When Professor Richards’ classic book first appeared in 1952, the tropical rain forests could be thought of as stretching endlessly over vast areas of the humid tropics, but now their nearly complete destruction is not far from realization. Over the years, ecological ideas have changed in many respects. The old notion of the stability of rain forest over long periods of time has been replaced by a dynamic concept of rain forests as kaleidoscopic mosaics continually reacting to climatic changes and human pressures.

The enormous growth of interest in tropical forests has led to an explosion of new data and ideas. This new and completely rewritten version provides a wide-ranging view of the field by one of the major contributors to our current understanding of rain-forest ecology. New chapters have been contributed on climate and microclimate by R.P.D. Walsh, and on soils of the humid tropics by I.C. Bullis, and there is an appendix on numerical methods in rain forest by P. Greig-Smith.

The new book will stand as a record of what the rain forest was like in the twentieth century.
The tropical rain forest
an ecological study
The tropical rain forest

an ecological study

Second edition

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To the memory of my friends

Carl Schroeter (1815–1939) whose *Pflanzenleben der Alpen* inspired me to write this book

and

Agnes Arber (1879–1960) to whose encouragement and constructive criticism it owes so much
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Preface to the second edition

The publication of the first edition of this book in 1952 was followed by reprints in 1953, 1964, 1966, 1972 and 1976 and a paperback edition in 1979. All of them included small corrections and additions, but none was fully revised. The present edition is virtually a new book as it has been completely rewritten: very little of the original text remains. The short section of Chapter 4 on the flowers and fruits of rain-forest trees has been expanded into a new chapter and the chapters on climate, microclimates and soil conditions have been replaced by entirely new chapters, the first two by Dr R.P.D. Walsh, the third by Dr Ian C. Baillie. Two appendices, the first on tree species recognition in the field, and the second (by Professor F. Greig-Smith) on quantitative methods in rain forest ecology, have been added.

Since The tropical rain forest first appeared, knowledge of rain-forest ecology has grown enormously. Interest in tropical forests has also spread among the scientific and wider public throughout the world. The term ‘tropical rain forest’ itself, which was once familiar only to professional botanists and foresters, is now seen in newspapers and popular magazines and heard almost daily on radio and television. At the same time the scientific literature on the ecology of rain forests has increased so rapidly that it is hardly possible any more for a single individual to keep abreast of it.

But even more important than the transformation in human awareness and attitudes to tropical rain forests is the change in the forests themselves. Up to the middle of this century they could still be thought of as stretching endlessly over vast areas of the humid tropics, but now their nearly complete destruction, foretold in the first edition of this book, is not far from realisation. Only relatively small areas remain where the natural forest has not been replaced by farms, plantations and secondary vegetation. Though the forest at Moraballi Creek, Guyana, which formed much of the subject matter of Edition 1 still stood in 1972 more or less as it was in 1929, many of the other areas referred to have been altered so much as to be no longer recognisable. Fortunately, owing to the efforts of some enlightened governments, the World Wide Fund for Nature, and other organizations, a few rain-forest areas are being conserved, but there is an urgent need for much more to be done.

The pace of change in both rain-forest ecology and the forests themselves has made the writing of this new Tropical rain forest a long and difficult task. The ever-expanding bulk of literature has made it impossible to cover the field to the extent which was possible in 1952. Like its predecessor, the present book does not aim to be encyclopaedic. What has been put in and what left out reflects the author’s experience and particular interests. Some branches of rain-forest ecology have been dealt with in cavalier fashion, for example productivity and biomass, not because they have been judged unimportant, but because the author feels ill-equipped to discuss them. Some subjects, for example mangrove ecology, are now very adequately dealt with in other books and do not need to be treated at length here. On conservation, vitally important though it is, only a short Postscript (Chapter 19) has been given; a full discussion would have greatly increased the size of the book. It has been impossible to deal adequately with the role of animals in rain-forest ecosystems; the book has had to be written (as one of its critics has said) from ‘a botanist’s point of view’.

Since 1952 ecological ideas, including the author’s,
PREFACE TO SECOND EDITION

have changed in many respects. The old notion of the
stability of rain forests over long periods of time has
been replaced by a dynamic concept of rain forests as
kaliedoscopic mosaics continually reacting to climatic
changes and human pressures. The rather rigid concept
of rain-forest structure and stratification of Edition 1
has become less formal.

This book will, I hope, be regarded as a record of
what the tropical rain forest was like in the twentieth
century. Revising a book originally published forty years
ago is like renovating an old building; the facade may
retain something of its old appearance, but it is hoped
that the interior has been sufficiently modernized to be
still serviceable.

P.W. Richards
Cambridge
Preface to the first edition

The scope of ecology is not easy to define—it has even been said that the only definition of ecology is that it is the subject-matter of the Journal of Ecology. In writing a book about the ecology of the Tropical Rain forest I have therefore had to decide for myself what was and what was not relevant to my theme; in this I have been influenced, no doubt, by my own particular whims and prejudices.

Because ecology is a synthetic science, embracing or touching many other disciplines, it has been my ambition to interest many who are neither botanists nor foresters—zoologists, geographers, in fact anyone who is concerned with the rain forest as a plant community or an environment. I have dealt scarcely at all with the economic aspects of my subject; my aim has been to provide a basis for future work, whether 'pure' or 'applied'. Because I hope the book will be of use to those not trained as professional botanists, I have tried to make the text as self-explanatory as possible and to avoid unnecessary technical terms.

