

Terrestrial Environments in New Zealand

Dr. R. R. Forster

Botanists have classified terrestrial habitats in New Zealand, and their classifications have been used by zoologists and ecologists, but no combined botanical and zoological classification has been attempted. In the absence of a well-developed vertebrate fauna any such classification would have to be based on invertebrates and the present inadequate knowledge of our invertebrates prohibits their use in a general classification.

Using some of the botanists' major ecological units I shall try to show their relationships to the New Zealand fauna. The units selected are:

Open Country

Grassland; River bed; Coastal; Sub-alpine meadow and rock.

Forest

Mixed rain forest; Beech forest; Sub-alpine forest.

Grassland: Although there are invertebrates characteristic of New Zealand's indigenous grasslands they are not as distinct a faunal unit as the fauna of larger and more permanent steppe areas. Grasshoppers, certain wetas, the tussock butterfly, many moths, particularly crambids, hepialids and noctuids, flies, ants, Hemiptera Heteroptera and a few Homoptera, melolonthid beetles, hunting and orb-web spiders are characteristic. The composition of the fauna of the lowland tussock appears to be different from that of the alpine tussock.

River bed: Gravel river beds provide a distinctive habitat with a characteristic fauna including the boulder butterfly, small carabid beetles, tiger beetles and a heteropteran, a number of species of mites, wolf spiders, jumping spiders, the water spider and a species of long-legged harvestman which appears to be restricted to this habitat.

Coastal: I intend to comment only on the supra-littoral zone of shore ecologists which supports a very distinctive fauna including

Pericoptis and staphylinid beetles, kelp flies, marine mosquitoes, marine caddis flies, the shore earwig and such spiders as the katipo, black jumping spider (*Marpissa marina*) and *Amaurabioides maritima*.

Sub-alpine: A distinctive fauna consisting mainly of insects—grasshoppers, beetles, wetas in some districts—*Erebia* butterflies and day flying moths (*Metacrias* sp.) in the South Island, is characteristic. Spiders are abundant, long-legged harvestmen are usually present and a large slug (*Athorocophorus* sp.) is common in the South Island above 4,000 ft.

Forest: The majority of our fauna is directly associated with forests. The two major forest types, mixed rain forest and beech forest, do not vary markedly from a zoological viewpoint, but there is a marked difference between the fauna of the leaf litter and the arboreal or aerial fauna. The animals of the leaf litter, the cryptozoic fauna, form perhaps the most distinctive terrestrial animal community in New Zealand. Thirty orders of animals, of which the Collembola, Acari, Coleoptera and Araneae are most abundant, are represented. In their structure, habits and physiological requirements they have much in common and they occur in vast numbers.

Two further habitats, soil and caves, must be mentioned. I do not intend to discuss the soil as a habitat, other than to record it as such. Caves in New Zealand have a restricted but distinctive fauna which shows little variation. Our cave fauna appears to be young in a geological sense.

The small area, insular setting and fairly uniform climate of New Zealand have produced a uniformity in its fauna, dominated by forest-dwelling animals. Although the fauna is more continental than insular in composition the restriction of migration due to isolation has resulted in a fauna lacking many elements. Many habitats, e.g. shrublands, coastal forest and swamp are characterised more by the absence of certain ani-

mals than the presence of distinctive ones, and the restricted variety would make it difficult to construct a firm classification of habitats—if this is desirable.

The most important point that emerges is that little progress can be made with ecological work until the composition of the New Zealand fauna is better known. For in-

stance, of the 30 orders of cryptozoic animals we know little of 22, including such important groups as mites, spiders, false scorpions, beetles and millipedes. Until the basic taxonomic work is attacked I feel that no major advances will be made in the detailed study of terrestrial ecology in New Zealand.

The Classification of Fresh-water Habitats

K. Radway Allen

Habitats are places where animals live; their essential characteristics are therefore those which enable the animals to survive, grow and breed there. These characteristics may be either positive or negative. The positive ones are those which provide some essential requirement; the negative ones are those which denote the absence of some condition which would make it impossible for the animal to survive.

The outstanding characteristic of fresh-water habitats, when compared with terrestrial ones, is the far greater basic significance of the physico-chemical conditions. While these are of great importance to a land animal, they are largely the result of the biotic conditions, particularly the vegetation, among which it is living. In the water, the relation is very different; the physico-chemical factors are the result of the topographic and geological structure of the locality and are virtually uninfluenced by vegetation or other biotic features. The physico-chemical factors therefore provide a much better basis for habitat classification in water than they do on land.

A factor of great biological importance is water movement. This may vary in intensity from virtual absence to great violence, and may be unidirectional and more or less constant, or variable both in direction and in intensity. It has both harmful and beneficial effects on animals—harmful when it tends to detach a bottom-living animal and carry it seaward—beneficial when it brings to an animal such requirements as food. In habitats where movement is continuous, the animals must be able to resist it but may or

may not be dependent on it; where movement is intermittent, dependent animals are excluded. Thus, among the movement-resistant animals are forms which are found impartially in places of continuous and of intermittent movement, and others only in place of continuous movement.

Temperature is another factor which must be considered more directly in dealing with aquatic than with terrestrial habitats, since it is less completely dependent on the local climate. For instance, cold and warm springs may provide temperature conditions entirely different from those on the surrounding land, or even in adjacent waters more subject to direct climatic influence. Such localities provide a habitat for many animals which are unable to survive in other waters of the same region which are more directly subject to climatic control.

On land, oxygen supply is rarely, if ever, a problem, but in fresh water there are many localities where the amount of oxygen available is extremely limited, either permanently or seasonally. Some aquatic animals possess devices which enable them to survive under these conditions. Animals without such devices cannot survive where oxygen is not plentiful and thus we can arrange habitats in a series with decreasing oxygen concentrations.

Other chemical factors may also be of significance to aquatic animals and call for consideration if the habitats of some species are to be fully understood.

The substratum is important to aquatic animals in many ways. For bottom-living