

## PART II.—SPECIAL ECOLOGY.

## A. THE ECOLOGICAL CONDITIONS.

The high rainfall and excessive number of rainy days make possible the presence of forest everywhere, even when soil-conditions are not specially favourable. For instance, the high dunes at Mason Bay are in places forest-clad, a quite uncommon occurrence in New Zealand generally. Low-lying land, where the surface-water cannot get away, may become altogether too wet for trees, but a swamp-forest may border such ground. The frequently cloudy skies and comparative poverty of sunshine must bring about a stronger shade within the forest than is the case in many of the allied formations of the mainland, but no investigations have been made on this head. Such lack of light would be greater were it not that the tree-tops are frequently at a considerable distance from one another.

On the other hand, when the forest has been removed, as is shown further on, the climatic conditions are admirably suited for its regeneration, for certain shade-loving plants—e.g., the rimu (*Dacrydium cupressinum*) and the slender tree-fern (*Dicksonia squarrosa*)—thrive quite well in the open. The mild winter is also favourable for tree-growth and for the presence of "tender" species of plants, and were it not for the comparatively cold summer the greater part of the New Zealand lowland flora could maintain itself in Stewart Island. On the scenic reserve of Ulva such characteristic northern plants as the nikau palm (*Rhopalostylis sapida*), the rangiora (*Brachyglottis repanda*), and *Pomaderris apetala*, planted by the late Mr. Charles Traill, are quite at home. Just as on the Canterbury Plain the cold of winter is hostile to many species of plants though the heat of summer is favourable, so in Stewart Island is it the reverse, whereas in northern Auckland winter and summer conditions are both suitable, a forest far richer in species being the result (Cockayne, 25).

The clay soil is not in itself very fertile, but the decaying vegetation has added a large amount of humus, rendering it not only more open but richer, its water-holding power at the same time being great. In many places there are considerable accumulations of peat, and even on sloping ground the water cannot get away, and bog-conditions follow.

So far as the grouping of the species is concerned, and the delimitation of the formations, of all ecological factors wind is the most potent. Were it not for its excessive violence there would be little open ground, even on the mountains, where the forest would ascend much higher, as shown now by the presence of the rimu (*Dacrydium cupressinum*) in the subalpine scrub, while this latter formation would occupy much of what is now meadow. The powerful effect of wind is well illustrated by the distribution of the vegetation on the shores of Paterson Inlet.

There the irregularities in the coast-line lead to every imaginable degree of exposure with regard to the prevailing westerly wind, which, its fury augmented in passing through the narrow opening of the Freshwater Valley, strikes the inlet with extreme violence. The vegetation changes exactly according to the degree of its exposure. In sheltered bays the ordinary forest, with its trees, shrubs, tree-ferns, and even filmy ferns, comes right to the water's edge, a special shore-belt being absent. Let the wind strike a little more fairly and *Senecio rotundifolius* makes its appearance, until with further increase of exposure the formation in which this species is dominant is established. With an additional increase manuka (*Leptospermum scoparium*) appears, and finally on the most exposed headlands it, as a wind-shorn shrub, alone flourishes, the *Senecio* being altogether absent (see Photo No. 2). Just as plants are ecologically defined as "shade-loving" and "shade-avoiding," so may they with equal propriety be designated "wind-avoiding" and "wind-tolerating," and on this conception may the distribution of many Stewart Island plants be explained. Thus on the exposed peninsula which separates the South Arm of Port Pegasus from the ocean the wind-tolerating inuka (*Dracophyllum longifolium*) is extremely abundant, its erect, slender yellowish heads standing above the general roof-level of the low forest.

The contour of the land-surface has much to do with the distribution of the formations or the associations. In the north of the island slow denudation has formed gullies and valleys where shade-loving and wind-avoiding associations can flourish. Likewise ridges and slopes occur where wind-tolerating plants of different degrees are congregated. In the south of the island a greater and more rapid denudation has reduced the general level of the country. Here, owing also to the narrowness of the land, the wind can exercise its full power, and, although much of the surface is near the sea-level, alpine rather than forest conditions exist in many places, and a formation almost identical with that of wet subalpine meadows is common.

Soil-moisture is a very important factor with regard to distribution, and this is also correlated with the conformation of the ground. Forest, swamp, bog, and sand plants have all their water-enduring capacity, and, on the other hand, their drought-enduring capacity, but each plant has its own special capacity, and in some—e.g., the manuka (*Leptospermum scoparium*) and *Crassula moschata*—the capability to tolerate extremes is enormous.

Excepting insects and certain birds which play a part in pollination, the animal factor is of little moment; no indigenous animal feeds on the plants so as to damage them. On the small outlying islands the sea-birds, as on the New Zealand subantarctic islands (Cockayne, 28), will have to be considered, but I know nothing definite on this subject.

The plants themselves react one upon the other, shade, shelter, increase of moisture in the air, and so on being provided by the presence of certain life-forms. The luxuriant growth of the punui (*Stilbocarpa Lyallii*) is favoured by the branching habit and leaf-form of *Olearia Colensoi*; *Sphagnum* cushions in bogs permit the presence of certain plants which would not grow on the actual wet sour ground; tree-fern stems support a rich vegetation; the peat-making habit of the coastal ferns leads to certain other species settling on rock-faces. Some plants act negatively, and by their close growth or special