Book Reviews

Rain Forest Biotas

Tropical Forest Ecosystems in Africa and South America. A Comparative Review. BETTY J. MEGGERS, EDWARD S. AYENSU, and W. DONALD DUCKWORTH, Eds. Smithsonian Institution Press, Washington, D.C., 1973 (distributor, Braziller, New York). viii, 350 pp., illus. Cloth, $15; paper, $5.95.

This book, consisting of 25 contributions prepared for an Institute of Tropical Biology conference scheduled to be held in Ghana in February 1971 but canceled for lack of funds, provides a series of comparisons of the rain forest biotas of the Congo and Amazon basins. Topics covered include: Mesozoic floral evolution after the occurrence of continental drift; floral relationships; comparative angiosperm evolution; radiation in palms; comparisons of the ant, grasshopper, *Diptera* parasite, amphibian, reptile, bird, and mammal faunas of the two regions; and ecology of aboriginal man in the two regions. There are also two rather sobering chapters on the dangers of land misuse in tropical ecosystems. Most of the authors concentrate on quantifying the similarities and differences between the two biotas; others, however, review the attributes and adaptations of rain forest plants and animals. This gives the book relatively good balance for one of its type and, with the help of the chapters on man, renders the whole very readable.

In view of the current interest in the influence of continental drift on the origins and evolution of biotas one of the most interesting facets of the work is what the various specialists have to say about transatlantic relationships. Is the West African–Brazilian junction that persisted through until the early or middle Cretaceous reflected in basic similarities in the two biotas? T. Delevoryas, writing on the Triassic and Jurassic floras, notes that these were wide-ranging; in the Cretaceous, however, coincident with the accelerated evolution in and dispersal of the angiosperms, significant changes became noticeable in the floras of the continents that were once part of Gondwanaland. Unfortunately the author does not detail precisely what these differences were. He notes, however, that floras are infinitely more diverse over smaller distances now than they were as recently as the mid-Tertiary. Delevoryas largely avoids being drawn into a discussion of the significance of continental drift relative to this. The dozen or so writers on present-day groups do not feel the need to invoke drift, however, to explain present-day distribution patterns. (An exception is H. E. Moore, who believes that palms radiated from West Gondwana.)

In his general paper on plant relationships R. F. Thorne notes that the floristic links between tropical Africa and tropical America are marked and include 12 families, 111 genera, and about 350 species. On the other hand 234 seed plant families are indigenous to Africa and 228 to South America. Obviously these differences must have arisen post-drift (not surprising since the angiosperms only radiated in the Cretaceous), and similarities at the species (and in most cases genus) level must be accounted for by transatlantic colonization, or by some other means. In his review of angiosperm evolution A. C. Smith partly explains some of the similarities at the family and genus level. He notes, "In every [non-annonalean] ranalean family that has been sufficiently well studied to permit analysis, the African and the South American elements seem separately related to an Asian-Australasian element which usually persists to a degree in that central area" (p. 60). In other words the two continents received their original stocks from this general source area independently and by different routes. H. G. Baker agrees with Thorne's views about the unimportance of drift, suggesting that even if D. I. Axelrod's 1970 theory that an origin of the angiosperms in the Triassic would have permitted the dispersal of some "advanced" families prior to drift, much of the stocking of the angiosperm-dominated tropical forests must have been achieved after geographic impediments began to appear. He suggests entry into South America via the north and into Africa by westward migration along the coasts of the Indian Ocean.

Zoological data on Amazon-Congo relationships broadly agree with the history indicated for the plants. W. L. Brown notes that none of the present-day subfamilies of ants are exclusive to the two continents. However, the faunas of sub-Saharan Africa and the Neotropical region, including those of their rain forests, are very different at both the species group and genus levels. They share only 29 genera, all of which are also widespread in the Northern Hemisphere. Analysis of generic distributions suggests that at least from the mid-Tertiary evolution of world-dominating new taxa has proceeded mainly from the combined tropical Africa–southern Asia area: these distributions offer no encouragement to the hypothesis of direct exchanges between the southern land-masses. T. S. Roberts, like some other ichthyologists, allows a Mesozoic transatlantic dispersal of the characoid fishes. R. F. Laurent finds few close relationships between the African and Neotropical amphibians and reptiles because most present-day groups evolved after continental separation; some of the most archaic families, moreover, are known as fossils from the Northern Hemisphere. Examples of ecological convergence, or parallel evolution, in the two faunas are numerous. The same remarks apply equally to the two avifaunas (D. Amadon). The mammal faunas likewise are very distinct (F. Bourlière), as would be expected since again radiations are post-Mesozoic.

How do the Amazon and Congo rain forests compare in terms of floristic and faunistic richness? The African rain forests, it turns out, are rather poor in terms of numbers of plant and bird species compared to equivalent regions elsewhere. Thus, West Africa has only 7,000 plant species compared to 20,000 in Indo-Malaysia; no precise figures are available for the New World tropics, but P. W. Richards suggests that they are at least as rich as those of Indo-Malaysia. Africa, furthermore, is very deficient in certain plant groups. West Africa has only 12 genera and 24 species of palms compared to 92 genera and 1140 species in the Americas. It has only 58 genera and 403 species of orchids compared to 107 and 800 in the Malay Peninsula, while the Panama Canal Zone alone has 57 genera. An equally striking set of differences is

found in birds. D. Amadon produces figures of about 250 species for the African rain forests and 550 species for the Amazonian ones. The mammal faunas, by contrast, are much more comparable, although Amazonia has a particularly rich bat fauna (F. Bourlière). The Amazon aquatic system is also much richer than that of the Congo; it has some 1300 species of fish against 560 in the Congo (R. Roberts). The freshwater turtle fauna of the former is also twice as rich (R. F. Laurent).

