

Plant Ecology and Evolution in Harsh Environments

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BOOK REVIEW

Plant Ecology and Evolution in Harsh Environments by Nishanta Rajakaruna, Robert S. Boyd, and Tanner B. Harris, eds. 2014. 475 pp. ISBN-13: 978-1633219557 \$250.00 (hardcover), ebook available. Nova Science Publishers, Hauppauge, NY.

I first became interested in harsh environments when I took an internship at the Donald and Sylvia McLaughlin reserve in northern California, where faculty and graduate students come from around the world to study the unique properties of serpentine soils. Little did I know that I would go on to join these researchers in the study of extreme environments as model systems in plant ecology and evolution. It may seem strange that we go to the extremes of the earth to study fundamental questions about the structure of the natural world, but there is a long tradition of studying “life on the edge.” We thrive on the study of organisms surviving on nutrient-poor soils or in extreme temperatures because they live on the brink of evolution and diversification. Harsh environments allow us to ask and answer complex questions such as: how fast does evolutionary change occur over environmental gradients, or how will ecosystems with low productivity respond to a warming climate?

In a research field that is growing vastly, it is important that we take lessons from all different types of harsh ecosystems—not only from those habitats that are well studied (such as serpentine), but also from other stressful habitats such as gypsum soils, saline soils, and mine tailings. We can also benefit by expanding these questions to taxonomic groups other than flowering plants (such as bryophytes, lichens, and mycorrhizae) and by drawing linkages among different taxa. The new book by Nishanta Rajakaruna, Robert S. Boyd, and Tanner B. Harris, *Plant Ecology and Evolution in Harsh Environments*, contains many important lessons for researchers and educators in the field of plant ecology, evolution, and morphology. In the preface of this new book, the authors write that they aim to “bring together a wide range of topics on ecology and evolution in harsh environments of plants...written by experts around the world.” I believe that they have succeeded in that goal.

Plant ecology and evolution in stressful environments is the central theme in several classic reviews, for example: Grime (1988)

and Chapin et al. (1993), the latter of which is revisited in this book. Furthermore, many recent texts have focused on the ecology and evolution of specific habitats, such as Rajakaruna and Harrison's (2011) *Serpentine: The Evolution of a Model System*. *Plant Ecology and Evolution in Harsh Environments* is certainly not the first to describe plants in extreme environments; however, it is the first to undertake describing so many different harsh ecosystems under the same unifying theme.

As a vascular plant ecologist, I found certain chapters that were more aligned with my interests than others. I particularly liked that an entire chapter was dedicated to the ecology of gypsum soils (Chapter 5), since there are often no more than a few short paragraphs or sentences on gypsum flora in other texts. Chapter 7, on arctic and alpine environments, was another highlight, particularly the sub-sections about responses of plants to climate change, and the importance of mycorrhizae in these communities. Selby et al.'s chapter (11) on *Mimulus* spp. as model taxa for studying evolutionary ecology in harsh environments was among my favorite chapters in this book. The authors have done an excellent job of showcasing the broad range of this genus throughout several types of harsh ecosystems and describing novel genetic techniques that were unfamiliar to me. Since most of this research has been done in the past few years, I would be surprised if there is such a comprehensive review of literature on this topic other than in this new book. Finally, Rajakaruna, Boyd, and Harris's summary chapter does an excellent job of tying together the central theme of the book, discussing how harsh environments serve as models for studying ecology and evolution and how we can channel new information towards conservation and restoration.

Although I found the book was well written and full of excellent examples, the organization of the chapters within the book was confusing. I would have preferred the chapters on microbes (Chapters 1 and 10), bryophytes (Chapter 12), lichens (Chapter 3), and mycorrhizae (Chapter 2) to be separate from those on vascular plants (Chapters 4–9, 11, 13–15), instead of being interspersed throughout. Also, I thought that Chapter 9 would have been better located at the beginning of the book, since it is more theory-driven.

For the most part, I found the format and organization within each chapter easy to follow. For those chapters heavily focused on morphology and physiology (Chapters 6 and 10), I thought the authors did an excellent job of making the material easily

understandable to those with more ecological and evolutionary backgrounds. I appreciated the use of colors in the photos and a few figures, although some of the photos (for example, page 109) were noticeably blurry and some would have been better in color (page 157). I think that the tables summarizing taxa with particular traits are excellent (Chapter 4: Table 1; Chapter 5: Table 1; Chapter 8: Table 1) and will be of great use for population and community ecologists. One minor critique is that the organization of tables throughout the book could have been more consistent. For example, some are organized alphabetically by species, others by family, and others by citation.

Overall, I was very impressed by Rajakaruna, Boyd, and Harris's new book. As someone who studies several different harsh environments (primarily serpentine and alpine systems), I appreciate the comprehensiveness of a book that serves to tie together such diverse systems under a cohesive theme. Furthermore, the book is filled with unique examples that fall outside of my research area (such as saline and desert systems) that are a perfect fit for the junior- and senior-level undergraduate Plant Ecology course I am teaching next semester. I look forward to using this book as a reference guide for my research, as well as a teaching aid, for the years to come, and I know that many other people will feel the same.

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