The natural foredune is not always so even as that just described, but may be cut into by the wind or washed away by the sea, when at once destruction begins in the dune-complex, and in time a general flattening takes place. Where a well-made natural foredune does not exist, in the best European procedure an artificial one is constructed. This has been done in a few places in New Zealand, either by design or accident. There is one at Waikouaiti Bay, but which is not altogether satisfactory (see Photo No. 2). At New Brighton, Canterbury, and Ocean Beach, Dunedin, are much better examples, the former having quite checked the once very troublesome drift from the shore.

(e.) GENERAL TOPOGRAPHY OF A DUNE-AREA IN NEW ZEALAND.

Where there is a sandy shore with more or less bare sand at high tide the dunes will commence at a variable distance beyond the limit of the highest tide. Where the supply of sand is small, as in the case of either a small belt of dry sand or a shore where there are more pebbles than sand, there may be only a foredune, and this of the smallest dimensions; but usually behind the foredune are numerous chains of sandhills of quite irregular form, which are generally divided in places by basin-like hollows of greater or less extent. Frequently the ridges are at right angles to the prevailing wind, but in New Zealand there are nearly always one or two other more or less common winds, which operate to no small degree in regulating the position of the hills, in altering their form, in determining windward and leeward slopes, and in modifying the slope-angles. There are also many openings through the chains, hills at all stages of decay or growth, basins in process of being hollowed out or filled up, and comparatively flat masses of sand where the dune-chains have been destroyed. In short, there is usually a bewildering maze, especially where winds blow from several quarters, the actual origin of which could be traced only with the greatest difficulty and uncertainty. Such a collection of dunes is called by Cowles the "dune-complex" (12, p. 194), a term well suiting the case.

The dune-area varies from a foredune, or merely a few low mounds of sand, to a width of several miles, the maximum being about seven miles, between the Rivers Wangaehu and Rangitikei, in western Wellington. It is easy to overrate dune distances, for traversing them on foot is very laborious.

Large tracts of land such as the above are not worthless by any means: they include low-lying wettish flats clothed with nutritious grasses, streams, shallow lakes, and extensive swamps. The hills themselves are not generally bare, but possess a plant covering varying from a few tufts of sand-binding grass or sedge to a close turf overlying a deposit of loam, and affording fairly good pasture. It frequently is at the extreme inland boundary where the wandering dunes, huge masses of bare sand slowly moving, are encountered (see Photo No. 14).

Generally speaking, the view from an eminence in a wide dune-area is that of a sea of sand, the ridges stationary billows, and the scanty vegetation showing only as small yellowish or dark patches on the general white or greyish groundwork.

Some important dune-areas in New Zealand have no connection with the coast sand at the present time. This is the case with those dunes which extend in many places inland from the summit of coastal cliffs, as generally in Taranaki and between the north Kaipara Head and Maunganui Bluff in Auckland. Here the distinction between dune chains, hollows, and so on, is not nearly so well marked, and in some cases does not exist. Dunes of this description were in general covered with vegetation when the settlers arrived; but now some of them are wandering dunes of the worst description.

In western Auckland these present cliff-dunes overlie ancient sandhills, now consolidated into rock of a most variable degree of hardness. Between the north Waikato Head and the south Manukau Head the sea is cutting into and has removed a good deal of these ancient dunes. From Tewahiaroa northwards the old line of dunes marks an ancient shore-line, but at the foot of this is now a mile or so of low recent dunes extending to the sandy shore. Between Cape Maria and Reef Point there are several chains of consolidated dunes, forming the bulk of the narrow land-surface, and in some places they extend right to the western shore. Beneath them in many places lie the remains of kauri forest and even lignite, and this is the case also with some of the ancient consolidated dunes on Reef Point. From the above it is evident that there have been various changes in the altitude of northern New Zealand, while possibly some of the changes have been quite local; but a consideration of these matters would be out of place in a report dealing chiefly with the economic aspect of dunes.

The dunes differ much in height in different parts of New Zealand. The foredune may be from 8 ft. to 25 ft. high or more; but dunes more inland are very variable, those at Mason Bay, in Stewart Island, attaining the great height of possibly 300 ft. Generally 20 ft. to 50 ft. is a common height; but hills of 100 ft. and more are not infrequent, especially on the more fixed and inland dunes, whose instability was so little suspected in the early days of settlement that some of them received names (Mount Amon, Mount Jacob, &c.), and were made the sites of trig. stations.

Some of the dunes look far higher than they really are, so far as the depth of sand goes, owing to their being underlain by rock or by the above-mentioned ancient dunes now consolidated into varying degrees of hardness. Even the great wandering dune at the north Waikato Head is in many places quite thin, and near its summit at more than one place a stream of water trickles over the sand, coming from the solid ground below.

(f.) MOVEMENTS OF DUNES AND DUNE-SAND.

(i.) General.

It is easy to see that, built of so unstable a material as sand, a dune-area is in a constant state of change. Just as the ridges of ripples and the hollows alternate, so do dune-ridges and sand-plains. The dune having reached maturity, it is at once attacked by the wind, gashes are made in its surface, slight depressions are changed into deep gullies, plants are uprooted or buried, and high hills are finally