Fire in the past and heat in the future

**Book review**

**Bombs Away: Militarization, Conservation and Ecological Restoration.** Havlick, D. G. 2018. University of Chicago Press, Chicago, IL, U.S.A. 204 pp. US$35.00 (hardcover). ISBN 978-0-226-54754-1.

**Burning Planet: the Story of Fire through Time.** Scott, A. C. 2018. Oxford University Press, Oxford, U.K. 231 pp. £20.00 (hardcover). ISBN 978-0-19-873484-0.

**Grasslands and Climate Change.** Gibson, D. J., and J. A. Newman, editors. 2019. Cambridge University Press, Cambridge, U.K. xiv+348 pp. £34.99 (paperback). ISBN 978-1-316-64677-9.

These 3 books are very loosely linked by the themes of fire, warming, and ecosystem management at different scales and how knowledge of the past is used to say something relevant about the future. The forced similarities fortunately end there. Nevertheless, they offer valuable knowledge, complementary at times, to anyone interested in using history to acquire intellectual ammunition to help prepare for a dire future.

**Bombs Away** starts with a description of the unexpectedly large variety of military installations and sites where “military-to-wildlife” conversions have occurred in the United States and an overview of military terms, such as *unexploded ordnance* (UXO). Next comes a nice discussion of philosophical issues connected with the feasibility and goals of restoration, the target state to be pursued and its temporal scale, an issue that is often more complex for military installations than for simpler or less transformed ecosystems. Issues specific to national wildlife refuges operating in former military sites and landscapes in the United States, including UXO cleanup and ecosystem restoration efforts are covered, and an overview of demilitarized zones in Europe (former Iron Curtain) and East Asia (Korean Peninsula) and atomic-bomb testing sites in Australia and the Bikini Atoll are presented. The 2 final chapters describe efforts by the U.S. Department of Defense to designate and manage marine and terrestrial protected areas in former military sea- and landscapes. Examples are provided of the history and restoration of former military landscapes and sites, such as the Hiroshima atomic bomb site in Japan, a coastal nature reserve in England, and the Berlin Wall. The chapters are followed by a thorough notes section with a bibliography and an index of the terms used.

The text is accessible to a broad audience, including scientists, personnel of nongovernmental organizations, managers, naturalists, and ecotourists with an interest in restoration. The material was collected over 20 years during numerous site visits and interviews. As such, this is mostly a personal account, and the book is a valuable storehouse of well-selected lessons learned from military-to-wildlife conversions. Because several of these projects resurface throughout the book, the text is occasionally repetitive. A fixed organization or structure for presenting each site could have alleviated this problem. The storytelling is enjoyable, although the sites are largely U.S. biased. With international sites, the storytelling is mostly confined to personal impressions gained during short site visits. More details on international sites would have greatly broadened the usefulness of this book. In particular, I would have liked to see information from Eastern Europe (where I come from) where there are numerous former militarized landscapes with huge tracts of often heavily polluted or transformed areas that were abandoned with the withdrawal of the Soviet military in the early 1990s. These sites still offer biodiversity surprises. For example, rediscovered populations of several subterranean mammal species described long ago (Méhely, 1909), lumped as one species, and almost extinguished in the 20th century have been confirmed recently as separate species based on molecular genetics (Csorba et al., 2015; Németh et al., 2020). This would be an impressive discovery for any part of the world, let alone for well-known Europe. It would also have been interesting to read more on military management methods that made the preservation of biodiversity possible at such sites, which would thus have provided a basis for future conservation. For example, while fires lit by military activity in shooting ranges and test sites are sporadically mentioned, a more systematic discussion of the type, extent, and intensity of fires, and their impacts on habitats and species would have made the book even more relevant to conservation.

**Bombs Away** is a useful compilation of the many aspects of and efforts, and obstacles to transforming former military installations for conservation. In addition, the book draws attention to the important but largely neglected task of conservation science and practice to address former militarized landscapes, installations, and sites because these often host extraordinary biodiversity, deserve increased attention, and should thus be of higher priority in conservation than they are now.

**Burning Planet,** in its first 3 chapters, scans what is known about fires, goes into the specifics of deriving information on frequency and extent of fires in the distant past from the types and location of charcoal, and provides a review of fuel, heat and ignition, and oxygen as the fundamentals of fire and their spatial and temporal scale dependence. A description follows of the...
evidence for changes in fire occurrences and frequencies and in atmospheric oxygen levels in the distant geological past, from the earliest signs of fire in the fossil record up to the peopling of the Americas and ending with the debate on the Younger Dryas impact hypothesis. The discussion of the role of wildfires and anthropogenic fires in historical times prepares the reader to understand future predictions and potential impacts of wildfires, especially in the light of climate change. The text is accompanied by the International Geological Time Scale, a glossary, and a detailed notes section complete with references and an index.

The book is written in a good, easily comprehensible style and presents a well-balanced mix of the major developments in our understanding of the history of fire, including the author's own research and insightful personal stories on the long and often strenuous process of scientific discovery. Based on its language and style, I believe this book is targeted to a broad professional audience of geologists, climatologists, paleontologists, and people interested in Earth's history.

