

The Tropical Rain Forest: An Ecological Study

P. W. Richards, 1996, 2nd edition
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THIS long-awaited book would seem to mark the end of classical tropical botany and phytogeography as subjects for scholarly pursuits. Since the middle of the century, when the first edition of *The Tropical Rain Forest* appeared, the wet tropical lowlands of the world have become an industrial battleground and, today at the end of the "Second Millennium", the future of the remaining rainforests that have evolved over millions of years looks bleak. Indeed, the book may well become "a record of what the rainforest was like in the twentieth century", as stated on its first page. This elegiac declaration not only reflects world concern about its pending extinction, but also Professor Richards' increasingly personal involvement with rainforest conservation in his later years.

In an ecological Introduction (Chapter 1) the historical perspective of the old edition is maintained, but like the following eighteen chapters, the text is essentially re-written to accommodate new research areas and new dynamic concepts instead of the "delicate but stable equilibrium theory" of the wet tropical environment. Despite an extensive literature review up to 1994, it seems that the flux of current ecological and palaeo-ecological theories of the tropics has yet to crystallize.

Following the Introduction, Structure and Physiognomy (five chapters) occupy about one quarter of the book. Here, new theories and facts are interwoven in lucid description using the basic framework of the first edition. Profile diagrams, developed originally by the author for comparative purposes, are used liberally to illustrate the structure and floristics of primary rainforests (Chapter 2). The now little used term "synusia" is retained to describe life form groups of complex rainforests in which stratification is still considered important. Simplification of tree strata and "single-dominant forests" are correlated with adverse edaphic factors as well as disturbances. Regeneration with its reliance on floristics (Chapter 3) is thought to reflect subtle differences in environmental factors, leaving only a small part to chance. However, the term succession is avoided in the discussion of developmental phases as in natural canopy gaps. The different natural turnover rates of rainforests in the Neotropics compared to the Old World are not interpreted. Description of basal tree features, leaf morphology and canopy roughness of trees is accompanied by theories of their functional significance (Chapter 4), and much new information is synthesized in the discussion of reproductive biology (Chapter 5). There is also considerable expansion of sections on climbers and epiphytes among other synusia of the rainforest (Chapter 6).

The role of animals is not meant to be dealt with in any detail in this book, written admittedly from "a botanist's point of view". Thus animals are mostly excluded from the discussion of community dynamics, although they are treated as important agents for pollination and seed dispersal and mentioned as being affected by the fragmentation of rainforests in Pleistocene refugia. The description of the huge variety and number of canopy arthropods and soil invertebrates as well as more conspicuous arboreal and terrestrial frogs, lizards, birds and mammals is not part of Richards' synthesis. Indeed, the author was careful to use the word "phytomass" in discussing biomass of the rainforest.

New contributions by specialists on The Environment are interpolated: climate (Chapter 7) and microclimate and hydrology (Chapter 8) by Rory Walsh and soils (Chapter 10) by Ian Baillie. A detailed account of tropical climates is given, including the effects of cyclones and climate change on different time scales, for which information did not exist for the first edition. Similarly, the microclimates and hydrology of tropical rainforests are elaborated, and the heterogeneity of soils in humid tropical regions treated systematically. Tropical and subtropical rainforests of Australia are shown on the map of world climate types associated with rainforests (Fig. 7.1). In this map the moist-wet tropics of northeast Queensland is designated as "tropical wet seasonal" with relatively low perhumidity index and evergreen seasonal rainforest. The climate diagram (Fig. 7.2) of Innisfail in this region, however, is grouped with other non-seasonal "tropical wet localities". Phenology (Chapter 9) is placed under the Environment to relate the phenomena of leaf-change, flowering and fruiting of rainforest trees to climate and soil.

Species richness and floristic variation are presented in two chapters (11 and 12) under Floristic Composition of Climax Communities, taking examples from primary rainforests of various types including heath forests. The climax theory is implicated in the discussion of Primary Successions over newly created bare areas (Krakatau in Chapter 13) and aquatic habitats (Amazonia, the Congo Basin and peat swamps of Malesia in Chapter 14). There is a welcome elaboration of mangroves and other coastal vegetation in similar contexts (Chapter 15).

Tropical Rain Forest Under Limiting Conditions is an incomplete survey of the recent work elucidating the diversity and composition of rainforests under some stress in each of the major tropical regions of the world. For drier vegetation (Chapter 16), Professor Richards emphasizes the distinction between species-poor "derived" savannas which are the result of recent human impacts and species-rich natural savannas which are not likely to be invaded quickly by forest trees even if fires are excluded. At the altitudinal and latitudinal limits (Chapter 17), the classical view of correspondence between the altitudinal zones of tropical vegetation and the latitudinal zones of subtropical and

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temperate rainforests has been challenged. The tropical-subtropical rainforests of north-eastern Australia are recognized in the new edition as having "characteristic features of their own", resulting from their unique palaeoecological history. However, their distribution under various climatic regimes (Nix 1982) and their environmental relations (Webb 1968) have been overlooked.

