

(γ.) *The Fixed Dune.*

Even now, short as is the time since the first settlement of western Wellington, it is not easy to say what was the typical vegetation of a fixed inland dune. The pasturing of stock, frequent burning of the vegetation, and the spread of introduced plants has, in most places, called into existence a plant-association quite foreign to primitive New Zealand. But there are certain places, here and there, more or less undisturbed, while probably even yet all the original native species remain, though in a much different percentage from what they were in the primeval vegetation.

In all probability there would be a manuka heath in many localities*; in others the bracken fern (*Pteridium esculentum*) would dominate. The following would be common plants: The tutu (*Coriaria ruscifolia*), *Styphelia Fraseri*, *Cordyline australis*, *Phormium tenax*, *Carmichaelia flagelliformis*, *Scirpus nodosus*, *Muehlenbeckia complexa*, *Coprosma acerosa*, *Olearia Solandri*, *Cassinia leptophylla*, *Arundo conspicua*, *Danthonia semiannularis*, *D. pilosa* var. *racemosa*, *Discaria toumatou*, *Acaena Sanguisorbæ*, *Mariscus ustulatus*, *Carex lucida*, *Oxalis corniculata*.

In sheltered gullies there were small woods containing the following species of trees and shrubs: *Cordyline australis*, *Macropiper excelsum*, *Sophora microphylla*, *Meliccytus ramiflorus*, *Rapanea Urvillei*, *Myoporum laetum*, *Pittosporum tenuifolium*, *Muehlenbeckia australis*, † *Clematis Colensoi*, † *Corynocarpus laevigata*, *Dysoxylum spectabile*, &c.

With burning and "stocking" the equilibrium between the species was upset, space was opened up for new plants, so that various grasses, leguminosae, &c., came in, and at the present time a turf, containing white clover, cocksfoot, Yorkshire fog, meadow poa, and even rye-grass, together with many worthless weeds, covers much of the ground, interspersed with a varying quantity of the indigenous plants mentioned above, and others.

The most important part played by the primitive vegetation in the first instance, and aided afterwards by the introduced plants, was the formation of humus from their decay, the surface thus getting covered by degrees with sandy loam, itself alone an excellent fixing agent which would render the dune stable unless disturbed. So much so is this the case that in certain places these stable dunes are successfully used for growing crops of oats or rape (see Photo. No. 33).

But, notwithstanding such a use as the above, the greatest care has to be exercised, for if once the true sand is exposed there is a rapid reversion, not merely to semi-stable sandhills, but to the wandering dune itself.

(c.) *HOLLOWS AND SAND-PLAINS.*

It has been shown how the advancing dune ridge leaves in its wake level sandy ground which continues to be lowered by the wind until moisture, rising from the quite adjacent water-table, forbids further removal of sand. It is obvious that such hollows are in themselves quite stable, while their moisture permits an altogether different class of plants to those of the dune proper to establish themselves.

The final destiny of these level areas does not depend, however, upon their own plant-covering, but on the stability of the adjacent dunes, † and according to the behaviour of the latter so is the subsequent history of the vegetation.

One of two things may happen—there may be an invasion of sand and a reversion to dune conditions, certain transient plant associations arising only to be destroyed; or there may be a long stage of stability, in which case an evolutionary series of associations will succeed one another, culminating in a climax association; but this final stage may be reached by different paths.

(a.) *The Moist Sand-plain or Hollow.*

The damp sand is early on occupied by the curious round mats, 3 ft. to 6 ft. in diameter, of *Gunnera arenaria*, the small, thick, pale-green leaves flattened to the ground. When the short erect racemes of orange-coloured drupes are present in quantity, raised well above the foliage, the plant is both pretty and conspicuous. Colonies of the umbelliferous *Crantzia lineata* are common, the small, green, rush-like leaves bent to the ground. *Lobelia anceps* and *Carex pumila* are also frequent. In places water lies during winter, but these are frequently quite dry in summer, and have at times a surface temperature of 100° Fahr., and probably more, notwithstanding which certain moisture-loving plants grow—e.g., *Epilobium Billardierianum*, *E. nerterioides*, *Cotula coronopifolia*, *Limosella aquatica*—and remain quite healthy. It seems almost incredible that these plants, whose structure fits them for a wet environment, can tolerate such extremes; but one must remember that the wet sand just below the surface is at a very much lower temperature than the dry crust above, and that it never becomes dry.

Should the hollow continue moist—i.e., should there be no invasion of sand—the salt marsh plant, *Leptocarpus simplex*, will appear and finally take complete possession, in many places acres occurring at a time, its stiff, erect, yellowish or reddish stems 2 ft. or more tall rendering it very conspicuous. It is quite well known to the settlers under the term "yellow rush," and they set fire to it constantly to make way for more nutritious plants. Other salt-meadow plants also appear, especially the fleshy-leaved and creeping *Selliera radicans*, which has generally much rounded and smaller leaves than the typical form. The small brownish-coloured *Elaeocharis novo-zelandica* is common in places, catching a certain amount of sand.

* Captain Smith, R.A., pointed out what excellent pasturage was afforded by parts of the dune area in the year 1849, between the rivers Rangitikei and Turakina. He also noted the great extent of bracken fern. ("Report on Cook's Strait," Notes on New Zealand, No. 6, 1850.)

† These are lianes.

‡ Thus afforestation of hollows, easy as it might be, would be a precarious piece of business without fixation of the neighbouring shrub or sand-grass dunes.