

up chiefly of the whauwhaupaku (*Nothopanax anomalum*). The scrub varies in height from 2 ft. to 4 ft. The individual bushes are so dense that one can quite well stand up upon them, and they touch, thus forming a raised platform of interlacing rigid stems, the apical portions of which have almost turned into spines,\* just as in the case of *Aristotelia fruticosa* and some other New Zealand xerophytic shrubs. This platform or roof is not quite even, the individual shrubs in places being slightly convex and even in others rising into ridges, or indeed here and there not meeting. The floor is usually quite bare, though in a few places *Poa anceps* is growing on it, its green leaves pressed upwards through the dense covering and so, liane-like, reaching the light. Also, the lianes *Muehlenbeckia australis* and *Parsonsia heterophylla* are fairly abundant, and help to bind the shrubs more closely, adding to the density of the roof.

At a first glance, no one would hesitate to pronounce this formation primeval, but a closer examination suggests that this idea is erroneous. Everywhere over the little valley are the remains of trees lying prone, and some showing traces of fire. Stumps also stand here and there. In addition, the north-west wind blows over the margin of the western cliffs with great violence. How great this is, or must have been on special occasions, is shown by the fact of so many dead rata-trees rising skeleton-like out of the present evergreen forest where this is exposed to the wind, while, where sheltered, the ratas still exist in all their glory. Denuded of forest, no ordinary tree could survive in such a wind-swept locality, but the intensely xerophytic shrub, *Nothopanax anomalum*, has been able with ease to occupy the ground. That it is still doing so is shown by isolated plants, and small colonies arising in different parts of the meadow.

### C. The Coastal Formations.

#### (a.) General Remarks.

The vegetation of any coast depends chiefly upon the variety of stations that the nature of the land affords. On Kapiti, boulder beaches, terraces, and flats, together with cliffs and rocks, play by far the principal part. Sand-dunes, so common on the neighbouring coast of the North Island, are barely represented; nor is there any great extent of ground subject to flooding by brackish water or wetting by spray, where salt-meadow plants can flourish. As for the plants themselves, they are almost altogether those which occur in similar positions on the mainland. The adaptations of coastal plants are much the same the world over, and those of New Zealand afford special interest only when they belong to genera peculiar to the Southern Hemisphere, or to those which in other lands are not coastal.

#### (b.) The Strand.

In many parts of Kapiti cliffs come right to the water's edge and there is no actual shore, but in other parts there is a distinct sloping strand made up of boulders. These are quite loose to the tread. Mixed with them is sometimes a small quantity of sand, which slowly blows to above high-water mark and there forms a more favourable station for plant-life. The actual shingly beach is frequently quite bare. In other places, but at some height above high-water mark, and especially on the shingly terraces, is a very open formation consisting of large mats, several feet in diameter, of the dull-coloured shrubby *Muehlenbeckia complexa*,† whose wiry underground stems enable it to spread amongst the loose stones, and whose prostrate habit and small leaves protect it against excessive transpiration. Certain introduced grasses grow in the shelter of such mats, together with the lowly herbs *Cardamine hirsuta*, *Geranium molle*, and *Oxalis corniculata*. Yellowish-green cushions of *Scleranthus biflorus*, about half a foot in diameter and 4 in. in height, are dotted about here and there. These cushions are quite loose in texture, and attached to the ground merely by a stout deeply descending root, which is the only connection with the substratum, the rest of the cushion being easily lifted upwards. It is only on the periphery that the leaves are alive—within all are dead and quite dry—the plant not living on the peat formed from its decay, as is the case with so many subantarctic plants. From the base of the root slender branches radiate, which repeatedly branch, the apices of the final branches alone bearing the leaves, which are one-tenth or so of an inch long, needle-like and stiff in texture. Other plants of the shingle beach are the erect tussocks of *Scirpus nodosus*, its assimilating stems close-growing, rigid, and about 2 ft. tall; and the far-creeping fleshy-leaved shore-convolvulus (*Calystegia soldanella*).

In some places a little coarse sand has blown inland to above high-water mark, making incipient dunes, which are occupied by the far-spreading sand-binding grass *Spinifex hirsutus*, with its silvery leaves and very stout enormously long rhizome. Here, too, is *Calystegia soldanella*, also the pale-green sand-sedge (*Carex pumila*), these two latter extending on to the shingle beach.

Usually such blown sand does not form dunes, but, mixed with the shingle, slightly improves the capacity of the station for plant-life. On such ground, just above the drift-wood of the tide-mark, is a fairly thick growth of *Geranium molle*, *Muehlenbeckia complexa*, *Scirpus nodosus*, *Hypochaeris radicata*, *Rumex acetosella*, *Holcus lanatus*, *Fumaria officinalis*, *Stellaria media*, *Acæna sanguisorbæ*, and *Apium prostratum*, the latter and the *Geranium* extending on to the shingle beach. Here, too, a species of *Lepidium* is plentiful, with leaves flattened close to the ground in small rosettes, and forming in certain places an actual turf. With it is mixed a little of the creeping shore-buttercup, *Ranunculus acaulis*.

#### (c.) Shingle Flats, Terraces, &c.

The stony flats, mentioned earlier on, which have been at one time sea-beach, have a richer vegetation than the actual shore, as may well be expected. They are especially interesting as showing a later stage in the development of the vegetation which commences on a shingly beach.

\* See Cockayne "On the Significance of Spines in *Discaria toumatou*," "New Phytologist," Vol. iv, 1905, p. 84.

† From experimental investigations which I have now in hand there is every reason to believe that more than one distinct form is included under this name.