How are these differences to be explained? Richards notes that evidence from lake sediments, pollen, and archeological records indicates that during, and since, the Tertiary Africa has been subject to a series of severe climatic oscillations. Again unlike those elsewhere, the African rain forests are characterized by a regular dry season. R. T. Moore also emphasizes the importance of the climatic oscillations, noting that R. E. Moreau postulated a long history of fragmentation and reduction in the case of these forests. Richards questions why, if Africa was subjected to a series of severe climatic shifts, Amazonia did not also suffer these. As yet little evidence has been developed one way or the other on this. Speciation patterns in contemporary Amazon birds and reptiles do, however, suggest temporary fragmentation of the rain forests during the Pleistocene, as is indicated by Haffer and by Vanzolini and Williams. (It is possible that the more central continental position of the Amazon forests and their greater extent could have been factors minimizing extinction in this biota. The Neotropical rain forest biota is, of course, also essentially a "double" one resulting from the late uniting of separate tropical North American and tropical South American ones, as Ernst Mayr has pointed out.)

The concluding chapters, on the ecology of aboriginal man and on the utilization of rain forest habitats, are interesting as much for what is not known as for what is known of these subjects. Interesting links are indicated between the food and cultural ecology of African pygmies and between Amazonian Indians and their habitats. On the other hand (to a biologist) it is depressing how purely descriptive and totally lacking in quantification this information is. One can but lament what a large proportion of anthropological work is limited to the cultural sphere and how different are the priorities of animal ecologists and anthropologists in data gathering. There is an urgent need for the initiation of a broad program to quantitatively investigate the ecology of primitive man relative to his natural environment before it is too late.

The chapters of H. Sioli and F. R. Fosberg are a sober warning against the dangers of misuse of the Amazonian rain forest habitats. In the seeming luxuriousness of the Amazon forests clearing and destructive agricultural practices continue at an undiminished rate. Humid tropical forest soils have only a low productive potential, however, owing to long-continued leaching and the rapid and complete decomposition of organic matter that occurs at their high temperatures. We still seem to be a long way from convincing politicians and the man in the street of this.

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Rare Earths and Magnetism

Magnetic Properties of Rare Earth Metals. R. J. ELLIOTT, Ed. Plenum, New York, 1972. x, 426 pp., illus. $28.

The rare earth metals occupy a unique and particularly interesting position in the study of magnetism and magnetic materials. Their magnetism originates from unpaired 4*f* electrons, which occupy localized atomic-like states even in metallic hosts, and the interaction between the spins occurs mainly via indirect processes involving the conduction electrons. Thus the electrons responsible for the magnetism and those involved in electrical transport are completely distinct. This separation, on the one hand, is responsible for the remarkable physical properties of rare earth metals, alloys, and compounds, and, on the other hand, simplifies considerably attempts at a microscopic understanding of these materials. By contrast, the transition metals, their alloys, and many of their compounds have proven remarkably intransigent to the most concerted attempts to understand their magnetic and transport properties.

This excellent book basically summarizes our experimental and theoretical knowledge of the rare earth metals and alloys up to 1971. It is composed of a set of review articles covering such subjects as the exotic magnetic structures exhibited by the rare earth metals, the concomitant bulk magnetic properties, the elementary magnetic excitations, transport properties, hyperfine interactions, band structures, indirect exchange, and crystal field effects. The authors are all scientists who have made important contributions to this area over the last decade. The articles are generally lucid, thorough, and authoritative. Indeed, my only serious criticism of the book is that there is rather little cross-referencing and that the basic physical ideas thus tend to be reintroduced in each chapter. This, however, seems to be a failing of many such edited books.

There are, of course, still many interesting and important properties of rare earths, particularly in metallic compounds, which to date have been explored only superficially and are poorly understood. Among these I might mention valence change effects, crystal fields, and anisotropic exchange interactions. Reliable empirical information on these has only appeared in the last three years.

This book should be an invaluable basic work for physicists and chemists who are interested in the properties of the rare earth metals and should in addition be useful for all workers concerned with magnetism and magnetic materials in general. Finally, the price of the book, though somewhat higher than I would have liked, is still within the reach of individuals who would like their own shelf copy.

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CMR Data and Methodology

Carbon-13 Nuclear Magnetic Resonance for Organic Chemists. GEORGE C. LEVY and GORDON L. NELSON. Wiley-Interscience, New York, 1972. xvi, 222 pp., illus. $9.95.

Carbon-13 NMR Spectroscopy. J. B. STOTHERS. Academic Press, New York, 1972. xii, 560 pp., illus. $24.

With the almost explosive growth of high-resolution carbon-13 magnetic resonance (CMR) spectroscopy in recent months there could be no better time for the publication of books in this field by Stothers and by Levy and Nelson. CMR has been long in reaching maturity owing to the problems of detecting a magnetic isotope of relatively low natural abundance (1.1 percent) and less than favorable magnetogyric ratio