



Tropical Rainforests

Past, Present, and Future

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From the Past to the Future: Evolution, Ecology, and Conservation of Tropical Rainforests

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The idea for this book arose from our conviction that there is much to be gained by increasing the level of communication and collaboration between the evolutionary biologists and ecologists engaged in the study of tropical rainforest communities. That knowledge of history and evolution should inform ecology, and vice versa, is hardly a new idea (Ricklefs and Schluter 1993a). Likewise, previous works have dealt explicitly with the effects of history on diversity in rainforests (Flenley 1979; Prance 1982a; Morley 2000). What is new is that we are reaching a sufficient understanding of ecological and evolutionary processes and, for some places, of patterns of local and regional diversity to attempt an integrative approach to the analysis of species-rich tropical rainforests.

As several contributions in this volume make clear, there is much still to be done by way of basic description of species, let alone their ranges, interactions, and phylogenetic relationships. However, the past few years have seen great advances in basic knowledge of tropical rainforests, resulting from, among other things, the establishment of networks of permanent tree inventory plots (Condit 1995), increasing knowledge of the paleoecological history of tropical regions (Morley 2000), the capacity for large-scale sequence-based analysis of phylogenetic and biogeographic history (Moritz et al. 2000), and the acquisition of fine-grained environmental data via remote sensing (Saatchi et al. 2000). These advances are moving us toward a deeper understanding of the origin and maintenance of species diversity in tropical rainforests.

Of course, the glue needed to bind these somewhat disparate fields is theory—specifically, theory that combines ecological and evolutionary approaches. The traditional view can be paraphrased as “ecological processes—productivity, demographics, and species interactions—determine local species richness, while evolutionary processes leading to speciation and extinction set species numbers at regional scales.” A newer view, exemplified by Hubbell’s neutral theory of biodiversity and biogeography (Hubbell 2001; Hubbell, chap.

4 in this volume), is that local community structure is determined by *both* ecological (productivity, J_M) and evolutionary (speciation rate, v) dynamics, moderated by dispersal limitation, and, as a deviation from the Hubbell model, species interactions. While far from universally accepted (Nee and Stone 2003) and subject to refinement, Hubbell's theory and other attempts to combine ecological and evolutionary theory (e.g., Rosenzweig 1995) provide a promising direction for integrative studies of rainforest diversity at varying spatial and temporal scales.

A principal aim of this book is to showcase the Australian Wet Tropics, because the history of this region has been more thoroughly reconstructed through geological, climatological, and molecular genetic records than that of other rainforest regions. As evolutionary biologists, the editors of this volume have looked at rainforest communities principally through a historical lens, and we felt that the integrated evolutionary and ecological research in the Wet Tropics provides a useful case study. Therefore, this book couples an integrated view of research in the Australian Wet Tropics to chapters focusing on rainforests in Africa, Southeast Asia, and the Neotropics. All of these rainforests have distinct evolutionary and biogeographic histories (Morley 2000), which have undoubtedly had a profound influence on regional differences in alpha and beta diversity (Richards 1973; Condit et al. 2002; Dick, Abdul-Salim, and Bermingham 2003).

The book also aims to provide an improved scientific basis for conservation that we hope will serve as one more resource in the battle to retard, and in some cases reverse, the steady clearing and degradation of rainforests worldwide. While the drivers of rainforest destruction are economic and political, it is up to biologists studying rainforests to develop an understanding of rainforest community dynamics across varying spatial and temporal scales and to communicate their observations and knowledge at multiple levels in order to develop effective conservation strategies. As D. H. Janzen (1986) has written, "Engineers build bridges, writers weave words, and biologists are the representatives of the natural world." The contributors to this volume lucidly represent rainforest biomes around the world, offering suggestions about how their science might lead to improved stewardship of tropical forests.

This volume is divided into three parts. Part I presents a series of contributions spanning general evolutionary and ecological influences on the species diversity of rainforest biotas, and includes approaches referencing different temporal and geographic scales. Part II focuses on the Australian Wet Tropics, with the aim of bringing together evolutionary, paleoecological, and ecological perspectives on the only region of the world's tropics where the rainforest is ade-

quately protected by legal and cultural means. The book with four chapters that record the history of the rainforests of the Wet Tropics, which are not the product of natural processes but depend on human behavior and

The concept for the book arose from a workshop on *Rainforests: Past and Future*, held in Cairns in 2001 at the Cooperative Research Centre for Rainforests and the Smithsonian Tropical Research Institute. The book, however, includes chapters from a broader Cairns symposium, and all contributions were presented at a symposium in Cairns in May 2003.

With so many new sources of information available, this is an exciting time to be a rainforest biologist. In this biologically rich biome, it is a challenge to study rainforests. We hope that this volume will inspire newcomers alike, to think broadly about how different factors interact to promote or maintain rainforests. This understanding can be used to better manage the world.

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quately protected by legal and cultural stewardship. Although human effects on tropical rainforests are not the principal theme of this volume, part III closes the book with four chapters that recognize that the future of tropical rainforests will depend on human behavior and political decisions.

The concept for the book arose in connection with the symposium *Rainforests: Past and Future*, held in Cairns, Australia, in April 1998, cosponsored by the Cooperative Research Centre for Tropical Rainforest Ecology and Management and the Smithsonian Tropical Research Institute. The volume in your hands, however, includes chapters by authors who were recruited after the Cairns symposium, and all contributions were updated prior to their final submission in May 2003.

With so many new sources of information and theoretical understanding, this is an exciting time to be a rainforest biologist. Given the ongoing threat to this biologically rich biome, it is a critical time to be engaged in the study of rainforests. We hope that this volume will stimulate investigators, old hands and newcomers alike, to think broadly about how evolutionary and ecological factors interact to promote or maintain tropical diversity, and how this understanding can be used to better protect the integrity of rainforests around the world.