ADAPTING TO A CHANGING ENVIRONMENT

Confronting the Consequences of Climate Change

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TIM R. McCLANAHAN *and* JOSHUA E. CINNER

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Joshua E. Cinner

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PREFACE

The changing climate may fundamentally alter the land and sea as we know it. For those who depend on the beauty and bounty of the Earth's natural resources for their livelihoods—especially the world's poor—these changes could spell disaster. The problems climate change poses are complex, as are the ways in which societies cope with and adapt to change. Understanding and addressing these problems requires bridging diverse fields within the geophysical, ecological, and social sciences.

An ecologist and a social scientist, we have spent the last decade working together to integrate these fields. We approach the book from the perspective that social and ecological systems are intimately linked. Social processes, which can include cultural, political, and economic characteristics of society, influence the ways that people use and manage natural resources. Likewise, ecological conditions and processes can influence the societies' well-being.

Using this interdisciplinary approach, this book synthesizes, in simple terms, the rapidly emerging fields of climate change science and human adaptation and develops a practical framework for much-needed policy and adaptive responses. The framework addresses the differential responses of the environment, ecology, and people in affected areas, and identifies the policy action priorities based on this heterogeneity. We hope that this type of integrated analysis and problem solving will lead to policy actions that promote appropriate and lasting adaptations.

As a focal lens for these integrated climate change issues, we explore coral reefs and the coastal societies that depend on them throughout the eastern coastline of Africa and the islands of the western Indian Ocean. This is where many of the Earth's most impoverished people live. Here, both ecosystems and peoples' livelihoods are extremely sensitive to climate disturbances. Monsoonal rains, which are heavily influenced by climatic patterns, provide nearly all of the rainfall for the region's agriculture. Likewise, the islands and coasts are fringed by coral reefs, which provide livelihoods for millions of fishers and their dependants in the region, but are one of the most climate-sensitive ecosystems. Considerable climate impacts have already occurred to the regions coral reefs-and even more severe ones are expected. This region, like others in poor tropical countries, has neither contributed much to rising greenhouse gas emissions, nor is it likely to contribute greatly to the efforts to mitigate climate change. Countries in the region will have little choice but

to adapt, but these efforts will face considerable challenges from persistent poverty, implementing decisions, corruption, and other prevalent socioeconomic conditions.

The challenges of undertaking climate science, making the findings accessible, and catalyzing action are considerable, but this region is where these efforts and responses are most needed. Harsh realities will need to be confronted with decisions that increase the chances for successful adaptation. Although our book focuses on a specific geographic region and ecosystem, the conceptual framework we develop is applicable to most regions and climate change problems. Those interested in how climate change may influence other regions or systems can adapt the framework and approach we develop beyond the specific case we present.

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LIST OF ABBREVIATIONS

AHP	Analytic Hierarchy Process
BMU	beach management units
BP	before the present
CV	coefficient of variation
EEZ	exclusive economic zone
ENSO	El Niño southern oscillation
FAO	Food and Agriculture Organization
GDP	gross domestic product
GELOSE	Gestion Locale Sécurisée
HDI	human development index
IOD	Indian Ocean dipole
IPCC	Intergovernmental Panel on Climate Change
ITCZ	inter-tropical convergence zone
LMMA	Locally Managed Marine Areas network
MPA	marine protected area
MMSY	multi-species maximum sustainable yield
NGO	nongovernmental organization
NOAA	National Oceanographic and Atmospheric Administration
OECD	Organization for Economic Co-operation and Development
PAR	photosynthetically active radiation
PDO	Pacific decadal oscillation
PPP	purchasing power parity
SIDA	Swedish International Development Corporation Agency
SST	sea-surface temperature
UNCLOS	United Nations Convention on the Law of the Sea
UV	ultraviolet
WIO	western Indian Ocean
WIOMSA	Western Indian Ocean Marine Science Association
WWF	World Wildlife Fund