criticized, and outbreaks and collapses in mammal and insect populations are suggested to be due to changes in food supplies.

Part 3 gives eight examples of population studies to illustrate the theory that has preceded it. The ecology of the rabbit (*Oryctolagus cuniculus*) in Australia is summarized in nearly 60 pages. Briefer analyses are given for the black-backed magpie (*Gymnorhina tibicen*), the gray teal (*Anas gibberifrons*), and marine fish populations in one chapter and for spruce budworm (*Choristoneura fumiferana*) and the fruit flies *Dacus tryoni* and *Dacus oleae* in a second chapter. The ecology of humans is described in a final chapter. These examples are an important part of the book. There is an Australian bias to be sure, but there is in the literature no comparable review and synthesis of all the work that has been done on the rabbit, the magpie, and the teal over the past 40 years. The critique of marine fish population dynamics is well done and is a good example of the utility of the methods discussed in part 1.

In spite of all these good points this book is somehow disappointing. The general theory it contains is too general to be very useful for addressing concrete questions about animal and plant populations. It is perhaps better described as a paradigm or research philosophy than as a general theory. And there is too much left out of the book. Population ecology is exciting now because it is rigorous, quantitative, and experimental, all the virtues espoused by Andrewartha and Birch in 1954 but curiously lacking in this book. The application of mathematical modeling and evolutionary thinking to population questions is almost absent from this book. Too much energy is spent attacking "competition theory" as though it were the only alternative paradigm to the theory of environment championed by Andrewartha and Birch.

In my judgment Andrewartha and Birch try to do too much in this book. There can be no general theory of the numbers of animals in natural populations that can subsume the great diversity of species and local populations without becoming trivial. If we are to find generalizations about population dynamics, it will be at a lower level of generality with much more detail and more restrictive conditions than most of us would prefer. We are reaching now for specific hypotheses, and much of the excitement of modern ecology is in finding the right level of generality to aim for. None of this is easy, and we should all be grateful to Andrewartha and Birch for trying to go so far and do so much. No one knows what a general theory of population dynamics should look like. Here is one. If you do not like it, be inspired to make a better one.

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Rain Forests

Tropical Rain Forests of the Far East. T. C. WHITMORE. With a chapter by C. P. Burnham. Second edition. Clarendon (Oxford University Press), New York, 1984. xvi, 352 pp., illus. $64.

Very few ecologists, biologists, or biogeographers have written substantively and at length on the tropical rain forest. Perhaps only P. W. Richards, in *The Tropical Rainforest*, published 33 years ago, has succeeded in presenting a unified ecological account of this complex subject. His book—aside from particular treatments in older works by Schimper, Warming, and more recently Walter—is the only classic in the field. Most tropical ecologists still return to it as an authoritative source and for its disinterested and coherent line.

The paucity of such works in any language—and there appear to be none by indigenous tropical scientists—suggests that the subject may now be too vast and diverse to be grasped in a unified way as it was by Schimper and Richards. Of course there is a fast-growing number of disparate works by specialists in the tropical forest. But it is a chastening thought, despite holism, that the little we know about these complex ecosystems is already too large to apprehend, even with our new computer wisdom.

Given this situation the second edition of Whitmore's *Tropical Rain Forests of the Far East*, providing a timely update and appraisal of ecological information for the Malesian region, is to be welcomed. This is especially so because of the delay in revision of Richards's classic, in whose tradition it follows. Whitmore's book, as in the first edition, emphasizes the ecological basis of forest disturbances, both natural and human, and so is relevant to growing problems of forest regeneration and land rehabilitation in the tropics.

The second edition is rather longer than the first, which was published ten years ago, with 352 pages as against 282. The bibliography has nearly doubled, although one may doubt that the plethora of material listed will be accessible to the general audience, especially in the Far East, to which the book is directed. The extension of the text has enabled some important topics that were virtually unexplored previously to be discussed in

Limestone pinnacles reaching 30 meters in height (altitude 1200 meters) from the island Gunung Api, Sarawak. "Between the pinnacles there is about 0.6 m of peat and a low forest which has distinct similarity to that on the adjacent sandstone mountain Gunung Mulu." [From *Tropical Rain Forests of the Far East*]

detail, such as the ecology of animals and polycyclic logging systems.

As appears to be inevitable given the vast array of topics, the treatment is not even throughout. The chapter on soils, contributed by C. P. Burnham, which follows chapters on climate, growth, and nutrient cycling, remains isolated from the mainstream of the book. Its concepts and correlations do not permeate the treatment of relevant topics such as shifting cultivation or more detailed environmental correlations with the climatic formation types. For example, the section in the following chapter on "the causes of the very curious structure and the xeromorphic physiognomy of heath forest" has a confusing and indecisive discussion of alternative ecophysiological and edaphic processes. The explanations could probably have been clarified by appropriate support in the soils chapter, since oligotrophic scleromorphy has now been well studied throughout the tropics. In the discussion of heath forests chemical defense mechanisms suffer an uncharacteristically trenchant dismissal.

