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BOOK REVIEW

Stewardship of iconic landscapes in uncertain futures: lessons from the US Rockies and Appalachians

A.J. Hansen, W.B. Monahan, D.M. Theobald, S.T. Olliff (eds.), Climate Change in Wildlands: Pioneering Approaches to Science and Management. Island Press, Washington DC, USA, 2016, 408 pp, illus., maps. Hardcover, USD $70, ISBN: 978-1-6109-1711-7; Paper, USD $35, ISBN: 978-1-6109-1712-4; E-book, USD $35, ISBN: 978-1-6109-1713-1

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Today's natural resource scientists are called upon to fulfill their social contract (Lubchenco 1998); that is, to ensure that their science is informed by the world's most pressing problems, and, in turn, that their science informs societal decisions about solving such problems. For natural resource practitioners, a related challenge can be to find ways to translate the most up-to-date science into effective and efficient management, often in the face of shrinking staffs and tightening budgets. The divide between the individually busy worlds of science and management can seem insurmountably wide. In *Climate Change in Wildlands: Pioneering Approaches to Science and Management*, an expert team of authors with decades of experience in applied conservation science lay out a detailed roadmap to help close this divide. Stemming from a five-year Landscape and Climate Change Vulnerability Project funded by the NASA Earth Science Program, the pages of this book help link scientific understanding to effective management of wildlands in the face of changing climate and land use. Drawing on rich datasets and expert knowledge, the authors provide a "how-to" guide for effective applied conservation science and management by focusing on two illustrative and contrasting wildland regions: the US Rocky Mountains and the Appalachian Mountains.

The text is organized into four main sections. In brief, the authors outline approaches for climate-adaptation planning (Part 1), describe past and future climate and land-use change in each of their two focal regions (Part 2), characterize ecological consequences and vulnerabilities under future scenarios (Part 3), and present case studies of managing for climate change while facing uncertainty (Part 4). Within each of the four sections, chapters are more or less stand-alone manuscripts rather than connected stories that build from one another. This has its benefits, in that readers can jump around to chapters that may be most relevant to them. However, a drawback for readers who are interested in the book in its entirety is that each chapter necessarily repeats much background information on study areas and methods that is already presented elsewhere.

In the first section of the book, the authors set the stage for later chapters by describing a broad framework for improving science-management links: the Climate-Smart Conservation framework (Stein et al. 2014). This framework (Chapter 2) forms the core of the outline for the rest of the book: describe climate scenarios, characterize vulnerabilities, and use adaptive management to address uncertainty. In Chapter 3,

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the authors present a thorough discussion of several existing barriers to implementation of climate science into Federal Land Management (e.g., working across boundaries with fragmented stakeholders), and they propose a very helpful "checklist" of ways that scientists can support managers in incorporating scientific understanding (e.g., including managers in the proposal-writing stage of projects/grants).

In Part 2, the authors describe patterns of climate and land use change in their two focal regions. Chapters 4 (US Rocky Mountains) and 5 (Appalachian Mountains) present very useful summaries of past, present, and predicted future climate, with futures covering a range of Representative Concentration Pathways (RCP) emissions scenarios. In Chapter 6, the Rocky Mountains are used as a case study to demonstrate how incorporating fine-scale and spatially explicit physiography data with climate projections can better predict nuances in future climate patterns across landscapes.

Part 3 of the book catalogues how climate and land use changes that are outlined in Part 2 will affect vulnerability (defined as "the potential impact of the climate or land use change on an organism or process and its adaptive capacity") of components within the two focal regions. This section of the book packs in volumes of data and analyses, as the authors use ecosystem models (Chapter 7), species distribution models (Chapters 8 and 11), and syntheses of existing studies (Chapters 9, 10, and 12) to explore vulnerabilities in each region. Analyses primarily examine climate effects on vegetation (individual tree species, plant communities, or biomes), but also include effects on carbon- and water-centered ecosystem processes and salmonid species. Land use is explicitly included in an analysis of the effects of climate and habitat fragmentation on future tree species distributions (Chapter 11), but is less explicitly incorporated in analyses presented in other chapters of Part 3.

Part 4 of the book is where the proverbial "rubber hits the road" when it comes to linking science and management. Chapter 13 serves as a brief refresher on the Climate-Smart Conservation framework (discussed in greater detail in Chapter 2), but importantly describes avenues within Federal land management where this framework is being, or could be, implemented (e.g., US Climate Change Science Program, the National Park Service Climate Change Action Plan, Landscape Conservation Cooperative Networks, USGS Climate Science Centers). Case studies are then presented, showing how this framework has been implemented in Rocky Mountain National Park (Chapter 14) and the Greater Yellowstone Ecosystem (Chapters 15 and 16). These three chapters are topically more comprehensive than others in the book; they include holistic discussions of the impacts of climate and land use change on vegetation, ecosystem processes (e.g., wildfires and insect outbreaks), and wildlife. Finally, in the concluding chapter, the authors close with lessons learned through their collective experience. These lessons center on ideas relating to relationship-building and clearly communicating across science-management partnerships and with stakeholder groups.

Compiling a book that contains this much data and information is no small feat; however, several minor issues could have improved the usefulness and interpretability for readers. The visuals efficiently conveyed complex datasets and analyses, and were generally helpful. Nevertheless, the black and white rendering of maps (e.g., Chapter 6) made it sometimes difficult to detect the main message being conveyed; color figures could have brought out rich detail with greater contrast. Another issue was that the text in many figures was nearly too small to read (e.g., Figure 8–3 in Chapter 8). These figures, presumably many of which were produced originally for the $8\frac{1}{2} \times 11$-inch layout of a primary research paper in a journal, could have been made clearer through a better design for the smaller book page layout.

Landscape ecologists may be left wondering how heterogeneity and landscape configuration factor into managing wildlands under future stressors. While heterogeneity was not an explicit focus of this book, the extensive data on landscape composition (e.g., proportions of regions occupied by different cover types) presented in many chapters could be a useful jumping-off point for additional investigations that use more quantitative landscape analyses to explore spatial patterns. In fact, understanding and effectively managing landscape *configuration* in many wildland landscapes may be where the biggest gains can be made in conserving ecosystem integrity.

The above critiques are very minor shortcomings of an otherwise thorough, useful, and well-written book on preparing scientists and managers for collaborative solutions to the most pressing natural resource

management problems. This book is sure to help scientists fulfill their social contract and help managers incorporate scientific understanding (and uncertainty) into action. Doing so will ultimately narrow the science-management divide in wildlands throughout North America.

References

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