evaporation to the utmost. During most of the time of my visit and for some weeks previously there was no rain whatsoever. The soil must have become abnormally dry, and, although I had no means of ascertaining its water-content, in many instances this must have reached its limit. *Celmisia spectabilis* occasionally perished with the drought, and frequently was much injured. The young shoots of both *Podocarpus nivalis* and *Phyllocladus alpinus* were damaged, and certainly a period of drought still more prolonged would have killed many of the plants. The truth is that, notwithstanding the apparently desert aspect of the substratum, in a normal season there will be a fair abundance of soil-water—more, indeed, than the plants really require—and the xerophytic adaptations described below are probably in excess of the demand put upon them. But, at the same time, the sun's rays and the frequent wind exercise, as stated above, a powerful effect. On a cloudless summer's day, when insolation reaches its maximum, the scoria and surface soil become burning-hot to the touch, and the heat easily penetrates for some inches into the ground, the scoria absorbing and retaining the heat. As for the wind, I do not think its violence approaches what is experienced in so many places in New Zealand, but still it is usually more or less felt, and, of course, is a strong factor with regard to transpiration, and one of the main causes of the prostrate habit in plants, as evidenced by the fact of shelter conditions causing a more upright growth in such plants as *Dacrydium Bidwillii*, or, indeed, taking the steppe-shrubs as a whole, *shelter eventually transforms the open formation of steppe into the closed one of scrub.*

The plants themselves exert some influence upon one another, some supplying shade conditions, others quickly decaying when dead and turning into humus, while on the other hand others dry up and have no ameliorating effect at all upon the soil. Some, too, of the mat habit help to conserve moisture, as also do those furnished with rotting and water-absorbing leaf-sheaths.

The snow of winter must have a good deal of effect on plant-distribution, chiefly from its melting and the consequent accumulation of water in the flatter and lower ground. This plays a much greater part than was actually visible during my stay, but the presence of bog-associations on quite dry ground pointed plainly to the frequent covering of such by water for no short periods.

(*d.*) General Ecology.

The plants of these deserts and steppes, as may well be expected, show a number of marked xerophytic adaptations. The following are some of the most important:—

(1.) *The Prostrate Form.*—This is rather a mechanical adaptation against the drying effects of wind than anything else, but indirectly its effect in repressing transpiration can hardly be overestimated. With but few exceptions the volcanic-plateau shrubs of the open are prostrate. In some this is possibly non-hereditary, but in others the prostrate habit is the fixed one. Even in the former case it can be by no means certain, for instance, whether *Dacrydium Bidwillii* is normally an erect or prostrate shrub. Bearing in mind the great plasticity of New Zealand plants, who can say, even with experimental evidence, that a shrub like the above, which is prostrate in the open, and which also roots freely with adventitious roots near the apices of the shoots, is merely a wind-prostrate plant because in the forest it assumes a tree-like and quite erect habit? The truth appears to be that the so-called normal form of a plant as it usually exists in nature is due to physiological causes, and there is no fixed and really normal form at all in certain cases, unless we consider the more common one as such, or, in other words, *the special structure is hereditary only so long as the special conditions under which it exists are present.* In other cases the special form with but trifling variation remains fixed even under very different circumstances. Two main classes of the prostrate habit may be noted—viz., (1) where the shoots are merely flattened to the ground, as in *Dracophyllum recurvum;* and (2) where the creeping stems are anchored by means of adventitious roots, as in *Podocarpus nivalis.* Between these two classes there are transitional forms, and the first category even may under certain conditions put forth roots.

(2.) *The Mat or Cushion Habit.*—This is but a variation of the prostrate form, but there is greater density of growth, and consequently stronger resistance against transpiration. *Raoulia australis* is an excellent example (Photo. No. 3). Also the dead portions frequently build up a peat upon which the living plant feeds.

(3.) *Absence of Leaves.*—Here in some instances a distinct action of the environment can be traced, as in the forest and scrub forms of *Aristotelia fruticosa* and *Pittosporum rigidum* already noted, while in others, again, the habit is hereditary, and new organs for transpiration purposes are provided, as in the dwarf Carmichaelias (Photo. No. 20).

(4.) *The Whipcord Form.*—This is exhibited to perfection in *Veronica tetragona,* and occurs in New Zealand even in the most diverse families (Scrophularinaceæ, Compositæ, Taxaceæ, &c.). Here the leaves are not merely reduced to scale-like organs, but their internal structure is quite changed, while an imbricating habit is also adopted (Photo. No. 18).

(5.) *The Divaricating Habit.*—Here the stems are much branched, the branches given off at a wide angle and all interlacing. In extreme cases this common New Zealand ecological form is one of the strongest of xerophytic adaptations. These shrubs are usually wonderfully plastic, and vary enormously according to environment. *Pittosporum rigidum,* already dealt with, is a typical example.

(6.) *Tomentose Leaves.*—These are to be found in many of the plants, and to a varying degree. The tomentum seems to be largely unaffected by change of circumstances. *Celmisia spectabilis* is a typical plant of this class.

(7.) *Leathery and Thick Leaves.*—This is also a most frequent adaptation, and by its means a comparatively large assimilating tissue can be provided without risk of overtranspiration. *Senecio Bidwillii* is typical.

(8.) *Needle-like Leaves.*—These also are strongly xerophytic, on account of their small surface.