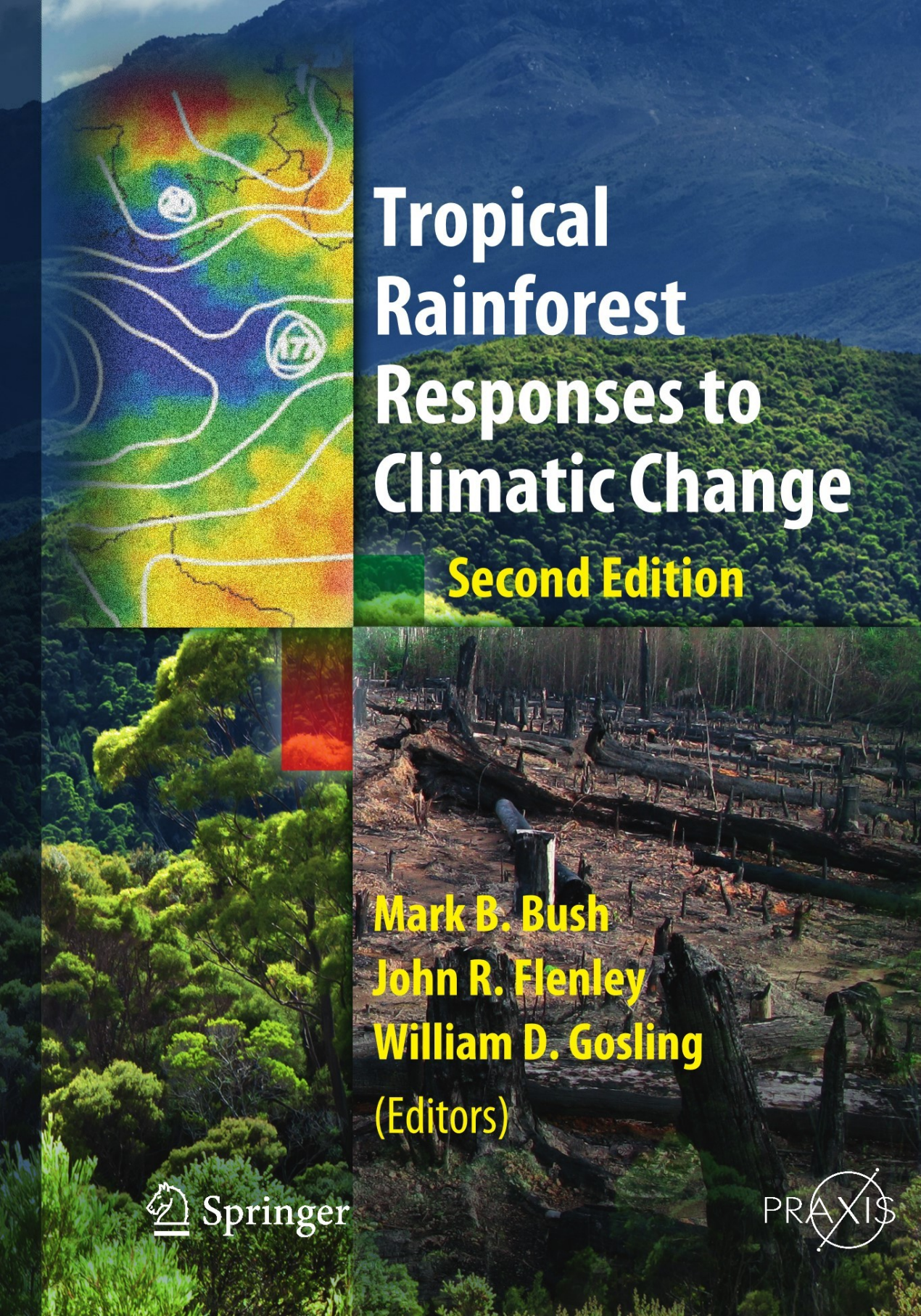
Tropical
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Responses to
Climatic Change
Second Edition
Mark B. Bush
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(Editors)
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PRAXIS

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Preface to the Second Edition

The First Edition of this book was well received and when a new print run was proposed we took the opportunity to revise, update, and expand the book. Our goal in the revision was to incorporate the most significant recent studies, yet retain the framework of the First Edition. Of course, the plight of tropical rainforests in response to climate change has not changed, and the political process that might have limited the effects of ongoing climate change appear to have faltered. For several decades the clarion call to save the rainforest biodiversity from the worst excesses of human exploitation has been loud. However, the threat to these systems from the synergy of climate change, logging, ranching, and other land use change appears to be cumulative. An investigation of the role that climate plays in shaping tropical rainforest biodiversity and, ultimately, how biodiversity may be lost is clearly needed. To that end we present chapters that deal with long-term climate and vegetation change, ecophysiology, and ecosystem processes in addition to considerations of how predictive models are constructed.

In this edition, we have added one entirely new chapter on fire, effectively replaced a chapter on Amazonian climate, and substantially modified most of the other chapters. We have attempted to minimize the period between author submission and printing of the book so that the most contemporary knowledge is portrayed. As part of that process of hastening the editing process we have been joined by William Gosling as an editor.

