

of the vegetation changes: the forest-trees become stunted and gnarled, and, as mentioned *re* the manuka zone, certain shrubs appear which were wanting or rare at a lower altitude; but the new association may be considered merely a changed forest. It is only on mountains of 2,000 ft. and upwards that a true subalpine scrub occurs analogous to that of the Southern Alps and high mountains of the North Island (see Cockayne, 19A and 29). All the same, the formation under consideration is ecologically related to certain of the coastal scrubs, to one phase of the yellow-pine association, and to the scrub found at quite a low altitude in the south of the island.

#### (b.) Composition of the Formation.

##### List of the Species.

(Filices) *Trichomanes Lyallii*, *Hymenophyllum sanguinolentum*, *H. Cheesmannii*, *H. multifidum*, *Polystichum vestitum*, *Blechnum discolor*, *B. capense*, *Polypodium Billardieri*, *P. grammitidis*, *Gleichenia dicarpa*; (Lycopodiaceae) *Lycopodium ramulosum*; (Taxaceae) *Podocarpus Hallii*, *Dacrydium Bidwillii*, *D. biforme*, *D. cupressinum*; (Gramineae) *Ehrharta Thomsoni*; (Cyperaceae) *Gahnia procera*, *Uncinia caespitosa*, *U. rupestris* var. *capillacea*, *U. filiformis*, *U. compacta* var. *caespitiformis*; (Liliaceae) *Astelia montana*, *Phormium Cookianum*, *Luzuriaga marginata*; (Cunoniaceae) *Weinmannia racemosa*; (Myrtaceae) *Leptospermum scoparium*; (Araliaceae) *Nothopanax simplex*, *N. Colensoi*; (Cornaceae) *Griselinia littoralis*; (Ericaceae) *Gaultheria antipoda* var. *erecta*; (Epacridaceae) *Styphelia acerosa*, *Archeria Traversii* var. *australis*, *Dracophyllum Menziesii*, *D. longifolium*, *D. Pearsoni*, *D. politum*; (Myrsinaceae) *Suttonia divaricata*; (Rubiaceae) *Coprosma parviflora*, *C. ciliata*, *C. ramulosa*, *C. foetidissima*, *C. Colensoi*, *C. retusa*, *C. cuneata*; (Compositae) *Olearia Colensoi*, *Senecio elaeagnifolius*.

The only species actually confined to the subalpine zone are *Dracophyllum Menziesii*, *Archeria Traversii*, and *Uncinia compacta* var. *caespitiformis*, while the two most important members of the formation—*Olearia Colensoi* and *Dracophyllum longifolium*—are also coastal plants. The different species are present rather because they can tolerate frequent wind and plenty of light than from a preference for a special altitude or decrease of temperature.

#### (c.) Distribution.

The true subalpine scrub—i.e., that in which *Olearia Colensoi* is the dominant plant—succeeds the narrow manuka belt at first as an unbroken girdle round the higher mountains, but afterwards is confined to gullies and sheltered spots, or occurs as islands in the subalpine meadow, ascending to 2,500 ft. or more on Mount Anglem. It appears to be present only on those mountains which exceed 1,500 ft. I have observed it on Mount Anglem and the unnamed peak to the south, the Thomson Range, Mount Rakiahua, the Table Hill Range, and the Remarkables, and it is certain to be on the Deceit Peaks. On the lower hills, such as Pryce's Peak, the scrub contains only a few plants of *O. Colensoi*, and is made up of the forest plants, but with certain species in greater abundance than in the forest proper.

#### (d.) General Character and Physiognomy.

The subalpine scrub is of the most extreme density. At first, particularly in the gullies, it may be 15 ft. tall or more; but as the altitude increases it becomes waist-deep, while finally certain of its characteristic members may form mere mats upon the ground. Seen from some point of vantage, the roof appears as a close, flattish, or slightly billowy mass of a sage-green colour, through the prevalence of *Olearia Colensoi*, with erect yellow-green slender bunches of twigs of *Dracophyllum longifolium* rising above it at short distances (see Photo No. 26). Within all is a complete tangle of stiff, rather thick bare trunks and branches, absolutely rigid, jutting out semi-horizontally as well as vertically, interlaced, touching, and extending right to the surface of the ground, and above are the heads of dense foliage.

The trunks of the *Olearia* may be prostrate, and yet quite tree-like, their horizontal spread exceeding the vertical height of the formation in dimensions (see Photo No. 27). *Suttonia divaricata* is abundant, and its crown of weeping and divaricating stiff twigs adds to the general density, though it plays no such conspicuous part as in the scrub of the Auckland and Campbell Islands. On the floor of the scrub itself any open space beneath the far-stretching branches is occupied by great tussocks on peaty trunks of *Gahnia procera*, and by moss and liverwort cushions. Progress through the formation can alone frequently be made by creeping under or climbing over the horizontal boughs. Seated upon the ground, or upon such a trunk as the above, the eye meets only a network of stiff, bare, horizontal, and semi-horizontal stems of a brown colour, huge green tussocks of *Gahnia* and yellow moss cushions of *Dicranoloma Billardieri* resembling moss-covered boulders. On the trunks of *O. Colensoi* will be a good deal of *Hymenophyllum sanguinolentum*, and on the floor and moss cushions colonies of *H. multifidum* and abundance of seedlings of *Olearia Colensoi*.

The scrub at first contains many small pyramidal trees of the rimu (*Dacrydium cupressinum*), small bushy kamahi (*Weinmannia racemosa*), and other aborescent members of the forest. The ivy-tree (*Nothopanax Colensoi*), with long, straight, naked, bamboo-like stems, is fairly common. In some places manuka is an abundant constituent, and may be recognised at a distance by its brown colour; in others, the mountain-pine (*Dacrydium Bidwillii*) will form one-half of the formation. The southern rata (*Metrosideros lucida*) growing merely as a shrub, the hupiro (*Coprosma foetidissima*), and the inuka (*Dracophyllum longifolium*) are also abundant. *Dracophyllum Menziesii* (Photo No. 7) occurs, so far as is known for Stewart Island, only on Mount Anglem, and there merely in the low scrub on the moraine. On the other hand, *Senecio elaeagnifolius* is absent on Mount Anglem, but is plentiful on the Table Hill Range.