The list and descriptions of the forest formations of the region, which are really the core of the book, remain much the same as in the first edition. The Indonesian forests are less well documented than those in Malaysia. As the late Marius Jacobs observed, it would seem that much closer consultation with the scattered authorities on the local vegetation is necessary to improve and consolidate the typology. Given the recent rapid progress of tropical ecological research based on Bogor and Kepong, one may hope that indigenous ecological perspectives will soon be provided in book form to amplify the present work.

In light of the greatly accelerated exploitation and clearing of the forests over the past decade, Whitmore has strengthened the sections dealing with the relations between humans and the tropical rain forest and has expanded the last chapter, "Looking ahead." The importance of the rain forest is noted laconically by characterization of three roles, "protective, productive, and prestigious," in relation to the "two faces of the human condition." The problem boils down to utilization now or permanent protection of the myriads of indigenous plant and animal species—or both if possible. The difficulties of management—let alone of scientific criteria and other desiderata—are noted in relation to encroachment by people and goals of national development. Given the doubtful viability of relatively small forest isolates, Whitmore admonishes those conservationists "who do not realize that many conservation values are compatible with managed as opposed to virgin forests" and repeats his plea for research into forest management for timber production, the life of the native animals, and visits by tourists.

Solutions are not yet in sight anywhere to reconcile all these conflicting requirements, which extend beyond biophysical to human ecology and beyond the tropical rain forest to uncertain ecosystems that are far more complex. In this diligent and singular book, Whitmore has taken traditional ecology and scientific and humanitarian concerns as far as a botanist can. One hopes that the more sharply focused "bird's eye view" he has attempted in the second edition will help convince the public and decision-makers in the region to keep their options open by saving what they cannot recreate of their remaining natural world.

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Pandas in the Wild

The Giant Pandas of Wolong. GEORGE B. SCHALLER, HU JINCHU, PAN WENSHI, and ZHU JING. University of Chicago Press, Chicago, 1985. xx, 298 pp., illus. $25.

There are probably no more than a dozen of the approximately 4000 mammals that are recognized by the vast majority of people, regardless of where they live and what language they speak. Most people, if ever exposed, remember and are able to name elephants, tigers, bears, rhinoceroses, and gorillas. The giant panda probably tops this list of charismatic megafauna in terms of attractiveness and mass appeal. It is big, conspicuously marked, lives in an exotic and remote habitat, and has a variety of other unique and interesting morphological and behavioral features (see D. Morris and R. Morris, *Men and Pandas*, McGraw-Hill, 1966). Curiously, we have less knowledge of the natural history and biology of giant pandas than of any comparably popular mammal, despite our fascination with this species.

Giant pandas became media figures in the 1930's when live animals were first exhibited in Western zoos. However, detailed studies of the species' natural history were only initiated when the Chinese began to conduct censuses and biological surveys in the 1960's. At the time, the Chinese were interacting little with the international community. Thus the results of several expeditions to giant panda habitat were generally unavailable outside China until 1979 and 1980, when the government of the People's Republic initiated discussions with the World Wildlife Fund to promote a collaborative research program to study giant panda biology. Its goals were: "(1) research on the ecology and behavior of free-ranging Giant Pandas . . . , (2) working on Emergency Plan to deal with natural disasters [as they affected giant pandas; between 1974 to 1976 nearly 140 giant panda carcasses were recovered, the deaths presumed to be a result of starvation after a bamboo species flowered and died in one region], (3) studies on pandas in captivity, including reproductive biology, nutrition, behaviour, and handrearing of newborn pandas" (p. xiv).

This volume summarizes the findings of extensive studies of giant panda behavior and ecology in the Wolong Reserve; presented are the results of investigations by Chinese scientists between 1978 and 1980 and of the collaborative work with Western scientists conducted between 1981 and 1982. The book also includes data from several other collaborating scientists who conducted analyses both in and outside China for the authors.

The volume is unique not only in its inception and development but also in offering the first glimpse of the giant panda within its remote montane home in western China. It sets as its major goal to answer the question "How is the giant panda adapted to bamboo?".

The study site is in the Wolong Man and Biosphere Reserve, 160 kilometers northwest of Chengdu in western Sichuan. The authors provide descriptions of the vegetation and its distribution within the Reserve as well as climatic, topographic, and other habitat information. The description of the study area is the first in such detail for this unique temperate ecosystem. A more complete comparison with other, comparable temperate habitats might have underscored its incredible biological diversity and high degree of endemism.

The giant panda and its major food resource, bamboo, are focused on very closely, and neither is considered as part of this region's diverse fauna and flora. For example, nearly 30 percent of the book is devoted to discussions of panda feeding behavior and an analysis of the composition and nutritional content of bamboo. By contrast, the discussion of vegetation structure and ecology does not delve deeply into the interaction of bamboo with the trees, shrubs, and un-