Mark Bush

Preface to the First Edition

Never before in human history has the need for an understanding of climatic change been so great. Nowhere in the world is that need so serious as in the tropics, where deforestation and extinction are at their most rapid, biodiversity greatest, and human lifestyles at their most precarious. We therefore hope and believe that this book will be timely and useful, as it attempts to describe and explain in scientific terms the past, present, and future changes in Earth's most complex terrestrial ecosystem, the Tropical Rain Forest.

The project grew from a discussion between Clive Horwood of Praxis and Mark Bush on the status of climate change research in Tropical Rain Forest settings. Mark's own involvement in attempting to apply lessons learned from the past to the formulation of conservation theory and practice led to a desire to move beyond a simple review of paleoclimatic data. The text aims to build upon and update the foundation of John Flenley's (1979) *The Equatorial Rain Forest: A Geological History* (Butterworth, London). In the intervening period our understanding of individualistic species migration, of potential interactions between climate and physical process, phylogenies, and of the looming impact of global climate change has revolutionized community ecology. In that same period the coverage of tropical paleoecological data has exploded—for example, there was not a single datum from Amazonia when John wrote his book.

John Flenley was called in to help when the sheer enormity of the task became evident to Mark. John had recently moved onto part time so was able to bring his experience of tropical regions fully into play, especially in the area of vegetational history.

We hope that the book will be used by scholars and senior students throughout the world, but especially in the developing countries of the Tropics, where climatic change may spell ecological and economic disaster very soon indeed. Perhaps it is not too much to hope that our book may contribute to influencing world policies

in relation to technology and economics, before the climatic changes become irreversible.

We are deeply indebted to all our contributors, a varied selection of excellent researchers, who have given their time and effort unstintingly to make this book possible. We are also grateful to those who have helped with the editing, especially Olive Harris. John Flenley wishes particularly to thank his wife, Helen, for her understanding and support. Our publishers, especially Clive Horwood, deserve exceptional thanks for their patience, tolerance and skill. Any remaining errors are of course our responsibility.

Mark Bush *John Flenley*

To
VHB, HCF, and CHG

Figures

Tables

Abbreviations and acronyms

AP	Arboreal Pollen
AGCM	Atmospheric General Circulation Model
ALLJ	American Low-Level Jet
AMIP	Atmospheric Model Inter-comparison Program
AMS	Accelerator Mass Spectrometry
ANN	Artificial Neural Network
ATDN	Amazon Tree Diversity Network
BIOCLIM	BIOlogical CLIMate model
BIOME-3	BIOsphere Model
CBD	Convention on Biological Diversity
CDI	Climate Decomposition Index
CMIP	Coupled Model Intercomparison Project
DBH	Diameter at Breast Height
DCA	Detrended Correspondence Analysis
DGVM	Dynamic Global Vegetation Model
DIF	Differentials
DO2	Dansgaard–Oeschger event 2
ELA	Equilibrium Line Altitude
ENSO	El Niño–Southern Oscillation
EVI	Enhanced Vegetation Index
FATE	Functional Attributes in Terrestrial Ecosystems
FORCLIM	FORests in a changing CLIMate
FORET	FORests of East Tennessee
GAM	Generalized Additive Modeling; Generalized Additive Model
GARP	Genetic Algorithm for Rule-set Prediction
GCM	General Circulation Model; Global Climate Model; Global Circulation Model

GHG	GreenHouse Gas
GISP	Greenland Ice Sheet Project
GLM	Generalized Linear Modeling
IBIS	Integrated BIosphere Simulator model
IPCC	Intergovernmental Panel on Climate Change
IPSL	Institute Pierre and Simon Laplace model
ITCZ	Inter Tropical Convergence Zone
kcal yr BP	Kilo calibrated years before present
LAI	Leaf Area Index
LGM	Last Glacial Maximum
LPJ	Lund–Potsdam–Jena Dynamic Global Vegetation Model
LTM	Long-Term Mean
MAT	Mean Annual Temperature
MIS	Marine Isotope Stage
MWP	Medieval Warm Period
NAP	Non-Arboreal Pollen
NPP	Net Primary Productivity
PFT	Plant-Functional Type
PVT	Potential Vegetation Model
RAINFOR	*Red Amazónica de INventarios FORestales*, *Red Amazônica de INventarios FlORestais*
RCM	Regional Climate Model
REDD	Reducing Emissions from Deforestation and forest Degradation
SALLJ	South American Low-Level Jet
SASM	South American Summer Monsoon
SDGVM	Sheffield Dynamic Global Vegetation Model
SDM	Species Distribution Model
SENAMHI	Meteorological service of Peru
SPI	Standard Precipitation Index
SST	Sea Surface Temperature
TDF	Tropical Deciduous Forest
TEF	Tropical Evergreen Forest
TRIFFID	Top-down Representation of Interactive Foliage and Flora Including Dynamics
TRMM	Tropical Rainfall Measuring Mission
TSEF	Tropical Semi-Evergreen Forest
UKMO	United Kingdom Meteorological Office
UMRF	Upper Montane RainForest
UNFCCC	United Nations Framework Convention on Climate Change
VECODE	VEgetation COntinuous DEscription Model
VPD	Vapor Pressure Deficit
WCRP	World Climate Research Program
WUE	Water-Use Efficiency

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