

Where there is no drift, as when there is a well-fixed marram-area to the windward, nothing can be better than tree-lupin as a sand-covering. The ease with which it can be raised from seed is a most valuable property; and, in addition, the rapidity of growth of the seedlings renders it, in countries where it is hardy, one of the most valuable instruments in the hands of the sand-planter. At Ocean Beach, Dunedin, the sand facing the sand-supply—i.e., the shore—has been well fixed in the first place by marram-grass; and behind this protection the lupin thrives amazingly, forming, too, a perfect covering to the sand, until such time as it shall be replaced by forest (see Photo No. 44).

At New Brighton, Canterbury, tree-lupin is not an unmixed blessing. In some places many acres are well fixed through its aid; in others it is rapidly being transformed into moving dunes (see Photo No. 67). It was planted some years ago, before the establishment of the artificial foredune, in the front garden of a house facing the beach; and, in consequence, a moving sandhill was formed, which came so close to the windows that the house had to be raised on piles a considerable number of feet.

In some parts of New Zealand, especially in the neighbourhood of the River Rangitikei, the farmers possessing sandy land look askance at tree-lupin, and will not use it for their dunes, fearing that it will seize on their sandy well-grassed hollows. It undoubtedly will spread and occupy such land if it is allowed in the first instance to increase; but there is no need to permit it to gain a foothold, and, even if it does so, *it is easily cut down, and there is no danger of its again growing from the stump.* It certainly seems to me that a plant which can do the best of work and be established much more cheaply than any other plant, should not be discarded without some better reason for so doing.

II. THE PRESENT CONDITION OF THE DUNE-AREAS.

Without an intimate acquaintance extending over many years with any special dune-area, let alone the whole sand region of New Zealand, it would be impossible to make a statement of any moment regarding its present condition as compared with that of long ago, or as to whether the ground as a whole is more or less stable than formerly. It is certain, however, that in the days of early settlement the greater part of the wandering dunes and the drifting sands as they now exist were wanting, and that in their place were hills clothed with a carpet of grass, with scrub, with waving toetoe, stately flax and cabbage-trees, while the hollows contained food for stock in abundance. But even in those early days drifting sand was not unknown, as evidenced by the account of the dunes in the neighbourhood of Wanganui published in 1849 by Lieutenant C. H. Smith and Lieutenant C. Hutchinson, who speak of the sand blowing in their faces, and of the numerous sandhills along the coast, which were very deep and "being drifted by the heavy gales." ("Notes on New Zealand," No. 6, p. 18; 1850.)

But, although comparative statements are of little moment, something can be said as to the present conditions of the dunes. It will be remembered that the various areas differ considerably in their topography, the extreme cases being those with a perennial supply of sand from the shore and those on the summits of cliffs, which receive little or nothing from the above source at the present time. Considering the former first, the foredune, although sometimes in an admirable state of preservation (see Photo No. 13), is very frequently indeed much damaged, in certain cases being altogether absent for considerable distances, as to the south of Reef Point, north-western Auckland (see Photo No. 21). Behind the foredune comes the area I have called the "dune-complex," which consists of chains of hills, isolated hills, and sand-hollows of various kinds. This area, taking the dunes of New Zealand as a whole, is probably changing very little. Of course, it is far from stable; hills are being eroded and blown away; bare masses of sand are slowly moving forward; sand-hollows are being filled up. But with the destruction goes on probably an almost equivalent construction; nor is there, generally speaking, any marked advance of this area inland.

Between the dune-complex and the most ancient and usually highest dunes, where the dune-area reaches its maximum, as in western Wellington, lie extensive sand-plains, the site of farms. These, of course, are being encroached upon to some extent, and in some cases to a dangerous degree. As for the ancient chains of dunes which abut in many cases upon first-class farm-lands—and the same applies to the cliff-dunes—they were originally admirably fixed by nature. At the present time many are still perfectly stable, and afford excellent pasturage for sheep. Others, again, have been transformed into typical wandering dunes with a long, flat, windward slope, and a great sandfall on the lee 100 ft. to 200 ft. or more in depth (see Photo No. 14). They advance slowly but surely, and bury all before them—fertile meadow-lands, cornfields, plantations, flax swamps; also, their lower portions may be rapidly blown over the lands adjacent as a sand-drift, burying and killing the grass covering.

The above account has also its bright side. Dunes, which some time ago must have been formidable enough, are in process of fixation on their lee slopes by plants which have come naturally. Toetoe-grass (*Arundo conspicua*) is doing admirable work in this regard, particularly on many of the dunes of western Auckland. Nor with regard to dune-amelioration must it be forgotten that the settlers themselves have in many instances done a good deal through planting-methods; but this is dealt with below.

The inland dunes of the Clutha valley, notwithstanding the work which has been expended on them, are still more or less troublesome. Those of Cromwell actually invaded the town, and the sand had to be carted away at great expense. The drift at the approach to the Bannockburn Bridge is very troublesome, the deep cutting which leads to the bridge being constantly choked by fine sand, the removal of which is a costly matter. At present, with the exception of the Alexandra dunes, the sand-supply from the River Clutha seems to have much diminished, and in addition vast quantities of fine sand have been blown away on to the distant hills, &c., leaving chiefly in many places only the very coarse sand (see Photo No. 45). One drift at Tarras is altogether gone, and the present one seems