

Suffice it to say there is much evidence in favour of land-connection at one time with Australia and the Malay Archipelago, and that a considerable number of the ancestors of our species, and indeed some of the species themselves, came from thence—New Caledonia, the New Hebrides, and Norfolk Island being portions of the ancient land-bridge. Also, perhaps before the northern invasion, there was land-connection with an ancient antarctic or subantarctic continent, which at one time or another had been also connected with South America, and from this ancient land-area came the ancestors of our endemic or special genera, and perhaps some of our present species. *Nothofagus* may be taken as a type of the southern invaders and *Agathis* as one of the northerners. Between these two antagonistic classes of plants a struggle for the land would ensue, and the weakest would be driven to the most inhospitable places if their structure would allow them to occupy such. Thus we find remnants of the *Nothofagus* horde still remaining in the kauri region and even on Little Barrier Island. But the great army of these plants are to be found now in the colder southern parts and these principally in the poorer ground or at high elevations, the subtropical mixed forest occupying the better positions.

Nor is this all, for in all probability, as so ably shown by Speight in the report that is being published on the Tongariro National Park simultaneously with this one, the North Island was at one time an archipelago, a strait cutting off virtually what is now the Northern Floristic Province from the southern part of the Island. If this were the case, it is possible that a natural barrier existed, making difficult the spread of certain species to the south. In favour of this view is the distribution of the earthworms, for, according to Benham,\* those belonging to an Australian genus, *Rhododrilus*, have not been found beyond latitude 38° south, whereas south of this earthworms of subantarctic origin are abundant. Bearing all these facts in mind, and also what has been said above as to the struggle for existence among the plants, the ecological optimum and so on, it seems to me that the above explanation is worthy at any rate of examination. Personally I can see various weak points. Many of the statements on which it is based can hardly be called facts, but if it assists in stimulating research it will fulfil the special and most important mission of any theory.

#### C. LIFE-HISTORY OF A KAURI FOREST.

From the forest itself, the distribution of its members, the difference noted in various parts, and especially from a comparison between forest proper, transition forest, and heath, something can be learned as to its evolution. First of all it must be borne in mind that the kauri forests have been very much more extensive than is now the case. I do not refer merely to the reduction of the area through sawmilling and fires, but go back much further, and to the time when not only the present northern heath, so full of kauri-resin, but the swamps also, equally full of the same, were kauri forests; otherwise whence came the resin? The heath, then, was certainly at one time a much less extensive formation than at present. Its presence now depends upon the nature of the ground, the absence of competition with other plants, wind, and other factors, which we cannot estimate. But the kauri grew there originally. Some probably was destroyed by fire in the Maori times, but that could not account for nearly all. Much more to do with the distribution have been the oscillations of the land: a sinking of surface would in many cases lead to swamp conditions and actual submersion by the sea, in which cases the new ground would be occupied by xerophytes in the first place. The great amount of kauri-gum in the swamps of the north points conclusively to this submersion. (See Cheeseman, 2.) If I am right, too, as to xerophytes being the first to occupy a barren and wind-swept area, where humus is absent, then the heath is not only the successor but also the forerunner of the forest, but this, as the heath becomes fitted for plant-life, may gradually encroach upon it, sending out first its more xerophytic plants, just as is happening at the present time in many places on the margins of the Waipoua Forest, where seedlings of nearly all the forest-plants exist within the transition forest and where those of the kauri are more abundant by far than under the kauri-groves or in such extensive colonies as that of the Huaki.†

If one thing more than another was impressed upon my mind it was the diverse character of the forest in different parts under very similar conditions. In other words, though it seems to be a most stable thing, it is really always in a state of change, and various parts represent various phases or climaxes. Thus it has been shown that one part may have little undergrowth and many large trees, while, on the contrary, another may have the undergrowth dominant. This latter will in time, through survival of the fittest and non-blooming of juvenile plants, result in a close forest with little undergrowth. These are two climaxes, and are expressions of the light-factor, the dense undergrowth meaning the maximum, and the final open forest with a close roof the minimum, of light. Between these two climaxes there are all kinds of transitions. Bring in more light still, and more xerophytic conditions will prevail, the hygrophytic forest-plants going to the wall, until with excess of light a transition forest and a heath may result.

But on the heath usually are abundance of juvenile members of the lofty forest-tree *Weinmannia sylvicola*, most of which acquire no great size but do not bloom. All the same, they show the heath to be a potential forest, and this is still more the case where young *Knightia* and even the kauri itself enter in. In fact, it seems to me that if heath were let alone and the climate was favourable, *Weinmannia-Leptospermum* forest would result, this followed in due course by kauri forest proper. In like manner we have the reversal to the heath. In other words, we have here Nature juggling with the same material as in the primeval New Zealand days, and much the same must be going on now as formerly—that is, where cattle, &c., and introduced plants are absent.

\* Trans. N.Z. Inst., Vol. xxxviii, p. 239, 1906.

† Greater light at once leads to increase in seedling kauris, as may be seen in most forests where the kauri has been out out. (See also Matthews 22A.)