Article Type: Book Review

Climate Change in Wildlands: Pioneering Approaches to Science and Management. Andrew J. Hansen, William B. Monahan, David M. Theobald, and Thomas S. Oliff, eds. Island Press, Washington, 2016, xiv + 391 pp. Price US \$35.00. ISBN: 9781610917124 (paperback, also available in hardback and as an Ebook).

The wildfires of the summer of 2015-16 that burnt a dramatic swathe through the forests and alpine regions of Tasmania's South West Wilderness World Heritage Area represented a turning point for many Australian ecologists. A significant proportion of the ancient and rare vegetation of this region was burnt following extended drought and lightning-strike fires burning under extreme fire weather conditions. Advocates for the creation of this large wilderness reserve were arguing for government intervention and to put people and equipment on the ground to fight the fires, a proposition contrary to the wilderness philosophy of letting natural disturbances take their course without human intervention. Academics and others were arguing that the widespread impacts of climate change mean that we need to rethink the concept of wilderness and be more proactive in anticipating and undertaking interventions across all landscapes to protect and prevent the loss of natural values.

This book demonstrates that different approaches are also being considered for wildlands in the USA. Partly, this was mandated under the Obama administration, with Federal agencies required to consider the implications of climate change on the sustainability of ecosystems, including wildlands, under their jurisdiction since 2009. However, managers have been aware of the growing threats of climate change to wildland values for much longer, with the increasing size and intensity of wildland fires and extensive impacts on vegetation of drought, insect pests and diseases. These management challenges have been exacerbated by past land management practices, such as fire exclusion, and increased built development around wildlands. Impacts on vegetation are having flow-on effects, many of which are unexpected and poorly understood, to wildlife populations and the provision of ecosystem services to humans provided by wildlands.

The editors of the book aimed to develop and demonstrate the means for bridging science and management to understand the rates and impacts of climate change in wildland ecosystems and to evaluate alternative strategies for managing to cope with these changes. Given the pervasive and

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the [Version of Record](#). Please cite this article as [doi: 10.1111/aec.12585](https://doi.org/10.1111/aec.12585)

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dynamic nature of climate change, the extent of impacts and the requirement to consider management options that extend across landscapes, climate change requires new modes of governance that bring together different land management agencies and land owners. The focus of the book is on two newly-formed Landscape Conservation Cooperatives: the Great Northern LCC, centred on the northern Rocky Mountains in the Central West and the Appalachian LCC in the Eastern USA.

The book is essentially a compendium of outputs from a 5 year project, the Landscape and Climate Change Vulnerability Project funded by the NASA Earth Science Program. The goal of this program was to use remote sensing products to inform climate change adaptation and a considerable proportion of the book is focused on the use of remote sensing and spatial modelling tools to assess climate and land use changes in the two regions and consequences and vulnerabilities for different ecosystems in the two regions. There are 38 different authors from a variety of disciplines, academic institutions and management agencies. There is a pleasing mix of input from scientists and managers and some valuable case studies of approaches taken for specific protected areas, such as the Rocky Mountains National Park.

The organisation of book is fairly standard for climate impact assessment: beginning with climate science, determining potential vulnerabilities and potential impacts and finally considering management options. There is an argument for starting with management challenges and using these to drive climate science needs. The introduction section makes some attempt to address this by considering the mechanisms for linking climate science and management through a framework for 'climate-smart' conservation but it is not clear that the first step in this framework – identifying conservation goals and objectives – drove the technical work on impacts and vulnerabilities.

The generally well-serviced and supported land management agencies in the USA meant that there is a high level of information and resources available to inform analyses. As a consequence, there is some doubt about the extent to which the approaches described in the book can be transferred to other jurisdictions outside the USA. Also, while the book attempts to provide a comprehensive picture of different disciplinary studies used to assess climate impacts, it is not clear that there is a strong linkage between the extensive information base generated in the impact studies and adaptation options considered in the later chapters.

For those interested in the issues of integrating climate change into the management of conservation and protected areas, it provides a useful background reference and frameworks for thinking about the challenges represented by climate change. As the authors in the synthesis chapter point out, climate adaptation needs to be a locally driven and lead process. Impacts need to

be considered and solutions derived at a local level, for each park or watershed but taking into account effects and responses operating at larger scales. In my view, the most important message of the book is the power of climate change to drive natural area managers to think at larger scales and over longer time frames. It also requires managers to engage with different scientific disciplines and with a more diverse group of local interests. This requires new mechanisms for dialogue and commitment to long-term engagement through new types of partnerships and institutions that link researchers, managers and stakeholders.

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Climate Change in Wildlands: Pioneering Approaches to Science and Management Andrew J.Hansen, William B.Monahan, David M.Theobold and Thomas S.Oliff, eds. Island Press, Washington, 2016, xiv + 391 pp. Price US \$35.00. ISBN: 9781610917124 (paperback, also

Date:

2019-02

Citation:

Keenan, R. J. (2019). Climate Change in Wildlands: Pioneering Approaches to Science and Management Andrew J.Hansen, William B.Monahan, David M.Theobold and Thomas S.Oliff, eds. Island Press, Washington, 2016, xiv + 391 pp. Price US \$35.00. ISBN: 9781610917124 (paperback, also. Austral Ecology, 44 (1), pp.164-165. <https://doi.org/10.1111/aec.12585>.

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