Secondary and deflected successions are restricted to areas of human impact (Chapter 18) though their separation from regeneration following natural disturbances is somewhat arbitrary. There is obviously much more information relating to human impacts today than four decades ago. Professor Richards' prediction (in Introduction) that old secondary forest and "true" primary forest can become indistinguishable "if undisturbed" for up to 200 years or more is a generalization fraught with political and legal overtones. In a Court of Inquiry (1980-81) into logging at Terania Creek in Whian Whian State Forest, northern New South Wales, forestry authorities tendered evidence by radiocarbon dating of wood and charcoal that mosaics of old secondary forests can persist for at least 1 300 years. Forestry prescriptions permitted logging in such "non-rainforest" types with desirable "hardwood" trees. However, such types are deemed integral ecologically in the development phases of "true" rainforest. The World Heritage values of rainforest areas now include such processes and are managed accordingly.

The future of tropical rainforests is discussed as a postscript, in which Professor Richards casts grave doubts about sustained-yield forestry based on natural regeneration, which does not give such quick financial returns as clear-felling. He forecasts that "there will be a gradual replacement of long-lived primary forest species by shorter-lived seral trees" and considers it "unrealistic to expect that the careful management necessary for sustained-yield forestry can be maintained indefinitely".

As in the first edition, Professor Richards stresses our scientific ignorance about these most complex terrestrial ecosystems, and the need for thorough

research, not only of commercial wood products, but also of "useless species . . . of unsuspected value". Besides economic and utilitarian benefits, the author claims that the disappearance of complex tropical rainforests at lower altitudes will adversely influence species evolution. Less quantifiable commercially is the role of "beautiful and bizarre forms of life" as a source of "wonder, enjoyment and instruction" and loss of "a vast realm of potential human experience". These are all admittedly anthropocentric, and there is no mention of intrinsic values of natural forests themselves, in contrast to the writings of tropical botanists such as John Corner and Marius Jacobs.

Two appendices are added in the new edition. One describes tree species recognition in the field and the use of vernacular names and the other, by Peter Greig-Smith, deals with quantitative numerical methods in rainforest vegetation analysis. Following 502 pages of text, references are meticulously listed in 38 pages (about 80% are new) and botanical names are indexed in 18 pages. The general index occupies 17 pages at the end of the book. The book is suitably illustrated and well produced. The quality of pictures is generally improved in the new printing of old photographs though there are some exceptions (e.g., Figs. 12.1, 15.1).

As the author states this is not a book of reference to be used as an encyclopaedia, nor is it a treatise only for seriously minded students of tropical rainforest ecology. It is a book to be read pleasurably by those who have any interest at all in the living environment of the humid tropics via their profession, recreation or conscience.

REFERENCES

- Nix, H., 1982. Environmental determinants of biogeography and evolution in Terra Australis. Pp. 47-66 in *Evolution of the Flora and Fauna of Arid Australia* ed by W. R. Barker and P. J. M. Greenslade. Peacock Publications, Frewville, South Australia.
- Webb, L. J., 1968. Environmental relationships of the structural types of Australian rainforest vegetation. *Ecology* 49: 296-311.

Conserving Biodiversity: Threats and Solutions

Edited by R. A. Bradstock, T. D. Auld, D. A. Keith, R. T. Kingsford, D. Lunney and D. P. Sivertsen, 1995. Surrey Beatty & Sons, Chipping Norton, New South Wales.

Hardcover, 297 × 206 mm, 428 pages with 25 colour plates, and numerous black and white figures and tables. ISBN 0949324590
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THIS book records the proceedings of a similarly titled conference organized by the New South Wales National Parks and Wildlife Service in June 1993. According to the editors, the book is a "systematic

attempt . . . to cover the current and future threats to biodiversity" in New South Wales and Australia, and "highlights the range of solutions needed to conserve biodiversity". The book contains 35 chapters structured in seven sections (conserving biodiversity, habitat loss, degradation and pollution of water resources, weeds and feral animals, commercial use of native biota, changes to fire regimes, can governments solve the problems?), with two to eight chapters in each. The book is a scientific treatise, chapters being written with other researchers and scientifically trained government officials in mind.

I had access to a copy just after putting together a set of readings for senior undergraduates and postgraduates for a course in Park and Wildland

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