Book Reviews

Southern Hemisphere Biota

Biogeography and Ecology in New Zealand. G. KUSCHEL, Ed. Junk, The Hague, 1975. xvi, 690 pp., illus. + plates. Dfl. 200. Monographiae Biologicae, vol. 27.

This attractive volume is based mainly on literature published before 1972, but with scattered references and notes up to late 1974. Its 17 chapters, each by a different author, are largely descriptive and provide useful and up-to-date reviews of the marine, freshwater, and terrestrial ecology of the region; of the vertebrates, including special chapters on the kiwi (*Apteryx*) and tuatara (*Sphenodon*); of the insects and arachnids; of the land snails; and of the plants. There are also special chapters on the geological history, climate, and soils and on the insects in relation to plants, and there are particularly valuable accounts of the development of the Maori and European cultures and their influence on New Zealand.

It is now generally accepted that New Zealand, which may have been separated earlier by relatively narrow water barriers, moved away from Australia-Antarctica about 80 million years ago, moved relatively northeast, and occupied very nearly its present position prior to the Miocene, at a time corresponding to a mid-Tertiary temperature maximum. The open alpine and subalpine habitats of New Zealand have developed within the past few million years, which provides a reasonable explanation for the restriction of some 95 percent of the total fauna to forest habitats. This likewise explains the explosive evolutionary radiation, particularly in some genera of plants and insects, in the roughly 5000 square kilometers of the country that lie above timberline. They are, in effect, behaving like early colonists on islands recently thrust up above the surface of the sea. If these and some other common premises could have been accepted by the authors, the book would have been more unified and consequently more useful.

Current evidence clearly indicates that the Maori people arrived from East Polynesia, over at least 2500 kilometers of open water, probably only once, in the 11th century A.D. or shortly before, and that they developed in isolation for about 800 years from a hunting phase to a gradually expanding agriculture involving plants such as sweet potatoes, taro, yam, cabbage tree, gourd, and paper mulberry brought in the initial landfall from East Polynesia. Moas (an endemic group of large ground-dwelling birds) and a number of other animals were eaten, with the moas apparently becoming extinct shortly before the arrival of the Europeans.

European settlement, which commenced around 1820, has rapidly altered the landscape of New Zealand. Of the total land area of 268,000 square kilometers, 74,000 square kilometers are in improved (exotic) grassland; 6,000 in field crops, gardens, and orchards; and 5,830 in tree plantations, mostly Monterey pine (*Pinus radiata*). Native forests have been reduced from over 68 percent of the total land area to about 14 percent, and widespread erosion, often associated with overgrazing by introduced mammals, has depleted many areas. The pre-European population of about 100,000 has now grown to some 3,000,000 and continues to increase at a rate of about 42,000 annually, so that it will reach approximately 4,300,000 by the year 2000. About 7.5 percent of the country has been set aside as national parks and reserves.

The proportion of endemic plants and animals in New Zealand is very high, this resulting from the lengthy isolation of certain elements that came in the Cretaceous, more or less directly overland from Australia-Antarctica (for example, moas, kiwis, tuatara, gymnosperms, and *Nothofagus*) together with the periodic addition of other kinds of organisms chiefly, but by no means exclusively, from across the Tasman Sea (for example, some birds, the butterflies and bees, and such plant genera as *Epilobium, Celmisia*, and *Veronica* sens. lat.). Among the vascular plants, 39 of the 393 native genera (10 percent) and 1618 of the 1996 native species (81 percent) are found nowhere else. Surprisingly, some 12.13 percent of the native species are dioecious, a very high figure. Among the native vertebrates, there are three species of an endemic genus of primitive frogs, *Leiopelma*; two endemic orders of ratite birds, the kiwis and the extinct moas; and the tuatara. The ancestors of all these probably reached New Zealand essentially overland prior to its separation from Australia-Antarctica. In addition there are about 29 endemic lizards, 85 land birds (37 endemic), and two endemic bats, all probably of more recent origin. At least 44 additional species of birds have become extinct during the past thousand years, probably mainly owing directly or indirectly to the activities of man, whereas 33 species each of mammals and birds have been introduced by European man, mostly from Europe and Australia, some bringing about drastic changes in the vegetation. Some 1700 introduced species of plants have been recorded, with about a third well established and over 80 considered noxious, aggressive weeds. Nearly all the 270 described species of land mollusks, 870 described species of spiders and harvestmen, and 9460 described species of insects are endemic; the vast majority of these species are restricted to forest habitats. On the other hand, many insects, like some plants and a few birds, seem to have been self-introduced following trans-Tasman dispersal in the prevailing westerlies.

Marine biota also exhibit a high degree of endemism (for example, 83 percent of the shallow-water echinoderms), with a mixture of older, warm-water, Malayo-Pacific taxa acquired mainly prior to the Miocene and colder-water ones of more recent arrival. Most of the relatively few species of freshwater organisms, on the other hand, are widespread and probably relatively recent arrivals. In an interesting attempt to assess insect-plant relationships in New Zealand in comparison with those in other areas, J. S. Dugdale concludes that monophagous insects are much better developed on cold-adapted (austral) plants than on subtropical ones; that few native insects feed on the often very abundant introduced plants; and that pollination systems, as far as is known, are highly generalized.

In conclusion, it may be said that this book, especially taken in conjunction with a similar recent volume edited by Gordon R. Williams (*The Natural History of New Zealand*, Reed, Wellington, 1973), provides a fascinating, scholarly, and useful review of the large amount of information that has accumulated on the biota of New Zealand, presented in the context of their ecology and biogeography.

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