



## BOOK REVIEW

**Ecological Consequences of Climate Change: Mechanisms, Conservation, and Management**, E. A. Beever, and J. L. Belant, editors. 2011. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA. 314 pp. \$99.95 hardcover. ISBN: 978-1-4200-8720-8.

Rapid and directional climate change has emerged as the defining conservation issue of our generation. Thus, *Ecological Consequences of Climate Change* is a relevant and timely volume that seeks a merger of results from research on mechanisms responsible for effects of climate change with consequences for management. This volume is a collection of papers motivated by a session at The Wildlife Society 2007 conference on biological responses to climate change.

The book begins with a chapter about physical climate. Chapter 1, with the deceptively simple title, *Western Climate Change*, is an exceptionally strong treatise by Mote and Redmond that provides an elegant and detailed description of recent historical and projected climate trends and the dominant factors that are thought to be responsible for these trends. This chapter is exemplary for its clear and logical consideration of factors that occur at local to global scales, and at a range of relevant time frames. It is a broad-ranging yet concise and valuable primer for ecologists and managers. Goodin (Chapter 9) further explores climatic relationships, focusing much more narrowly on how precipitation at Long Term Ecological Research (LTER) sites was related to 4 indices of atmospheric circulation.

The 3 chapters that target specific taxonomic groups vary considerably in length (11–25 pages), focus, and detail. By virtue of their lifestyle and biology, amphibians are tightly coupled to the physical and chemical environment and they are considered sensitive biotic indicators of environmental change. Blaustein et al. (Chapter 2) provide a comprehensive review of information on climate and related factors implicated as potential causes of amphibian declines. The authors have clearly mastered the literature, but my understanding of the complex relationships would have benefited from the addition of diagrammatic conceptual models and/or summary tables. The chapters on butterflies (Chapter 3, Fleishman and Murphy) and mammals (Chapter 5, Guralnick et al.) are shorter and more focused, addressing subsets of species and issues, and they emphasize the need for studies and methods that simultaneously account for effects of both climate and non-climate factors. Guralnick et al. use pika (*Ochotona princeps*) and polar bears (*Ursus maritimus*) as examples of species with a relative wealth of data. They emphasize the dearth of information on mechanistic relationships linking climate change to the ecology of other mammals, and they articulate the types of studies still needed.

Separate chapters discuss effects of climate change on sandy beaches (Chapter 7, Jones), on methods for projecting changes in distribution and abundance of species (Chapter 4, Martínez-Meyer), and on the related topic of shifts in elevation of species' distributions (Chapter 6, Wilson and Gutiérrez). Martínez-Meyer's chapter includes an in-depth treatment of ecological niche models. Peterson et al. (Chapter 8) describes the long running, highly collaborative, and integrative Western Mountain Initiative (WMI). The WMI is exceptional for its multi-decadal focus on climate change impacts on western United States ecosystems, for the wealth of knowledge it has generated, and especially for the effective use of scientific results to inform management. These attributes are effectively described, along with the resulting recommendations for management actions to adapt to climate change. Management is the subject of other chapters that discuss mitigation through carbon sequestration (Chapter 11, Dudley et al.) and climate-related challenges and decision-making for refuge managers (Chapter 12, Knutson and Heglund).

Chapter 10 by McLennan describes climate-related activities in Canada's northern national parks. These parks are generally very remote, pristine, and ecologically intact. They are experiencing warming rates well above global averages, and they are increasingly threatened by industrial and community development. McLennan describes the emerging design and implementation of a highly integrative, state-of-the-art monitoring program, intimately linked to management and reporting. Monitoring is an essential foundation for informed management, and this chapter is a step towards addressing common needs to devise and implement cost-effective monitoring of extensive, remote, and rugged natural areas in the face of rapid climate changes.

In the final chapter, the editors reflect on the main messages in the book, emphasizing the need for a mechanistic understanding as the basis for applying the best science to conservation management.

Climate change is an exceptionally broad field, and the wide range of topics in the book represents that breadth. One cost of this breadth is that most chapters could only introduce topics, and further reading will be necessary to obtain a thorough understanding of what is known in a particular field. I thought the book contained a few curious omissions (e.g., metapopulation dynamics of butterflies, chapters on fish and birds), and the chapter on mammals missed a good opportunity to relate the extensive body of work on environmental physiology to directional climate change.

This book would serve well as the basis for an advanced undergraduate or graduate seminar, where the unavoidable omissions provide opportunities for scholars to augment the material through further literature research. The chapters are somewhat uneven in their scope and the depth to which they consider topics, but in aggregate they provide an admirable overview of many important concepts

in physical climatology, ecology of specific taxonomic groups, key ecological effects of climate change, and aspects of management. The scope of climate change is too broad to be fully covered in any single volume, and this relatively short book includes some particularly well-crafted chapters that provide a readily accessible entry into a vast and complex literature. It is valuable reading for ecologists and managers

interested and concerned about the nearly ubiquitous effects of rapid climate change.

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