

Publications

Biodiversity in a Changing Climate: Linking Science and Management in Conservation edited by Terry L. Root, Kimberly R. Hall, Mark P. Herzog and Christine A. Howell (2015), 244 pp., University of California Press, Oakland, USA. ISBN 978-0-520-28671-9 (pbk), 978-0-520-96180-7 (ebook), both USD 39.95 (GBP 27.95).

The 2015 Conference of Parties of the UN Framework Convention on Climate Change removed any remaining doubt about the necessity for action to address the problems posed by the planet's changing climate. Readers of this journal can feel encouraged by the progress made on this issue in Paris but perhaps concerned that the lion's share of the attention was devoted to energy and economic aspects. Although these are critically important to governments, the negotiators gathered in Paris seem to have forgotten that climate change affects people primarily through its impacts on ecosystems. So what are the most significant expected impacts of climate change on biodiversity? Which of these are likely to be positive for some ecosystems? Perhaps more urgently, how can conservation take advantage of the attention, and funding, being devoted to adaptation to climate change?

It seems reasonable to expect more attention to be given to such questions, and *Biodiversity in a Changing Climate* is a useful and timely contribution. Based largely on research carried out by young scientists in California, it starts by describing the roles of ecologists in helping to incorporate climate change into natural resource management. Its key point is that research will be most useful when it can support management options that lead to adaptation to changing conditions. It then has two chapters that put California's climate changes in a global context and outlines the impacts of climate change on ecosystems. These lay the foundation for what follows.

The main focus of the book is on case studies that address climate change effects on krill in the California current, marine biogeographical ranges, salmon in the Klamath River, pollinators and meadow restoration, elevational shifts of breeding birds, conserving grasslands, and invasive species. The most interesting aspect of these chapters is the brief Manager Comments at the end of each, not least because the managers of the sites and species tended to have decades of experience and freely shared their wisdom with the young researchers.

California is a promising location for studies that promote dialogue between scientists and practitioners. It has a long history of

field research and therefore many long-term datasets are available; its university system has a long history of ecological research; it has a good system of protected areas, with both National Parks and State Parks that have provided management to many of the state's key ecosystems for many decades; it is large and biologically rich, with numerous management challenges in the coastal zone, rivers, mountains, forests and deserts; and it has long taken climate change seriously at local and state levels.

The researcher–manager discussions often have wider application, with the managers providing key insights that make the research relevant. They recognize that climate change worsens uncertainty, leading them to seek practical management responses. The researchers often focus on single species (one even suggested 'rescuing a species by breeding it with another species', even though that would lead to a new species rather than a rescue) and consider marine protected areas primarily in terms of fisheries production, leading to a suggestion that managers shift fishing seasons as time of reproduction or migration changes; but managers point out that such exquisite timing is often difficult to put into practice because fisheries management has multiple dimensions that may respond slowly to ecological changes. Managers already realize that climate change does not necessarily mean a general northward or upward shift of species, but rather a more comprehensive consideration of ecosystem changes. On the other hand, whereas the chapter on shifts in marine biogeographical ranges calls for species-specific protected areas for the purple sea urchin *Strongylocentrotus purpuratus*, the chapters on grasslands, meadows and pollinators focus on ecosystem functions and community diversity. Clearly, different questions yield different answers.

The managers generally sought to allow for uncertainty and expected surprises, leading to precautionary and flexible management. They were grateful for research that could help them implement adaptive management; for example, the research that led them to monitor vegetation outside areas that are open to grazing by cattle rather than focusing just on the grazed areas. They also welcomed data that will help gain access to funding from California's Climate Action Reserve (it would have been nice to learn more about this innovative funding mechanism, which could be replicated elsewhere).

The book concludes with three chapters on framing the biological impacts of climate change: using evolutionary perspectives, fos-

sils to predict future climate change, and historical data on species occurrence to help bridge the past to the future. A key point from this section came from a manager who observed that abundant examples of unfortunate consequences from well-intentioned management actions indicate that care should be taken to avoid counterproductive climate response programmes. The manager also pointed out that it is difficult for a management agency to devote resources to a project unless outcomes can be expected within a decade, making it difficult to convert evolutionary perspectives into practice.

The book would have benefited from a concluding chapter written by the editors, and a more comprehensive glossary that included key terms from all of the chapters. But the book already indicates the kind of collaboration that should be promoted between the scientists who are seeking to answer questions about climate change impacts on ecosystems and the site managers who must focus on action and decisions that need to be taken urgently with inadequate information. And so it goes. . . .

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Biodiversity Conservation and Environmental Change. Using Palaeoecology to Manage Dynamic Landscapes in the Anthropocene by Lindsey Gillson (2015), 240 pp., Oxford University Press, Oxford, UK. ISBN 978-0-198-71303-6 (hbk) GBP 52.50, 978-0-19-871304-3 (pbk) GBP 26.24.

For all their interest in conserving nature as it was in previous times, conservation practitioners remain poorly informed about the past. We have been all too ignorant of the fields of palaeoecology, archaeology and historical ecology and what they can offer us to help achieve conservation outcomes. With this volume Lindsey Gillson sets out to remedy the situation, in particular by showing how long-term information on ecosystem variability and resilience can be used to help conserve ecological function and process.

The author's approach is to work through case studies, starting with elephant management in southern Africa and then with increasingly complex cases including rewilding, fire management, climate change adaptation and the provision of ecosystem services. Although rich in detail, these studies are not tightly linked and read like dense review