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Applied ecology in the 21st century

Goodenough, Anne E., and Adam G. Hart. 2017. **Applied ecology: monitoring, managing, and conserving.** Oxford University Press, Oxford, UK. xii + 413 p. \$49.95 (paper), ISBN: 978-0-19-872328-8.

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From deforestation and the introduction of non-native species to changes in climatic conditions, we live in a world where biodiversity is lost fast, with almost every major ecosystem impacted by human activities. Serious concerns have been voiced about the implications of biodiversity loss for human well-being, particularly for the world's most marginalized and impoverished communities, leading to several high-profile political commitments to promote the conservation and sustainable use of biological diversity. Addressing

the environmental, economic, and societal challenges posed by these rapid changes is urgent and requires sound science to inform policy and management decisions. As a result, applied ecology, sometimes referred to as the “space” where interactions between ecological science and society can be explored and advanced (Toomey et al. 2016), has increased in prominence and relevance over the past decade (Cadotte et al. 2017).

Applied ecology: monitoring, managing, and conserving, by Anne Goodenough and Adam Hart, aims to provide a detailed overview of the approaches and underpinning theory used in applied ecology to solve specific problems. Contrary to other textbooks on this topic, it focuses on concepts and real-world situations, as opposed to detailing applied ecological techniques and survey methodologies. Specifically, the textbook cleverly illustrates for students and non-specialists how applied

ecology seeks to gather evidence and develop tools that can inform management and policy across spatial scales, and how this can lead to advances in our fundamental understanding of the natural world.

The book is divided into three broad topics: monitoring, managing, and conserving. Chapters 3 and 4 cover common approaches to monitoring habitats and species and present examples of biological, environmental, and biodiversity indicators. The authors highlight citizen science, eDNA, and camera trapping as particularly valuable approaches for monitoring, but sadly for me satellite remote sensing, unmanned aerial vehicles (UAVs), and bioacoustics did not make the selection. Similarly, I enjoyed reading about exemplar environmental and biological indicators, but missed a discussion on recent efforts to identify essential biodiversity variables and develop a coordinated monitoring framework for biodiversity under the auspices of the Group on Earth Observations Biodiversity Observation Network (GEO BON).

Chapters 5 to 9 cover management, including topics such as ecological impact assessments, remediation ecology, landscape ecology and management, non-native species management, and pest management. In these chapters the authors elucidate the difference between environmental and ecological impact assessments; mitigation and compensation strategies; phytoremediation and bioremediation; nativeness and invasiveness. They introduce and discuss key concepts such as the edge effect, fragmentation, connectivity, invasion risk, and economic injury level, with several carefully-chosen case studies providing essential context. Hot topics, such as biodiversity-offsetting schemes and genetically manipulated organisms in bioremediation, are also given consideration.

Chapters 10 to 13 relate to conserving, with Chapter 10 introducing basic principles of conservation; Chapter 11 focusing on in-situ conservation; Chapter 12 dealing with ex-situ conservation, and Chapter 13 covering reintroduction and rewilding. There, one learns about active and custodial management; community-linked conservation; gene banking; and code of practice for reintroduction. In the final section of the book, the authors primarily discuss concepts and management options relevant to species conservation, such as population viability analyses, umbrella species, and reintroductions and translocations. However, just like ecology, applied ecology spans all spatial and temporal scales, levels of biological organization, and interactions among these. The book could have therefore benefitted

from providing a more holistic view on what to conserve and why, addressing the multiple dimensions of biodiversity. For example, ecosystems are barely mentioned in that part of the book; yet it could have been interesting to compare species prioritisation schemes [e.g., the International Union for the Conservation of Nature (IUCN) Red List of species] with ecosystem-based approaches (e.g., the IUCN Red List of ecosystems). That said, in this section the authors offer a great up-to-date introduction to many of the issues being currently discussed in wildlife conservation, presenting multiple perspectives to encourage readers to form their own opinion.

Altogether, Goodenough and Hart have produced a visually interesting and engaging textbook, which illustrates well how applied ecology inhabits the space between fundamental science and hypothesis testing and the development and application of novel environmental solutions and technology. The chapters are full of concrete examples, detailed case studies, interviews with applied ecologists (I particularly enjoyed the efforts made to showcase a highly diverse selection of interviewees), and targeted suggestions for further readings on specific topics. Throughout the book, connections between the chapters and the online activities accompany them are graphically displayed. In sum, this book will help support the emergence of a new generation of scientists with the skills to carry out integrated, multi-disciplinary approaches, and who are interested in anchoring their research with the ecological realities of the Anthropocene. It provides a stimulating read and comprehensive introduction to current environmental and wildlife management issues.

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