No general account of the Tropical Rain forest has been written since A.F.W. Schimper published his great Plant Geography (1898; English edition, 1903), which has since been revised and expanded by Prof. F.C. von Faber (1933). My main qualification for such a formidable task is first-hand experience of rain-forest vegetation adding up to nearly two years. At this experience, though short, was very intensive, and as I had the unusual good fortune to visit each of the three chief tropical regions—South America, Africa and Malaya—within a space of seven years, this qualification is perhaps not as painfully inadequate as it appears. The great development of interest in tropical vegetation during the last fifteen years has given rise to a voluminous and very scattered literature. In writing the book I have endeavoured to make full use of this, but much has had to be deliberately neglected and still more has probably been unintentionally overlooked.

In a work of this kind it is inevitable that many statements will prove to be wrong, and in some places the facts may prove to have been misinterpreted. These shortcomings may not matter if the book stimulates further work. In my travels I have been impressed by the large amount of valuable ecological information which exists unpublished in the minds and notebooks of foresters and buried in departmental reports; I hope the publication of this book may coax some of these data from their hiding places. Much valuable information has been obtained from letters from various friends; the source of such data is indicated in the text by the name of my correspondent in brackets without date. In every chapter I have tried to point out the chief gaps in present knowledge and to suggest lines for future work. No better prospect for my work can be wished than that it may soon become out of date.

Many ecologists would agree that their science is not yet ripe for a rigid theoretical framework, but since a theoretical background of some kind is necessary, the general principles of the Anglo-American school of ecologists have been followed. The absence of a chapter on biotic factors is due, not to a failure to realize their importance, but to the lack of a sufficient body of suitable data.

Part of the matter in the book has appeared in a series of papers published from 1933 onwards. As might be expected, I have since modified some of the views and interpretations given in those papers.
XX

PREFACE TO FIRST EDITION

With regard to the nomenclature of species, it is obvious that in a work of this kind, in which names are quoted from papers and books dealing with the flora or vegetation of many different countries, the author cannot answer for the correctness of every name used, though the nomenclature has been checked as far as time and opportunity have allowed. I am much indebted to various members of the staff of the Kew Herbarium for helping me in this part of the work. Where information has been taken from published books or papers the names given here are not always those used in the original, but some synonyms will be found in the Index of Plant Names. In a few instances names of plants in the text have been placed in inverted commas; this indicates that the validity of the name or the correct citation is doubtful.

I could not have written a general account of the tropical rain forest without the help of many kind friends. Though it is impossible to acknowledge individually the help of all who have provided data, references to literature, or who have assisted in other ways, a word of special thanks is due to Dr Agnes Ather, F.R.S., who has given me much valuable advice on matters of presentation and has read and criticized a large part of the manuscript. Also to Sir Edward Salisbury, C.B.E., F.R.S., whose help in planning the book was invaluable; it was also a suggestion of his that gave rise to the ‘profile-diagram’ technique which has proved such a useful tool in the study of tropical vegetation. Special thanks for help of various kinds are also due to Dr J.S. Beard, Prof. H.G. Champion, Dr E.M. Chewny, Mr E.J.H. Corner, Mr T.A.W. Davis, Dr G.C. Evans, Mr P.J. Greenway, Prof. F. Hardy, the late Mr A.P.D. Jones, Mr R.W.J. Keay, Prof. J. Lebrun, Prof. G. Manley, Mr R. Ross, Dr C.G.G.J. van Steenis, Mr C. Swabey, Prof. J.S. Turner, Prof. T.G. Tutin, and Dr Frans Verbom. A word of gratitude is also due to the librarians of several libraries who have assisted me in searching for literature, especially the Librarian of the Imperial Forestry Institute, Oxford. For permission to reproduce figures and photographs, I have to thank Dr J.R. Baker, Dr J.S. Beard, Mr W.J. Eggling, Dr G.C. Evans, Dr E.W. Jones, Prof. F.W. Wens, the Director of the Musée Royale d’Histoire Naturelle de Belgique, the Editor of the Bulletin du Jardin Botanique de Buitenzorg, the Forestry Department, Malayan Union and the Editor of the Journal of Ecology. Lastly, I am indebted to my wife for much help, especially in preparing the indexes.

P.W. Richards

Botany School, Cambridge

August 1928
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I thank the Royal Society and the Tansley Fund of the New Phytologist Trust for contributing to the cost of typing the manuscript.
Note on geographical names

The geographical names used in this book are, with a few exceptions, those in The Times Atlas of the World, seventh comprehensive edition (Times Books, London, 1985). 'Tropical America' is used for Central and South America. 'Malaysia' is used for the Malay Peninsula and Malay Archipelago, including New Guinea and the Philippines, as in Flora Malesiana (Nijhoff, The Hague, 1948–). To avoid tedious repetition, 'Malaya' is used for the Malay Peninsula (Peninsular Malaysia plus Singapore).
Most studies of vegetation have been carried out in Europe, and I am of the opinion that owing to a paucity of material these investigations have begun with an inverted viewpoint. When studying the manifold types of vegetation, comparing them and relating them to each other, one ought logically to start with the richest and to derive from it the less complicated, impoverished types which have arisen from it by selection. The richest type of vegetation in number of species, volume and density, is found in the tropics. It is not the impoverished anthropogenic vegetation of Europe which should be the starting-point of one’s investigations.

C.G.G.J. VAN STEENIS (1937, transl.)