

to be losing its power, while the dunes proper are confined to the lee slope of certain terraces, to the source of the sand at Sandy Point (see Photo No. 63), and to the vicinity of the old accommodation-house. No sand is said to come from Sandy Point at the present time, and the presence of certain plants, especially of *Epilobium melanocaulon*, strongly support that statement. At Alexandra the dunes are well developed, and more active than elsewhere in the district. Rather than as moving dunes, it is as flying sand and as rapid drift that the Central Otago sand is most troublesome. Roads are buried, crops are damaged, rich soil is cut into and then blown away, and houses are made almost uninhabitable when the sand-storm rages.

So far as dune-reclamation in New Zealand goes, a good deal has been done here and there, but the patches are generally isolated, while vast stretches exist where nothing has been attempted as yet. In Taranaki many cliff-dunes which drifted some years ago have been stopped. Here, according to Mr. James Mackenzie, the sand-drifts have passed through their most dangerous state, and, with one or two exceptions, have been overcome by the regular planting of marram-grass. In western Wellington the younger dune-complex is, in nearly all cases, altogether unplanted. Planting has been carried out on the private lands to the lee of the above dune-complex, and in some instances with marked success, especially in the case of Mr. McKelvie, who has planted some hundreds of acres (see Photo No. 62). Here and elsewhere where tree-lupin has been used it has been planted without a true knowledge of its effect. There has been some planting on the Auckland dunes as far as Whangape Harbour, but it is much scattered; further north all is in the wild state.

The South Island dunes, generally speaking, are of less moment than those of the North Island. Marram-grass has been planted in many localities, but only a few examples can be cited here. At New Brighton, where the effect of the east wind is much felt, a long foredune has been established by the Town Council on the shore in front of the town. Tree-lupin has also been used with good results in many places, and probably some hundreds of acres are thus covered. In some places it is, however, in process of burial. At Ocean Beach, Dunedin, there is to be seen the most complete and successful example of dune-planting in New Zealand. Marram and tree-lupin combined have been used, together with a small foredune of marram-grass (see Photo. No. 47). The work here does not nearly approach in difficulty many other places on the New Zealand coast, but this does not detract from the excellent manner in which it has been carried out by the Domain Board. The Invercargill Town Council has done some marram-planting on the reserve near the head of the New River. This, unfortunately, I was only able to see from a distance. A little marram and tree-lupin have been planted in Central Otago—at Alexandra, Cromwell, and Tarras. At Cromwell the common tussock of the neighbourhood has been used, and grows remarkably well, as it also does naturally at Alexandra, but it would not tolerate a strong drift. A little marram has been planted near the road between Waicuru and Lake Taupo, where it passes over the Rangipo desert. Here the grass grows well in the pumice and ash, far from the sea.

As for tree-planting, nothing has been done on the younger dune-complex. There is an extensive plantation at New Brighton, Canterbury, consisting of a good many kinds of trees. There has also been much private planting, chiefly of *Pinus insignis*, on the more landward dunes. Here comes my former experiment-garden, where a good many different species of trees and shrubs not used elsewhere in dune-planting are growing vigorously (see Photo No. 48). Trees are now being planted on the Dunedin dunes by the City Council under the direction of Mr. D. Tannoch, and there is every chance of great success. It is hoped ultimately to have a forest facing the beach for its entire length. Earlier planting by the Dunedin Reserves Improvement Society showed the capabilities of these dunes for afforestation.

In the North Island there has been very little tree-planting on the dunes, and that mostly by private individuals. Near Foxton especially there are some fine plantations of *Pinus insignis*.

Generally speaking, there is not much to be learnt from the planting of New Zealand dunes. A great deal has been carried on in easy places. Other plantings are being blown away or buried. Some in difficult places appear to be successful, but they are mostly of no great age, and time alone will certify as to their efficacy. So far as the planting of tree-lupin is concerned, it has usually been quite futile, not because it did not grow, but because the planter did not know its correct application.

III. METHODS OF RECLAMATION.

(a.) GENERAL.

A great proportion of the dune-areas as they at present exist are, in the first place, a constant menace to the surrounding lands, and, in the second, are themselves valueless. Reclamation-methods seek to change this state of affairs, and to render them both harmless and profitable. This may be brought about by clothing them with a *continuous* plant covering, and the one which is most permanent and will yield the best income is undoubtedly forest. But in many places it is absolutely impossible to establish trees in the first instance, and in other places it would be, if not impossible, a work of the greatest difficulty, and altogether too costly to entertain. Other methods must then frequently precede afforestation. Further, as already pointed out, there are many acres of fertile land forming broad oases in the sandy wastes where there are valuable farms, and the protection of these is imperative. In Europe generally, whence come our methods of dune-reclamation, the protection of the coast-line and the treatment of the adjacent dune-area is the first need, just as it was at Ocean Beach, Dunedin; and European methods especially refer to such work. But in New Zealand the actual coast-line usually matters little at present. *The critical portions of the dune-areas are where the sand and farm-lands meet*, and those hollows in the dune-complex which are now grassed but liable