going on in many parts of New Zealand, little is heard of the work, except for an occasional write-up in the daily press.

Localities in the Auckland district where the operations are in progress are the Kaitiaki dunes on the Ninety Mile Beach, Te Kōpuru to the South West of Pargaville, the Kaipara South Head, Muriwai area and the Waikato Heads. On the East Coast there is Te Kao in the far North, Ruakaka to the East of Whangarei, and the Mangawai-Parkiri area between Bream Head and Cape Rodney.

It is to the Te Kōpuru area in particular that this description refers.

The Te Kōpuru dunes differ from the general type of dune in that they are what is known as "cliff dunes". Drift is probably a better description as they are in all cases areas of drifting sand which have "blown out" from the old elevated dunes fixed by the native vegetation.

In the most familiar type, the beach dune, there is a constant supply of fresh sand from the beach but at Te Kōpuru such is not the case. The drifts are separated from the beach by a sandstone cliff of an average height of 150 feet. At only one place in the area under consideration is the beach sand escaping up a gully to the top of the cliffs.

It is a curious fact that on the whole of the Point Peninsula, i.e. the land below Pargaville enclosed by the Wauroa River, the Kaipara Harbour and the Tasman Sea there is almost no rock harder than soft sandstone. The one exception is Green Hill, a small dasite cone on the banks of the Wauroa River opposite Tokatoka. The rest of the peninsula is built up of alluvial deposits and sand of varying ages from the old mature podsol localities where the kauri grew, to the narrow low dune edging the beach. In between these two there is on the inside a belt of very fertile consolidated sandy loam and on the outside a strip of recently fixed sand that will "blow out" if the surface cover is broken. It is extensive "blow-outs" in this latter belt which form the drifts with which we have to deal.

It would seem that the land has been raised and lowered several times. Along the seaward side, both outcropping from the beach below highwater mark and from the cliffs are beds of lignite. They range from a few inches to 20 feet thick. In some of the beds timber is still to be seen in an excellent state of preservation. One can distinguish kauri (*Agathis australis*), totara (*Podocarpus totara*), monoa (*Dacrydium kirkii*), puriri (*Vicax lucens*), rata (*Metrosideros robusta*), and possibly kawaka (*Libocedrus plumosa*). Incidentally the lignite makes excellent fuel and saves cutting a lot of firewood.

All along the cliffs small waterfalls appear from above the lignite or a layer of impervious sandstone. Even during the driest summer they never fail and indeed do not seem to shrink in volume.

Native plants which do a certain amount of sand fixing are the silvery sand grass (*Spinifex hirsutus*), and pingaewo (*Scirpus foetidus*). The former is usually found nearest the beach and is the major agent in fixing the foredune. The pingaewo usually forms sand mounds on the drifts proper and is generally more trouble than it is worth as it causes eddies and wind tunnels which start the sand moving again. The toetoe is to be found around the edges of the drifts, both on the windward and lee sides. It too, unless growing thickly, will start fresh drifts by its action on the wind. Other plants of less importance are the sand coprosma (*C. acerosa*), the sea bindweed (*Calystegia soldanella*), and various cassinias and pinelias.

The plants used to arrest the drifting sand are first marram grass (*Panicum maritima*) and later tree lupin (*Lupinus arboreus*). These two will stop the sand. Later various pines are planted in an attempt to provide the best permanent fixation but so far these latter have not got beyond the experimental stage.

Once the marram and lupin is sufficiently established to supply some shelter there is a remarkable influx of both native and exotic plants which together with the marram and lupin will form an effective cover as long as they prevail. Insects, too, soon appear, and snails become very numerous.

Marram grass grows from 2½ feet to 4 feet high and at a distance is not unlike an undersized toetoe. It is a very strong grower and flourishes when the sand is continually burying it. In fact it seems to die off when the sand supply ceases. This dying off is probably caused by the marram exhausting the available food supply in the sand within reach.

Marram was first brought to this district about 40 years ago but the first serious efforts to arrest the drifting sand were made in 1930 by settlers whose lands were being invaded. In about 1932, the reclamation of sand dunes became a national undertaking and the Public Works Department, acting under Government authority, commenced planting operations on the Te Kopuru dunes. Since then work has extended over 40 miles of coastline and on twelve miles of this the advance of the sand has been completely stopped. Work is proceeding with the establishment of marram nurseries on the unfixed drifts. These nurseries, which are established on the most favourable parts of the drifts, are intended to supply stocks for the future planting of the whole of the drifts. Thus the transport of large quantities of marram, a very expensive item, is avoided.

The planting season, governed by the workability of the sand, starts about May and continues to the end of August or to mid-September. For planting out, as far as possible only the young marram

is used. It is recognised by its fresh green appearance and purple stems. "Plucking" as the digging operation is called, is accomplished by cutting the roots with a sharp spade well below sand level and then pulling up the plants. Stems so dug should for preference buds at the base. Stems without buds will not grow. Once plucked the stems are tied in bundles of 500. The bundles are occasionally counted but are gauged mainly by girth and weight. A freshly tied bundle has a girth of 20 inches and weighs 15 lbs. to 17 lbs. When tied the tops are cut off with a spade so as to leave the bundles 2 feet long. This reduces transpiration losses and makes the bundles easier to handle.

Having the marram cut to a standard length also gives a check on the depth to which the stems are planted, 18 inches being the standard. As soon as a bundle is tied it is stood up on damp sand and the roots covered with sand as a protection from the sun. Thus stacked marram will keep for weeks or even months without deterioration. Considerable growth takes place in the bundles.

Co-operative contract work is employed for plucking. The price paid is about 3d. to 4d. per bundle, according to how easy the marram is to procure. At 4d. a man has to dig about 50 bundles a day and this keeps him busy in an average stand of marram.

When marram is being plucked on contract it is a good plan to have the tops cut off the bundles when they are being tallied. Then there is no chance of counting any twice.

The next job is the transporting of the bundles to the planting location. At Te Kopuru this is usually an involved process. They must first be sledged to a place accessible to a truck. If transport is by roads this will be on the lee of the drifts, usually on private property. But if the marram is to be trucked along the beach the carry of the cliffs is the place. On the sand a two horse sledge can carry 40 to 50 bundles and this work is usually done by local farmers who are engaged when the marram is ready.

From the top of the cliff the bundles of marram are shot down a wire to the beach. Two bundles at a time are sent, hanging from a small hook made from the same wire as the conveyor. No. 12 gauge steel fencing wire is used. Two men can "wire" a hundred or more bundles per hour. The slope from top to bottom should be about 15 degrees.

Once accessible to a truck loading does not take long. On the roads a three yard truck can carry 250 to 300 bundles and on the beach up to 400. But for long hauls on the beach a 4½ yard 6-wheeler is hired and this truck can be loaded with up to 1,000 bundles if the beach is in good condition. Thus the cost can be brought down to something like 3d. per ton mile. Local trucks are hired for the work, the standard P. W. D. rates of truck hire being paid.