

THE VEGETATION.

In what follows my remarks are confined to the plant-covering of the south-western slopes of the mountain (Fig. 2), as revealed by observations made during a visit of two days only in the vicinity of the track, from its beginning near the Rotorua-Taupo Road to its ending at the summit, where there is a lookout station of the State Forest Service. Only the vegetation as it is at present and its evolution are considered, notwithstanding there must have been in places an earlier plant-covering, as evidenced by the fact that Mr. Phillips Turner observed "dead totara trunks" in many places, the timber of which "was quite sound." These trunks he considered pointed to the existence of a former forest distinct from the present plant-covering, and his opinion—to my mind reasonable enough—was that "the trees had been killed within the last one hundred years or so, by explosions of boiling water from the craters," or, I might add, detrimental fumes. However that may be, the present vegetation shows many types of succession from that of almost bare ground up to low forest, and it is clear that even the latter can hardly exceed thirty years of age, and is merely transitory. That does not affirm that plant communities similar to those of the present time have not occupied parts of the mountain for far longer than the period mentioned above, for there must have been many changes in regard to the heat, &c., of the ground, and destruction and rejuvenation must have proceeded hand in hand for many years. As for the question of some parts of the vegetation being successions after fire, no evidence is available.

Quite distinct from any other type of the plant-covering is a small piece of true rain-forest, perhaps three hundred years old or older, which is situated in the bottom of a crater several hundred feet below the summit of the mountain (Fig. 5). The presence of this forest is most surprising, but with my limited knowledge of the recent history of the mountain it is idle to speculate as to either its origin or the reason for its stability.

In the year 1908, according to Mr. Phillips Turner, on the southern and south-western slopes of the mountain (Fig. 2) there were a great many fumaroles and solfataras and "comparatively recent extinct craters"; so that, "when seen in the early morning the whole southern side of the mountain seemed to be emitting steam." During my recent visit dry weather with bright sunshine forbade steam being in evidence except for a limited amount issuing from some of the cliffs. According to Mr. L. J. Grange, M.Sc., who has recently examined the mountain from the geological standpoint, and who gave me some interesting information, there are still many fumaroles, and the ground is warm in no few places, but probably thermal activity is less marked than at the time of Mr. Turner's visit twenty-one years ago.

Taking the vegetation as a whole, it comes in large part into that class I have defined in "The Vegetation of New Zealand" (ed. 2, p. 191) as "volcanic plateau (pumice) manuka shrubland"; but in many places the dominant manuka (*Leptospermum scoparium* and *L. ericoides*—one or both) constituent has been greatly reduced in quantity, or even swamped, and the physiognomy of the vegetation changed, by the incoming of certain young trees or shrubs, notably toru (*Persea toru*), kamahi (*Weinmannia racemosa*), whauwhaupaku (*Nothopanax arboreum*) and karamu (*Coprosma lucida*). Above all other species to give a most unusual but specially striking aspect to the vegetation—though far exceeded in number of individuals by many of its associated species—is the toru (*Persea toru*), a low tree, with its ovoid, much-branched, dense heads (Fig. 6) furnished with long, narrow, smooth, polished bright-green leaves; the yellow flowers are deliciously fragrant.

Coming now to the matter of succession, and of the various combinations of species, I can give no direct information as to the incoming of plants on the warm, bare ground in the presence of steam, but it must have been similar to what is happening at Whakarewarewa, Waiotapu, and elsewhere. There the first vascular plants to gain a footing are one of the umbrella-ferns, *Gleichenia microphylla* (*G. circinata* Sw. in "Manual of the New Zealand Flora") and a far-creeping and rooting club-moss, *Lycopodium cernuum*; in fact, both species are still present in the early vegetation of Rainbow Mountain. But of another common denizen of the early succession elsewhere—the water-fern (*Histiopteris incisa*)—I saw no trace.

The mark *par excellence* of warm ground—hot mud may be pretty near the surface—is white tea-tree (*Leptospermum ericoides*), forming a dense rooting mat at times less than 6 in. deep (Fig. 7). Though various other plants gain a footing along with the tea-tree, this—thanks to its far-spreading, light-excluding life-form—easily wipes out its competitors. Apparently the specially characteristic species of the primary succession—using this term in a rather wide sense—are the following: bracken-fern (*Pteridium esculentum*), *Gleichenia microphylla*, *Lycopodium cernuum*, dwarf gahnia (*Gahnia gahniaeformis*), white tea-tree (*Leptospermum ericoides*), mingimingi (a distinct but unnamed variety of *Cyathodes acerosa*), and monoac (*Dracophyllum subulatum*) (Fig. 8); there may also be more or less manuka (*Leptospermum scoparium*), snowberry (*Gaultheria antipoda*), totorowhiti (*Dracophyllum strictum*), and a few lichens and mosses.

Following on after the primary succession are various shrub associations made up of the shrubs of that community together with a few other shrubs and juvenile trees, but frequently *Leptospermum scoparium* is almost pure (Fig. 6). These shrub associations as regards height form many transitions (Fig. 9) between the primary succession and well-defined, tall shrubland which, at its fullest development, may be termed low shrub-forest (Fig. 10). Certain shrubs, when they occur in abundance, give a specially distinct character to an association—e.g., the totorowhiti (*Dracophyllum strictum*), particularly in its long-persisting juvenile form (Fig. 11), with long, tapering leaves extending outwards horizontally. Then in places there is abundance of the niniwa (*Gaultheria oppositifolia*), most striking with its large panicles of white flowers after the manner of the lily of the valley, and biologically of first-class interest on account of its hybrids with *G. antipoda*, which include hundreds of forms making every combination imaginable between the diverse characters of the two species. Were it only on