While I appreciate the author's efforts at describing the tools of his trade in each chapter, the reader could have benefited from a separate chapter on methods in which each of the major techniques could be explained in a logical order. For example, I wanted to learn even more about charcoal forms, how researchers find them in various geological strata, and their relative importance and use in inferring paleoenvironments. I was also expecting more insight on how fires in the distant past shaped ecosystems and how this knowledge can be used in modern ecosystem management and biodiversity conservation even though I admit that an in-depth coverage of these topics may lie beyond the scope of this book. Finally, I had the impression that scientific debates in which the author was involved are described in detail, whereas other debates of relevance are covered only briefly—it would have been interesting to learn more about these as well.

Nevertheless, this book offers a superb presentation of the intriguing story of fire on Earth and the scientific methods deployed to decipher this story. The book more than fulfills what it sets out to do, that is, to convince readers that fire has been an important agent of change on Earth for millions of years. We tend to forget this history, even as a major effect of climate change is the increasing frequency, extent, and intensity of wildfires in areas that are becoming hotter and drier. When confronted with images of large fires, all we humans can think of is the damage to human lives and livelihoods and how to put them out as quickly as possible. The book makes the well-argued points that fires have been much worse at certain times in Earth's history and that lessons from these and other geological times should be better understood to increase preparedness for what we will face under anthropogenic climate change. Its most important messages for conservationists are that fire has been an integral part of Earth and our lives for a long time; its absence is a very recent and apparently temporary phenomenon; and fire should be accounted for in the design and implementation of ecosystem management and restoration and biodiversity conservation in the future.

Grasslands and Climate Change is an edited volume in the prestigious Ecological Reviews series of the British Ecological Society. As such, its primary target is ecologists, conservationists, and climate scientists, but the book will also be highly useful to applied ecologists, conservation practitioners, and site managers.

The 19 chapters are divided into 4 main parts. Part I gives an overview of methods (experiments and remote sensing) to detect changes in grasslands due to climate change (3 chapters). Part II encompasses reviews of expected changes in the distribution, productivity, regime shifts and thresholds, biogeochemistry, and ecosystem services of grasslands (5 chapters). Part III presents changes in non-native invasive species; demography and population dynamics; trophic interactions; belowground feedbacks; evolutionary changes, such as dispersal and migration; and biogeography of C3 versus C4 grasslands (6 chapters). Part IV is about human responses, adaptation, and mitigation to climate change effects in grasslands related to grazing, traditional grassland management, assessment of rangeland health, restoration, and research and conservation needs (5 chapters).

The book is not an easy read. If the experience can be summarized in one word, it would be daunting. It is daunting because the reader will come to believe that something big is going to happen with grasslands and because so little is known about what will affect grasslands due to the high degree of uncertainty in predictions and projections. Nevertheless, the book is a must-have for ecologists and conservationists working with open landscapes, especially grasslands. After all, grasslands form Earth's largest terrestrial biome, covering 31–43% (depending on definition) of the total land area. The variation in definitions and estimates of surface area reflect the many different types of grasslands. Take that variation and add to that the complexity of grasslands (soil, moisture, nutrients, species composition, successional changes, and management) and the uncertainty in local or regional estimates from climate-change modeling, and one will see how difficult it is to state anything about the changes likely to occur under climate change. The book equips readers with a mindset and a toolbox for thinking about grasslands by highlighting the ways this biome can be affected by climate change. Will it be changes in soil biogeochemistry; increased fixation of atmospheric nitrogen; increased primary productivity due to higher CO2 concentrations; changes in species composition due to individual species responses to increased temperature or drought; changes in frequency and intensity of natural disturbances; spread of non-native invasive species; or changes in ecosystem functioning and services? This edited volume lays out the state-of-the-art in these and many other fields, a way to think about these problems systematically and presents what is known about these problems. While the general message is that we do not know enough of these patterns and processes, the book does provide the fundamentals and helps one understand the challenges grasslands are facing.

The volume is laudably well edited. The chapters are relatively short (approximately 6000 words each) and are thus easily grasped in one sitting. Each chapter ends with a separate conclusions section, which nicely summarizes the main points and offers a quick grasp of the topics covered. I found it a nice surprise that the closing chapter is not a boring summary and that it raises substantial questions related to novel ecosystems and presents a useful list of research gaps and priorities. The
readability of a few chapters is relatively poor. I missed introductory road-map passages in some chapters and was startled by the occasional complexity or verbosity of expression. Some minor inconsistencies existed, including mixed use of numbering versus author-year in-text citation style.

Globally, most grasslands (up to 80% of total grassland area) are used for economic purposes; thus, climate change will affect local livelihoods and regional economies, the exploration of which would warrant a similar volume. Until that happens, or if you prefer to think more locally, whether you are using your favorite grassland for walking your puppy; tending your precious lamb, baby goat, or calf; or observing flowers, butterflies or birds, this book compiles all the things you probably should know to start imagining how climate change will affect it.

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